



## Novel ceramic membranes for water purification and food industry

Boffa, Vittorio

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# PPM 2013

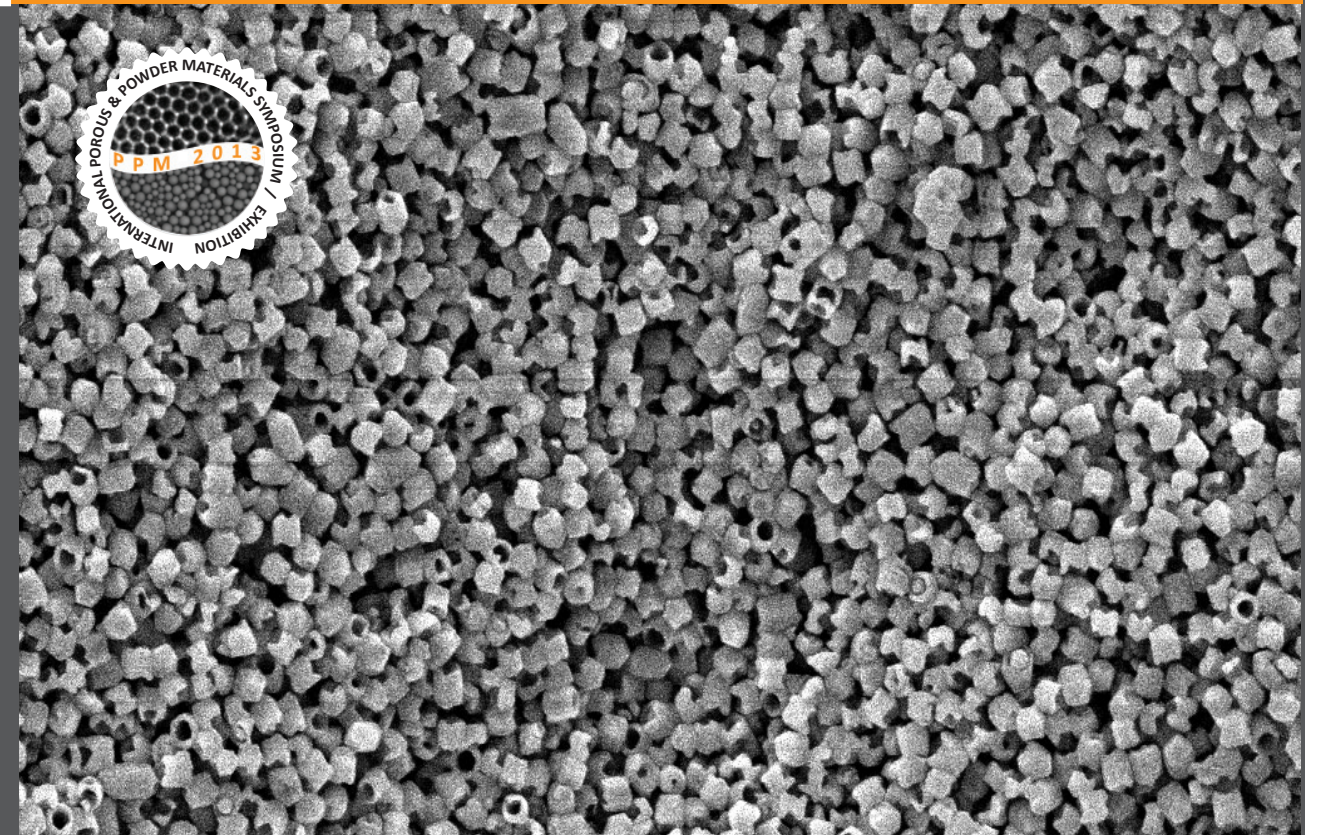
*Abstracts*

# *Abstracts*

## PPM 2013

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INTERNATIONAL POROUS  
& POWDER MATERIALS  
SYMPOSIUM & EXHIBITION



INTERNATIONAL POROUS  
& POWDER MATERIALS  
SYMPOSIUM & EXHIBITION

3-6 September 2013

İzmir Turkey



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# PPM 2013

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Symposium Secretary  
Izmir Institute of Technology, Department of Chemical Engineering  
Urla Izmir Turkey  
sevgikilic@iyte.edu.tr  
+90 232 750 6647

Mehmet POLAT  
Symposium Chair  
Izmir Institute of Technology, Department of Chemical Engineering  
Urla Izmir Turkey  
mehmetpolat@iyte.edu.tr  
+90 232 750 6693

Metin TANOGLU  
Symposium Chair  
Izmir Institute of Technology, Department of Mechanical Engineering  
Urla Izmir Turkey  
metintanoglu@iyte.edu.tr  
+90 232 750 6693

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## FOREWORD

We welcome you to the first of the International Porous and Powder Materials Symposium and Exhibition, PPM 2013.

The idea of organizing a symposium on porous and powder materials owes its germination to the curiosity about the ‘other side of the fence’. We are all familiar of the mild surprise when we come accross with a research paper from a totally unrelated field written in a completely different terminology but describing something pleasantly familiar. Just imagine the elation of a PhD student in ceramics who is trying to optimize the stability and plasticity of the green body reading about the double layer around a protein, of an environmental engineer who is attempting to flocculate a nasty sludge coming accross with the concept of aggregation of micellar structures or of a researcher in chemical engineering who is looking for the perfect catalyst seeing the SEM pictures of porous nanoparticles developed for drug delivery. The list could be extended with much better examples by the readers of this book. But the best set of words to describe these feelings is an awareness of wholeness and solidarity.

PPM 2013 aims to focus on and amplify this awareness which will in turn help to forge pathways between different fields of science and technology, as well as creating a familiarity for the work of each other. Porous and Powder Materials Symposium is intended to bring us together around a topic which we all deal with in our proliferiated research fields.

This ambitious aim in mind, the symposium was structured around the following themes:

- Theme A: Development and Characterization
- Theme B: Catalytic Aspects
- Theme C: Environmental and Hygenic Aspects
- Theme D: Biological and Medical Aspects
- Theme E: Transport and Surface Chemistry
- Theme F: Modeling and Simulation
- Theme G: Industrial Applications

Both the Oral Sessions and the Proceedings Book are constructed around these themes. We are proud to say that, for a symposium which has the *first* in its title, what emerged was astounding with number of abstract submissions reaching eight hundreds. The submissions were distilled to 175 oral presentations and 300 posters. The Symposium venue, Cesme Sheraton Hotel in Izmir, will host around 600 participants from over 40 countries. *This Abstract Book contains 696 of the submitted abstracts. A Proceedings Book which includes 185 full papers submitted to the symposium is also printed for distribution.*

It is obvious that the symposium have adressed a need for those of us who work with porous and powder materials. A need which arises from the curiosity about what is happening beyond the fence. We believe that this healty curiosity will make Porous and Powder Materials Symposium and Exhibition a regular and respected gathering in the field for years to come.

Hope to get together in both sense of the word in future PPM's.

With our best regards.

Mehmet Polat and Metin Tanoglu, Symposium Chairs  
Sevgi Kilic Ozdemir, Symposium Secretary

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## ADSORPTION AND DIFFUSION OF METHYLENE BLUE ONTO SILICA HYDROGEL

Murat Özüyamanbaş<sup>1</sup>, Ayhan Kaçar<sup>1</sup>, Yelda Akdeniz<sup>1</sup>, Sevgi Ulutan<sup>2</sup>, Devrim Balköse<sup>1</sup>

<sup>1</sup>Dept. of Chemical Eng. Izmir Inst. of Technology Gulbahce Urla Izmir Turkey

<sup>2</sup>Dept. of Chemical Eng. Ege Univ. Bornova Izmir Turkey

a. Corresponding author: (devrimbalkose@iyte.edu.tr)

Silica hydrogel is also a rigid material in which water is trapped within a three-dimensional disordered silica matrix. Silicahydrogel having 8% silica and 86% water was produced from water glass and sulfuric acid and purified by washing and it was used for adsorption of methylene blue from aqueous solutions in the present study. Methylene blue was adsorbed first to the interphase between the aqueous and silica hydrogel phases during the first few hours of contact time. The rate of adsorption of methylene blue in silicahydrogel fitted to pseudo first order model with average rate constant of  $0.0046 \text{ min}^{-1}$  from the change of the concentration of the methylene blue solution in contact with silica hydrogel with time. The diffusion coefficient of methylene blue in silicahydrogel was determined as  $5.3 \times 10^{-13} \text{ m}^2 \text{ s}^{-1}$  from the rate of progress of the blue colored diffusion front in silica hydrogel. Since nearly all methylene blue in aqueous phase quantitatively adsorbed at the interphase the adsorption isotherm was of the irreversible type for initial concentration range of 2-20  $\text{mg dm}^{-3}$  methylene blue initial concentration.

The results suggest that the silica hydrogel in particulate form could be used efficiently in removing basic dyes such as methylene blue present in waste waters.

## HIGHLY POROUS C RICH SiOC CERAMICS FOR GAS SENSING APPLICATIONS

Aylin Karakuscu<sup>1</sup>, Andrea Ponzoni<sup>1</sup>, Elisabetta Comini<sup>1</sup>, Guido Faglia<sup>1</sup>, Giorgio Sberveglieri<sup>1</sup>, Gian Domenico Soraru<sup>2</sup>

1. Sensor Lab, Univ Brescia and CNR-IDASC, I-25133 Brescia, Italy

2. Univ of Trento, Dipartimento di Ingegneria dei Materiali, Via Mesiano 77, 38123 Trento, Italy

a. Corresponding author (aylin.karakuscu@ing.unibs.it)

Due to their unique nanostructure in which silica nanosized clusters are encased into a graphene network, SiCO ceramics combine very high temperature stability with un-usual functional properties such as semiconductivity, piezoresistivity and luminescence. For these reasons porous SiCO ceramics have been proposed as anode for Li-ion batteries and high temperature sensors. Here we present a simple and elegant synthetic route to produce highly porous monolithic SiCO without the usage of any templates. Different starting bis(trialkoxysilyl) alkanes and bis(triethoxysilyl)-arylenes were used to synthesize aerogels by non-supercritical drying avoiding the conventional supercritical process. The aerogels possessed low densities, surface areas in the range of 500-1000  $\text{m}^2/\text{g}$  and a narrow pore size distribution in the range 5-10 nm depending upon the type of organic spacer. Upon pyrolysis in argon atmosphere the aerogels yielded porous, monolithic silicon oxycarbide glass of different chemical composition with surface area above 400  $\text{m}^2/\text{g}$  and maintained a narrow pore size distribution. Standard techniques were employed for characterizing the materials. Studies showed that porous ceramic sensor offers high sensitivity toward humidity. Moreover, pore size distribution, total porosity and surface area control the gas sensitivity and resolution of the ceramic materials. Therefore, in this study, we focused on structural properties of C rich SiOC ceramics to correlate them with gas sensing measurements.

## **GROWTH OF ONE-DIMENSIONAL NANOSTRUCTURES IN POROUS POLYMER-DERIVED CERAMICS (PDCS).**

Cekdar Vakifahmetoglu<sup>1</sup> and Paolo Colombo<sup>2</sup>

<sup>1</sup>Dept. of Mechanical Eng., Istanbul Kemerburgaz Univ., Turkey

<sup>2</sup>Dept. of Industrial Eng., Univ. of Padova, Italy

*a.* Corresponding author(cekdar.vakifahmetoglu@kemerburgaz.edu.tr)

Open cell polymer derived ceramic (PDC) foams with high amount of porosity were fabricated from preceramic polymers by varying the parameters such as the type and the ratio of the polymeric precursor and blowing agent, pyrolysis temperature and atmosphere, and catalyst type. In the method different types of 1D nanostructures (nanowires) were formed on the cell wall surfaces of the macro-porous ceramics. Depending on the pyrolysis atmosphere and temperature, nanowires of silicon nitride (Si<sub>3</sub>N<sub>4</sub>) or silicon carbide (SiC), were produced by in-situ catalyst-assisted-pyrolysis (CAP). The nanowires grew directly upon heating, via reaction/condensation processes occurring in the gases developed during thermolysis. Nano composition and microstructure were elucidated by XRD and HRTEM investigations combined with EELS and EDXS methods, enabling also to ascertain the particular growth mechanisms.

## **DESIGNING POROSITY IN POLYMER-DERIVED-CERAMICS**

Paolo Colombo

Dept. of Industrial Eng., Univ. of Padova, Italy

Adjunct Prof., Dept. of Materials Sci. and Eng., The Pennsylvania State Univ., USA

Visiting Professor, Dept. of Mechanical Eng., Univ. College London, UK

*a.* Corresponding author(paolo.colombo@unipd.it)

This talk will discuss the use of preceramic polymers to fabricate highly porous ceramics with a wide variety of pore morphology and sizes, ranging from the micro-meso to the macro scales, using a variety of processing approaches. These include direct foaming, the use of sacrificial fillers, and the mixing of preceramic polymers of different characteristics. Furthermore, by using fabrication methods such as electro-spraying, micro-fluidics and emulsification, hollow micro beads particles and porous capsules can be produced. Additive Manufacturing Technologies, such as 3D printing, can be also applied to preceramic polymers to produce highly porous bodies with well controlled morphology and characteristics not achievable with other processing methods.

Bodies with a hierarchical porosity (e.g. micro-macro) can also be obtained. Chlorination of polymer-derived-ceramics (PDCs) leads to carbon-based materials with high specific surface area values, high pore volume and outstanding gas storage properties.

Moreover, the direct growth of 1D nanostructures (e.g. nano-wires, nano-belts) on the cell wall surfaces commercially available cellular bodies, enables the production of components possessing a hierarchical pore structure, of interest for different applications (particle filtration, catalysis or catalyst support).

## **POROUS SILICON: DETERMINING THE CRITICAL ANODISATION CURRENT BY MATHEMATICAL MODELLING**

S.Doğan, T.Mammadov, S.Özçelik

Gazi Univ., Physics Dept.

a. Corresponding author( sozcandogan@yahoo.com)

The rate of pore formation is heavily dependent upon the resistance of the Si substrate, anodization current, electrode position respect to the substrate and HF concentration. The main parameter effecting the pore growth is anodization current. In this study the critical anodization current is determined from the experimental results fit with respect to the effecting factors. Three types of HF mixture and 2 types of silicon with different dopant concentration were used to complete the study. With an increasing HF concentration the critical current density decreases as well as an increase in substrate resistance result as a decrease in critical current density.

## **IDENTIFICATION of NANOPOROUS MATERIALS for CO<sub>2</sub> SEPARATIONS USING MOLECULAR SIMULATIONS**

Gamze Yilmaz and Seda Keskin<sup>a</sup>

Koç Univ., College of Eng., Istanbul, Turkey

a. Corresponding author(skeskin@ku.edu.tr)

Development of nanoporous materials to achieve biogas (CO<sub>2</sub>/CH<sub>4</sub>) and flue gas (CO<sub>2</sub>/N<sub>2</sub>) separations with high gas selectivity and high gas permeability would have important social and economical impacts on mitigation of CO<sub>2</sub> emissions. The current membrane market for CO<sub>2</sub>/CH<sub>4</sub> and CO<sub>2</sub>/N<sub>2</sub> separations is dominated by polymer membranes due to their ease of fabrication and low cost. Unfortunately, polymer membranes have a trade-off between selectivity and permeability. Several types of nanoporous materials such as zeolites, carbon molecular sieves and carbon nanotubes have been widely studied to replace polymeric materials to achieve CO<sub>2</sub> separation with a better performance. Identification and development of new nanoporous materials that can exhibit high CO<sub>2</sub> selectivity and permeability have been the central focus of research for the past two decades.

Zeolite imidazolate frameworks (ZIF) are a new class of nanoporous materials with fascinating chemical and physical properties such as high surface area, high porosity and a wide range of well defined pore sizes. ZIFs mimic the topology of the traditional zeolites but they have a large variety of chemical functionalities which results in a high number of promising materials. We examined the CO<sub>2</sub> separation performance of ZIFs from CO<sub>2</sub>/CH<sub>4</sub> and CO<sub>2</sub>/N<sub>2</sub> mixtures using detailed molecular simulations. We compared the performance of ZIF adsorbents and membranes in CO<sub>2</sub> separations with the traditional nanoporous materials such as zeolites and carbon nanotubes and concluded that new generation ZIFs can outperform other nanoporous materials due to their high CO<sub>2</sub> selectivity. We also examined the performance of hybrid membranes in which ZIFs are used as filler particles in polymer membranes using atomistic and continuum modeling. Our results showed that selecting appropriate ZIF as filler particles in polymer membranes can result in hybrid membranes with extraordinarily high CO<sub>2</sub> selectivity and CO<sub>2</sub> permeability relative to pure polymer membranes. The methods we introduced in this study will create many opportunities for accelerating the development of ZIF membranes and ZIF-based hybrid membranes in CO<sub>2</sub> separation applications.

## **SYNTHESIS AND ELECTROMAGNETIC ABSORBING PROPERTIES OF SPINEL FERRITES AND PARAFFIN NANOCOMPOSITE STRUCTURES**

Harun Bayrakdar<sup>a</sup>

Çanakkale Onsekiz Mart Univ., Faculty of Eng., Dept. of Materials Sci. and Eng., Çanakkale, Turkey  
a. Corresponding author (h.bayrakdar@comu.edu.tr)

We have synthesis ferrite nanoparticles and ferrite-polymer nanocomposite structures, theoretically and experimentally investigated electromagnetic propagation, absorption properties of these nanocomposite materials at 8-20 GHz in microwave guides. Microwave absorbing measurements was made by transmission line method for an absorber thickness of 2 mm. These nanocomposites can be attractive candidates for microwave absorption materials.

## **SAXS INVESTIGATION OF THE SINTERED NIOBIUM POWDER SURFACE PORES**

Leonid Skatkov<sup>a</sup>, Valeriy Gomofov, Svetlana Deribo, Sergey Samoylenko  
a. Corresponding author (sf\_lskatkov@bezeqint.net)

This report presents a method for investigating the solid porous surface inhomogeneities. The method proposed was used to investigate the surface of compact Nb samples obtained by high temperature vacuum sintering of niobium powder. The technique was used the small-angle X-ray scattering ( SAXS ). The range of scattering angles is to 2 up to 360 angular minutes. With the collimation process used and the radiation chosen, a resolution is achieved which allows to detect pores with dimensions from 0,1 to 50 nm. The SAXS measurement were treated according to special program which included the background curve subtraction of the SAXS diffractometer through the use of the 5-point cubic interpolation technique in the region of every experimental point. The pores obtained by SAXS in the present communication has two dimensions exceed the third one – lamella – are approximated by cylinders. The curve of the SAXS data scattering invariant has some peak values. This indicates the polymodality of the surface inhomogeneities system. It should be noted that surface inhomogeneities displays the fractal nature. The approximation procedure of the cylinder shapes is known in the fractal theory as the Swartz area paradox.

## **A COMPARISON BETWEEN DIFFERENT TECHNIQUES FOR MEASURING SIZE OF ULTRAFINE POWDERS**

Faranak Shojai  
Corresponding author (fara.shojai@gmail.com)

Particle size and size distribution of fine and ultrafine powders are important in many of the industrial applications of powders. One of these applications is in electronic components where Ni powders are used as internal electrodes and size distribution has a significant impact on the properties of the passive electronic component. In this study, different techniques of particle size measurement based on diffraction, light scattering, optical and electron microscopy and rheological measurements are discussed with strength and weaknesses of each measurement technique.

## **THEORETICAL STUDY OF THIOL-SILICA-CISPLATIN INTERACTIONS**

Díaz Compañy, S. Simonetti  
a. Corresponding author (jcs@bvconline.com.ar)

The present study contributes to the investigation in relation to guest-host interactions between the chemotherapeutic agent cisplatin and a functionalized silica matrix, in order to improve and find new materials such as drug delivery carriers. The adsorption of cisplatin and its complexes,  $\text{cis-}[\text{PtCl}(\text{NH}_3)_2]^+$  and  $\text{cis-}[\text{Pt}(\text{NH}_3)_2]^{2+}$ , on a SH functionalized  $\text{SiO}_2(111)$  surface has been studied by the Atom Superposition and Electron Delocalization method. The adiabatic energy curves for the adsorption of the drug and its products on the delivery system were considered. The electronic structure and bonding analysis were also performed.

The molecule and their complex are adsorbed on the functionalized surface resulting in a major absorption of the  $\text{cis-}[\text{Pt}(\text{NH}_3)_2]^{2+}$  complex. The molecule-surface interactions are formed via -SH group. The molecule/complexes-SH electron donating effect plays an important role in the catalytic reaction. The more important drug-carrier interactions occur through the Cl-H bond for the adsorption of  $\text{cis-}[\text{PtCl}_2(\text{NH}_3)_2]$  and  $\text{cis-}[\text{PtCl}(\text{NH}_3)_2]^+$ , and through the Pt-S and Pt-H interactions for  $\text{cis-}[\text{Pt}(\text{NH}_3)_2]^{2+}$  adsorption. When the new interactions are formed, the functionalized carrier maintains their matrix properties while the molecule is the most affected after adsorption. The Pt atomic orbitals present the most important changes during adsorption.

## **SULFURIZATION OF ACTIVATED CARBON WITH SULFUR DIOXIDE IN A FLUIDIZED-BED FURNACE**

Neda Asasian; Tahereh Kaghazchi\*

Amirkabir Univ. of Technology, Chemical Eng. Dept., Tehran, Iran  
a. Corresponding author (kaghazch@aut.ac.ir)

Adsorption by sulfurized activated carbons (ACs) seems to be one of the most efficient ways for mercury removal from wastewaters.

In this work, AC sulfurization has been carried out by exposing the virgin AC to a nitrogen stream containing SO<sub>2</sub> in a bubbling fluidized-bed reactor; such a system provides better mixing conditions and it leads to production of more homogenous sulfurized adsorbents compared to those obtained from fixed-bed reactors. The effects of sulfurization time (30-180 min), temperature (400-900°C) and SO<sub>2</sub> concentration (2-8 vol.%) in the feed stream were investigated on the porous structure, elemental analysis, sulfur functionalities and mercury adsorption capacities of the final sulfurized adsorbents.

The optimized sulfurization conditions were as follows: sulfurization time: 60 min, temperature: 700°C and SO<sub>2</sub> concentration: 4 vol.%. Sulfurization under these conditions has led to introduction of about 11.0 and 6.9 wt.% sulfur into the bulk and surface structure of AC, respectively; however, its surface area was reduced only about 8.6%. The XPS results have shown that the sulfur functionalities formed on the surface of the optimized sample include the organic sulfur (73%) and the oxidized sulfur (17%). The sulfurized groups especially the organic forms have improved mercury adsorption capacity of the sorbents, significantly.

## **MICROSTRUCTURE AND CHARACTERIZATION OF B<sub>4</sub>C REINFORCED AL2024 ALLOY MATRIX COMPOSITES PRODUCED BY MECHANICAL ALLOYING TECHNIQUE**

T. Varol<sup>1</sup> and A. Canakci<sup>1,a</sup>

1. Dept. of Metallurgical and Materials Eng., Eng. Faculty  
Karadeniz Technical Univ., Trabzon, Turkey.  
a. Corresponding author (aykut@ktu.edu.tr)

In this study, Al2024 composite reinforced with B<sub>4</sub>C particles was produced by mechanical alloying. Al2024 and B<sub>4</sub>C powders were mixed mechanically and milled at different times (0.5, 1, 2, 5, 7 and 10h) to achieve Al2024-5 wt.%B<sub>4</sub>C, Al2024-10 wt.%B<sub>4</sub>C and Al2024-20 wt.%B<sub>4</sub>C composite powders. The microstructure of Al2024-B<sub>4</sub>C composites was investigated using a scanning electron microscope. The mechanical and physical properties of the composite specimens were determined by measuring the density, hardness and tensile strength values. The results showed that relatively homogeneous distribution of B<sub>4</sub>C reinforcement in the matrix was obtained by mechanical alloying technique after 5h. The hardness of the composites increased with increasing the weight percentage of the B<sub>4</sub>C particles, while the relative density of the composites decreased with increasing the weight percentage of the B<sub>4</sub>C.

# **ARTIFICIAL NEURAL NETWORK APPROACH TO PREDICT OF EFFECT OF PROCESS CONTROL AGENT ON THE MICROHARDNESS OF AL-AL<sub>2</sub>O<sub>3</sub> COMPOSITE POWDERS PRODUCED BY MECHANICAL ALLOYING**

A. Canakci<sup>1,a</sup>, T. Varol<sup>1</sup>, S. Ozsahin<sup>2</sup>

<sup>1</sup>Karadeniz Technical Univ., Metallurgical and Materials Eng. Dept., Trabzon, Turkey.

<sup>2</sup>Karadeniz Technical Univ., Woodworking Industrial Eng. Dept., Trabzon, Turkey.

a. Corresponding author (aykut@ktu.edu.tr)

In this study, an artificial neural network approach is generated to predict of effect of process control agent on microhardness of Al-10 wt.% Al<sub>2</sub>O<sub>3</sub> composite powders fabricated by mechanical alloying. This composite powder was synthesized by utilizing planetary high energy ball mill for different milling times of 0.5, 1, 2, 4, 6, 8, 10h. Ball mill velocity was 400rpm and ball to powder weight ratio was 10:1. Methanol was used as process control agent (PCA). Different amounts of methanol (1, 2, 3 wt. %) were used to study the effect of the process control agent on microhardness of the Al-Al<sub>2</sub>O<sub>3</sub> composite powders. The microhardness of composite powders was determined by a microhardness tester. As a result of the study neural network was found successful for the prediction of effect of process control agent on the microhardness of Al-Al<sub>2</sub>O<sub>3</sub> composite powders produced by mechanical alloying.

## **EFFECTS OF DIFFERENT PROCESS CONTROL AGENT ON CHARACTERISTICS OF MECHANICALLY MILLED AL2024 POWDERS**

A. Canakci<sup>1a</sup>, S. Ozkaya<sup>1</sup>, F. Erdemir<sup>1</sup>, T. Varol<sup>1</sup>

1. Metallurgical and Materials Eng. Dept., Karadeniz Technical Univ., Trabzon, Turkey.

a Corresponding author (aykut@ktu.edu.tr)

In this study, the effect of different process control agents (PCA) on particle size, particle morphology and particle hardness produced mechanical milling method was investigated. To evaluate the effects of PCA with increasing milling time, powders have been successfully milled from 0.5h up to 16h. Methanol and stearic acid were used as process control agents to investigate the effect on milled powder properties. The particle size of alloy powders was determined by laser particle size analyzer and the milled powders were characterized by SEM. Microhardness values were obtained for different milling time show that the hardness of powders increase with increasing milling time. The results show that both methanol and stearic acid have different effects on the morphology, particle size and structural behavior of the as milled Al2024 powders. Moreover, it was observed that methanol is earlier than stearic acid for steady state in ductile-ductile milling system.

## **FABRICATION OF FE–AL INTERMETALLIC COATINGS USING MECHANICAL MILLING TECHNIQUE**

A. Canakci<sup>1a</sup>, F. Erdemir<sup>1</sup>, T. Varol<sup>1</sup>, S. Ozkaya<sup>1</sup>

1. Dept. of Metallurgical and Materials Eng., Eng. Faculty, Karadeniz Technical Univ., Trabzon, Turkey.

a. Corresponding author (aykut@ktu.edu.tr)

In this work, ball milling was used to produce Fe-Al coatings. Steel samples, which were ball-milled with Al powder in a planetary ball-mill, were in the cubic form with 12 mm×12 mm×3 mm dimensions. The repeated substrate-to-ball collisions flattened the Al powders and deposited them onto the surface into a bulk material. Surface morphology and cross-section microstructure of the developed coatings were studied by using scanning electron microscope (SEM). Experimental results showed that the thickness of the aluminum coating on the steel substrate increases with increasing milling time. The surface roughness increases gradually with increasing milling time and particle size. The results revealed that a Fe-Al coating had been formed on the surface of the substrate by formation of Fe-Al intermetallics.

## **ABRASIVE WEAR BEHAVIOR OF POWDER METALLURGY CUSN10-GRAPHITE METAL MATRIX COMPOSITES PRODUCED BY POWDER METALLURGY**

A. Canakci<sup>a\*</sup>, H. Cuvalci<sup>a</sup>, T. Varol<sup>a</sup>, F. Erdemir<sup>a</sup>, S. Ozkaya<sup>a</sup>, E.D. Yalcin<sup>b</sup>

<sup>a</sup>Dept. of Metallurgical and Materials Eng., Eng. Faculty,

<sup>b</sup>AbdullahKanca Vocational School of Higher Education  
Karadeniz Technical Univ., Trabzon, Turkey.

a. Corresponding Author (aykut@ktu.edu.tr)

In this study, CuSn10 metal matrix composites (MMCs) reinforced with 0, 1, 3 and 5 vol.% graphite particulates, respectively, were produced by powder metallurgy. SiC abrasive papers of grit size 400, having an average particle size of 38 µm, were used. The applied loads were selected as 60N. The tests were carried out under sliding speeds of 0.8 m/s. In all tests, the sliding distances were chosen in the range of 50-500m. The effects of sliding distance and graphite particle content on the abrasive wear properties of the composites have been evaluated. The microstructure evolution of composites and the main wear mechanisms were identified using a scanning electron microscope. A decrease in hardness and density of the sintered CuSn10-graphite composites was observed with increase in graphite content. According to results, the abrasive wear resistance of metal matrix composites could be increased by incorporation of graphite particles.

## **APPLICATION OF OXIDIZED AND REDUCED ACTIVATED CARBON FOR PARA-NITROPHENOL REMOVAL**

Mohammad Hassan Mahaninia<sup>1</sup>, Tahereh Kaghazchi<sup>1,a</sup> and Mansooreh Soleimani<sup>1</sup>

1. Amirkabir Univ. of Technology, Dept. of Chemical Eng., Tehran, Iran  
a. Corresponding author (kaghazch@aut.ac.ir)

Due to toxic properties of para-nitrophenol, it is necessary to remove this component from wastewater. In this work, introduction of oxygen functional groups on the surface of activated carbon have been investigated in order to enhance its adsorption properties toward para-nitrophenol. Functional groups on activated carbon produced from oxidation by NO<sub>x</sub>-containing gaseous by-product and reduction by heat treatment at 700°C in H<sub>2</sub> flow. The modified activated carbons were characterized by several analysis methods, including N<sub>2</sub> adsorption/desorption, elemental analysis, FTIR spectroscopy, thermo-gravimetry analysis (TGA), scanning electron microscopy (SEM), pH of zero point charge, and Boehm titration. It was found that oxidation of activated carbon produces carboxylic acid, lactone, quinone, phenol, and nitro groups and reduction of activated carbon produces alcohol and amine groups. Also, the influences of these treatment methods on adsorption of para-nitrophenol on activated carbon were studied. Experimental results indicated that oxidized carbon had the higher adsorption rate and capacity toward Para-nitrophenol.

## **MESOPOROUS TiO<sub>2</sub> THIN FILMS EXHIBITING ENHANCED THERMAL STABILITY: PREPARATION AND PHOTOCATALYSED DESTRUCTION OF CATIONIC DYES**

Jinshu Wang, Hui Li, Hongyi Li  
a. Corresponding author: (wangjsh@bjut.edu.cn)

Ordered mesostructured TiO<sub>2</sub> thin films were constructed through the sol-gel combining with evaporation-induced self-assembly (EISA) method. The films exhibited good thermal stability, i.e., the mesoporous structure could keep to 600°C. The mesoporous framework had a narrow pore size distribution. The average pore size for the sample calcined at 450-600°C was around 7.3 to 7.8 nm. Based on tension stress calculated by the surface energy of crystallites and the compression calculated by interface energy between the crystallites, the thermodynamic study for the sample had been carried out and the critical crystallite size expression of the mesoporous film was presented for the prediction of the thermal stability of the mesoporous structure at high temperature. The sample calcined at 450-500°C which had higher specific surface area and larger pore size exhibited higher photocatalysed destruction capability of methylene blue.

## **EFFECT OF THE BINARY AND TERNARY EXCHANGES ON CRYSTALLINITY AND TEXTURAL PROPERTIES OF X ZEOLITES**

H.Hammoudi (1)\*, Souhila Bendenia (1), Kheira Marouf-Khelifa(2), Reda Marouf (3), Jacques Schott(4),  
Amine Khelifa(1)

(1) Laboratoire de Structure, Elaboration et Applications des Matériaux Moléculaires (S.E.A.2M.)  
Département de Chimie, Université de Mostaganem (hammoudi1966@yahoo.fr)

(2) Laboratoire des Sciences et Techniques de l'Environnement et de la Valorisation (S.T.E.V.A.)  
Département de Chimie, Université de Mostaganem, Algeri

(3) Laboratoire S.E.A.2M., Centre Universitaire de Mascara, Algeria

(4) Géochimie: Transferts et Mécanismes, CNRS (UMR 5563)-OMP- Université Paul-Sabatier,  
Toulouse, France

a. Corresponding author (hammoudi1966@yahoo.fr)

The ionic exchange of the NaX zeolite by  $\text{Cu}^{2+}$  and/or  $\text{Zn}^{2+}$  cations is progressively driven while following the development of some of its characteristic: crystallinity by XR diffraction, profile of isotherms, RI criterion, isosteric adsorption heat and microporous volume using both the Dubinin–Radushkevich (DR) equation and the t-plot through the Lippens–de Boer method which also makes it possible to determine the external surface area. Results show that the cationic exchange process, in the case of  $\text{Cu}^{2+}$  introduced at higher degree, is accompanied by crystalline degradation for  $\text{Cu}(x)\text{X}$ , in contrast to  $\text{Zn}^{2+}$ -exchanged zeolite X. This degradation occurs without significant presence of mesopores, because the RI criterion values were found to be much lower than 2.2. A comparison between the binary and ternary exchanges shows that the curves of  $\text{CuZn}(x)\text{X}$  are clearly below those of  $\text{Zn}(x)\text{X}$  and  $\text{Cu}(x)\text{X}$ , whatever the examined parameter.

On the other hand, the curves relating to  $\text{CuZn}(x)\text{X}$  tend towards those of  $\text{Cu}(x)\text{X}$ . This would again confirm the sensitivity of the crystalline structure of  $\text{CuZn}(x)\text{X}$  with respect to the introduction of  $\text{Cu}^{2+}$  cations. An original result is the distortion of the zeolitic framework of X zeolites at middle exchange degree, when  $\text{Cu}^{2+}$  competes with another divalent cation, such as  $\text{Zn}^{2+}$ , for the occupancy of sites distributed within zeolitic cavities. In other words, the ternary exchange accentuates the crystalline degradation of X zeolites. An unexpected result also is the noncorrelation between crystal damage and the external surface area.

## **NOVEL CERAMIC MEMBRANES FOR WATER PURIFICATION AND FOOD INDUSTRY**

Vittorio Boffa

a. Corresponding Author (vb@bio.aau.dk)

Ceramic membranes are typically highly hydrophilic and present higher thermal, mechanical and chemical stability than their polymeric counterparts. Therefore, filtration by means of ceramic membranes is attractive for the food industry, since these devices allow high permeate fluxes and are not sensitive to cleaning agents even when sterile conditions are required. This work reports the fabrication of novel ceramic membranes and their application to the dairy industry and to desalination processes. Silicon carbide and aluminum oxide microfiltration membranes have been applied to milk sterilization and casein fractionation. Alumina and silica nanofiltration membrane have been used in water purification treatments. Membrane performances, in terms of permeability, selectivity, stability and resistance to fouling, will be discussed for each of these examples. The results reported in this work allow appreciating the advantages of ceramic membrane processes compared to other separation technologies, as pasteurization, evaporation and distillation.

## MICRO-SCALE POROUS SURFACE STRUCTURES FOR HEAT AND MASS TRANSFER APPLICATIONS

Muammer Koç<sup>1a</sup>, Omer N Cora<sup>2</sup>, Zafer Evis<sup>3</sup>

<sup>1</sup> Istanbul Şehir Univ., Istanbul, TURKEY

<sup>2</sup> Karadeniz Technical Univ., Trabzon, TURKEY

<sup>3</sup> Middle East Technical Univ., Ankara, TURKEY

a: Corresponding Author (mkoc@sehir.edu.tr)

This paper presents a review on design development and manufacturing of micro-scale porous surface structure arrays on large surface areas for heat and mass transfer applications. With miniaturization of products and devices, this kind of surface structures are required to meet the increased heat and mass transfer needs in smaller and confined volumes to offer increased surface area in highly integrated and compact applications such as power electronics, electronic cooling, micro-processors, micro-reactors, heat pipes and in fuel cells. Two examples will be presented based on the previous studies of authors. In the first case, design, manufacturing and testing of micro-scale porous surfaces made from copper alloys for heat transfer application will be discussed. 2-D and 3-D porous micro-scale surface structures using powder forming approach will be explained to offer an overall assessment and comparison of the surface types in terms of structural integrity, porosity, heat transfer capability. In the second case, preliminary results for micro-scale porous surfaces for bio-implant application will be discussed. Design, material and manufacturing conditions of fixation implant samples made from Mg alloys will be presented.

## ISOMERISATION OF PARAFFINS NC10-NC17 OVER PT/H-HALLOYSITES

Ahmed BELHAKEM, Samia Amina GHOMARI

a. Corresponding Author (ahmedbel39@hotmail.com)

Paraffin chain such nC10 to nC17 were converted on halloysite (Algerian clay material) intercalated and functionalized with platinum and ammonium ions (Pt<sup>+</sup>/H<sup>+</sup>). Products isomerization and hydrocracking obtained were analyzed and identified by GC / MS methods and results were compared with those obtained by reaction elsewhere. High yields of isomers are obtained. Pt/H-halloysite catalyst showed good bi-functional catalytic activity, a high selectivity for isomerization, a primary cracking of the hydrocarbon chain and finally a small percentage of small chain alkanes. Unlike founded results for zeolites, functionalized clay materials seems to favor the formation of multibranched isomers and therefore these materials have no steric hindrance towards formed products. This is explained by the adsorption and reaction occurred on the active sites localized on the inner surface. Dimethylbranched Isomers, formed preferably, have separate connections from three to fourteen carbon atoms. The second terminal methyl is preferably formed from a center of the monomethylbranched isomer. Owing to differences in energy of adsorption, the reaction at high temperatures is favored. The distance between the two branched isomers and the most abundant isomer is greater. The nature and distribution of isomers obtained suggest that the activation of inner surfaces affect directly the selectivity.

## **ADSORPTION STUDIES OF LEAD IONS FROM WASTEWATER USING WASTE FOUNDRY SAND**

Semra Çoruh<sup>a</sup>, Elif Gürkan

a. Corresponding author (semcoruh@omu.edu.tr)

Heavy metal ions can contaminate water resources in different ways: via industrial processes, paints, fertilizers, pesticides, animal manures, sewage sludge, wastewater irrigation, coal combustion residues, atmospheric deposition, and so on. The heavy metals most commonly found in contaminated waters are Ni<sup>2+</sup>, Cu<sup>2+</sup>, Zn<sup>2+</sup>, Pb<sup>2+</sup>, Hg<sup>2+</sup> and Co<sup>2+</sup>. Numerous techniques and treatment technologies have been developed to remove heavy metals from wastewaters, including chemical precipitation, ion exchange, membrane separation, chemical coagulation, solvent extraction, complexation/sequestration, cementation, electrochemical operation, coagulation-flocculation, biological treatment, and adsorption. Adsorption has demonstrated its efficiency, easy handling, availability of different adsorbents, and economic feasibility as a wastewater treatment process compared to the other purification and separation methods, and has gained importance in industrial applications. The aim of this study is to investigate the effects of the influential parameters such as adsorbent dosage, contact time and initial metal ions concentration on removal of Pb<sup>2+</sup> ions from aqueous solutions using waste foundry sand. The equilibrium adsorption data were analyzed by Langmuir, Freundlich and Temkin adsorption isotherm models. The adsorption kinetic data were modeled using the Lagergren-first order, pseudo-second order and Elovich. The results indicate that waste foundry sand is good adsorbent for Pb<sup>2+</sup> in aqueous solutions.

## **RELATION BETWEEN RHEOLOGICAL PROPERTIES AND PORE STRUCTURE OF THE FLY ASH/CEMENT BASED AAC MORTAR AND PRODUCT PROPERTIES**

M. Serhat Başpınar<sup>1a</sup>, Gökhan Görhan<sup>2</sup>, Erhan Kahraman<sup>2</sup> and Ismail Demir<sup>2</sup>

1. Afyon Kocatepe Univ., Technical Education Faculty., Metal Education. Dept., Turkey

2. Afyon Kocatepe Univ., Eng. Faculty, Dept. of Electric Eng., Turkey.

a. Corresponding author (sbaspinar@aku.edu.tr)

Fly ash/cement based AAC mortar viscosity changes during the hydration period. When hydration occurs, at the same time Hydrogen gas evolved. Successful pore formation depends on the nucleation, growth and stability of the gas bubbles. However, growth and stability of the gas bubbles depends on the hydrostatic pressure exerted by the mortar. Hydrostatic pressure depend mainly on the viscosity of the mortar. The main objective of this study was to investigate the effect of mortar viscosity on the properties of the fly ash/cement based AAC. Different fly ash/cement ratios and water content mortars were tested by using Viskomat-NT rheometer. Replacement of fly ash with silica fume was also studied. Physical and mechanical properties, pore structure were measured for each series and their relations with starting rheological properties were investigated. It was concluded that, rheological properties of the mortar is important factor for the macrostructure (pore structure, pore size and distribution) of the AAC and rheological properties of the starting mortar can be used as a material design criteria for the designing new foam concretes by using new materials other than conventional AAC raw materials.

## **SYNTHESIS OF POROUS ACTIVATED CARBON NANOFIBERS VIA ELECTROSPINNING**

Yakup Aykut<sup>1</sup>, Behnam Pourdeyhimi<sup>2</sup>, Saad A. Khan<sup>3</sup>

<sup>1</sup>Dept. of Textile Eng., Uludağ Univ., Bursa, Turkey, 16059

<sup>2</sup>Fiber and Polymer Science, North Carolina State Univ., Raleigh, NC, USA, 27695-8301

<sup>3</sup>Chemical and Biomolecular Eng., North Carolina State Univ., Raleigh, NC, USA, 27695-7905  
a. Corresponding author (aykut@uludag.edu.tr)

Porous activated carbon nanofibers have been produced via electrospinning a metal nanoparticle (MP) containing polyacrylonitrile (PAN) solution followed by a heat treatment processes. After preparation of MP/PAN nanofibrous mat, the precursor nanofibers are stabilized in an air atmosphere at 280 °C and carbonized in a nitrogen atmosphere at 800 °C. As a result of the phase behavior of MP and PAN, some nanoparticles diffuse out of the nanofibers leaving a porous nanofibrous structure behind. Morphologies of the precursor and activated porous carbon nanofibers are investigated with scanning and transmission electron microscopies. Thermal analyses of the nanofibers are conducted with differential scanning calorimeter and thermo gravimetric analysis. Microstructural investigations were carried out with X-ray diffractometer and Raman spectra. Electron emission capacities of the activated porous carbon nanofibers were analyzed in ultra high vacuum environment for their possible use in electron emitted devices. The addition of the metal nanoparticles together with the porous structure of carbon nanofibers provide enhanced electron emission property compared with their non-porous counterpart, suggesting promising applications of these porous nanofibrous structure in electron emitting applications such as field emission displays (FEDs), field-effect transistors (FETs), cold cathodes, microwave generators, and electron microscopy, etc.

## **COATED SOLID SPONGES AS HIGH-PERFORMANCE CATALYST PACKINGS**

Bettina Kraushaar-Czarnetzki

Bettina Kraushaar-Czarnetzki, Inst. of Chemical Process Eng. CVT, Karlsruhe Inst. of Technology,  
Kaiserstrasse 12, 76131 Karlsruhe, Germany  
Corresponding author (kraushaar@kit.edu)

Solid sponges, also denoted as open-cell foams, are irregular structures, permeable in all directions and exhibiting porosities between 70% and 95%. This contribution focuses on the potential of ceramic and metallic sponges used as monolithic catalyst carriers in fixed bed reactors.

Mass, heat and momentum transfer in sponges of different materials and with a broad variety of porosities and pore densities was investigated. Transport correlations were elaborated which enable both, the ranking of sponge packings with different properties and the rational and quantitative comparison with other catalyst carriers like formed particles or honeycombs.

Catalytic functionalization can be achieved by conventional wash coating. Supercritical fluid reactive deposition (SFRD) and flame spray pyrolysis (FSP) are introduced as alternative techniques, useful for the uniform deposition of catalyst nanoparticles in the tortuous pore structures of sponges.

The oxidation of o-xylene to PAA and the hydrogenation of benzene are discussed as examples to show the impact of sponge packings as compared to other catalyst carriers. Polytropic reactors were used which enabled monitoring of spacial temperature distributions in the fixed beds upon reaction. Our studies show that sponge packings are superior for reactions with large heat effects, if effective heat removal (or supply) is a prerequisite.

## **STUDY OF DESORPTION IN A SATURATED CLAY WITH NITROGEN OF MEDIUM FRACTION OF PETROLEUM**

Baia, L. V. <sup>a</sup>; Souza, W. R. <sup>a</sup>; Figueiredo, M. A. G. <sup>b</sup>; Chiaro, S.S.X. <sup>c</sup>.

a. Laboratory of Eng. and Technology of Petroleum and Petrochemical, Chemical Inst., Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil.

b. Dept. of Operations and Industrial Projects, Inst. of Chemistry

a. Corresponding author (mgaya@uerj.br)

The adsorption technique is a promising alternative to be employed in the removal of nitrogenous contaminants existing in a medium fraction of petroleum in order to reduce the severity of Hydrotreating. However, the desorption step of the employed adsorbent is also very important for enabling industrially the adsorption process. Thus, it was studied different desorption steps (by displacement with gas, by washing with solvent, by burning, by burning and a washing with solvent) for a commercial clay. In the desorption by displacement with inert gas carried out at two different temperatures, it was found that at temperature of 200 ° C, the efficiency of clay showed a recovery efficiency greater than that one obtained at 400 ° C. Desorption, by washing at room temperature, gave evidence that the methyl tert-butyl ether (MTBE), among the solvents tested, was which allowed greater recovery. The desorption process by burning at 450 °C, without wash the adsorbent, showed a slight improvement compared to the burning using the eluted adsorbent. In tests for reuse, it was concluded that the clay presented good results showing a sharp decrease in adsorption capacity after the third series of washing, however recovering partially adsorption capacity after a controlled burning. Although, desorption by displacement with gas and by burning obtained the best results, they consume much energy and release harmful compounds. Therefore, it's necessary to invest efforts in other desorption methods.

## **INFLUENCE OF SURFACE CHEMISTRY ON $\beta$ -GALACTOSIDASE FROM KLUYVEROMYCES LACTIS IMMOBILISATION ONTO CELLULOSE ACETATE MICROFILTRATION MEMBRANE**

Hacı Ali GÜLEÇ<sup>1</sup>

<sup>1</sup>Dept. of Food Eng., Trakya Univ., Turkey

a. Corresponding author (ggulec@gmail.com)

The aim of this study was to investigate the effects of surface characteristics of plain and plasma modified microfiltration cellulose acetate membranes on the immobilization yield of  $\beta$ -galactosidase from *Kluyveromyces lactis*. Low pressure and low temperature plasma treatments involving oxygen plasma activation was used to modify plain cellulose acetate membranes.  $\beta$ -galactosidase from *Kluyveromyces lactis* was immobilized onto plain and oxygen plasma treated surfaces by simple adsorption. Oxygen plasma activation increased the hydrophilicity of cellulose acetate membrane surfaces and it improved the immobilization yield of the enzyme by 42%. Immobilized enzyme on the plasma modified membrane was successfully reutilized for cycles at 25°C and enzymatic derivative retained approximately 75-80 % of its initial activity at the end of the reaction.

## HYDROGEN STORAGE ON $M^{1+}$ -ZSM-5 CLUSTERS (M = K, LI AND NA)

Mehmet Ferdi FELLAH

a. Corresponding author (mferdi.fellah@btu.edu.tr)

Since the fossil hydrocarbon resources have been becoming limited, the concept of using hydrogen as a future energy vector has been important for the last three decades. Large scale and safe hydrogen storage should be developed. Among adsorbents for hydrogen adsorption, active carbon, zeolites, and several metal alloys are most significant candidates.

The hydrogen adsorption capacities of  $M^{1+}$ -ZSM-5 clusters (where M = K, Li and Na) have been analyzed by using DFT/B3LYP/6-31G(d,p) method. A 5T ZSM-5 cluster modeled as  $[(SiH_3)_4AlO_4]^{1-}$  and  $[M]^{1+}$  sites have been use. The dangling bonds of the terminal silicon atoms were terminated with H atoms. All atoms of the cluster (except terminating H atoms) and the adsorbing molecules were kept relaxed.

The optimized geometries for the clusters were obtained with neutral charge and singlet spin multiplicity. In order to determine the hydrogen adsorption capacity of metal exchanged ZSM-5 clusters,  $H_2$  molecules were adsorbed on metal site of ZSM-5 clusters until the latest hydrogen molecule added was not adsorbed on metal site. After each  $H_2$  molecule addition to metal site EG calculations were utilized.

As a result, the following hydrogen adsorption capacity order of clusters could be characterized:  $K > Na > Li$  for M-ZSM-5 clusters.

## EFFECT OF PORE WALL MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF LOW ALLOY STEEL FOAMS

Nuray BEKÖZ<sup>1,a</sup> and Enver OKTAY<sup>1</sup>

1. Istanbul Univ., Metallurgical and Materials Eng. Dept., Istanbul, Turkey

a. Corresponding author (nbekoz@istanbul.edu.tr)

Mechanical behaviour of metal foams is not only affected by porosity level, pore shape and pore size but also depend on properties of pore wall material. This study primarily concerns the role of pore wall microstructure which influences mechanical behaviour of steel foams. Three low alloy steel foams having rather similar porosity and pore structure but differences in pore wall microstructure were produced by space holder-water leaching technique in powder metallurgy. Pre-alloyed steel powders with different Cu-Ni-Mo contents were mixed with space holder (carbamide), and then compacted at 200 MPa. The spacer in the green compacts was removed by water leaching at room temperature. The green specimens were sintered at 1200 °C for 60 min in hydrogen atmosphere. The microstructural and mechanical property variations resulting from the use of steel powder containing different alloying elements were discussed.

## **SYNTHESIS, H<sub>3</sub>PO<sub>4</sub> ACTIVATION ,CHARACTERIZATION AND USE OF ACTIVATED CARBONS PREPARED FROM RICE HUSK FOR CONGO RED ADSORPTION**

Vahid Mohammadi\*, Somaye Ranjbar Mohammadi,

Dept. of Chemistry, Imam Khomeini International Univ., 34149-16818 Qazvin, Iran.

a. Corresponding author: (vahidm85i@yahoo.com)

In our study, activated carbons were prepared via hydrothermal and microwave methods by chemical activation with phosphoric acid at 500 °C. Materials were characterized for their surface chemistry by infrared spectroscopy, as well as for their porous and morphological structure by Field Emission Scanning Electron Microscopy and nitrogen adsorption at 77.3 K. Also, XRD analysis was used for obtaining the structural parameters and features of the activated carbons. The BET specific surface area of activated carbon prepared by microwave method was 693 m<sup>2</sup>/g which was higher than that of carbon prepared by hydrothermal method. (554 m<sup>2</sup>/g) .These activated carbons were used as adsorbents for the removal of congo red from aqueous solutions..The congo red adsorption reached the maximum value after 10 and 15 min for AC(micro) and AC(hydro), respectively.

## **MECHANICAL PROPERTIES OF SINTER-HARDENED Cu-Ni-Mo BASED STEELS**

Nuray BEKÖZ

Istanbul Univ., Metallurgical and Materials Eng. Dept., Istanbul, Turkey

a. Corresponding author (nbekoz@istanbul.edu.tr)

Sinter hardening is an attractive technique for the manufacturing of high hardness powder metallurgy parts which eliminates secondary heat treatment by increasing the post-sintering cooling rate, thus significantly reducing processing costs. In this study, the effect of sinter hardening on the mechanical properties of steel specimens produced using pre-alloyed Cu-Ni-Mo powders with addition 0.5% C was investigated. Powder mixtures were pressed uniaxially at 650 MPa in order to obtain cylindrical compacts, and then sintered at 1130 °C for 20 min under cracked ammonia atmosphere. After the sintering step, the specimens were rapidly cooled directly from sintering temperature. As-sintered specimens were sinter-hardened at two different cooling rates (2 °C/sec and 3 °C/sec). Mechanical properties (macrohardness, microhardness and compressive strength) of as-sintered and sinter-hardened specimens were determined and the results discussed in light of the microstructure of the specimens. The study showed that sinter hardening enhanced the mechanical properties of the specimens as a consequence of microstructure strengthening.

## THE EFFECT OF THE POROUS BENTONITE- $\text{AlCrNi}$ MATERIAL IN THE TURBINE EFFICIENCY PRESERVATION

Mokhtar Bounazef<sup>a</sup>, Ali Djeflal, Seif eddine Bendaoudi, El Abbas Adda bedia

Djillali Liabes Univ., Mechanical Dept., Sidi Bel Abbes, Algeria  
a. Corresponding author (bounazef@yahoo.com)

In order to increase the turbine gas efficiency and its power, the clearances between rotating blades and the interior casing should be as small as possible. To obtain that, one sprays a sacrificial material on the casing by the thermal blowtorch flame-powder process and one obtains a coating layer. During rotation, they scrape the  $(\text{Al}_2\text{O}_3.4\text{SiO}_2.\text{H}_2\text{O}-\text{Na}-\text{Ca}-\text{Mg})-\text{AlCrNi}$  coating and tear off a fine layer in small remains. It creates itself a functional gap between the blades and the casing seal. The combustion gases do not escape through the clearance, and contribute in the power production. The aim of this work is to investigate the behaviour of a particular sacrificial material, the Bentonite-metallic phase and its effect on the turbine blades wear during inter-reaction between them under experimental conditions of operating rotor blades. To determine this problem, we carried out several tests by changing 4 functional parameters. They are the incursion speed within the seal, the linear blades speed, the blades depth incursion inside the casing and the operating temperature. The obtained results are shown in form of graphs and maps, and the comments explain when there are blades wear or material transfer, and the different effects on coating surface.

## CHARACTERIZATION AND REACTIVITY IN PROPENE OXIDATION OF $\text{H}_{3+x}\text{PMo}_{12-x}\text{V}_x\text{O}_{40}$ HETEROPOLYACIDS SUPPORTED ON MESOPOROUS SBA-15

Siham BENADJI<sup>1,2\*</sup>, Pierre ELOY<sup>2</sup>, Alexandre LEONARD<sup>3,4</sup>, Bao-Lian SU<sup>3</sup>, Chérifa RABIA<sup>1</sup> and Eric M. GAIGNEAUX<sup>2</sup>

<sup>1</sup> Laboratoire de Chimie du Gaz Naturel, Faculté de Chimie, Université des Sciences et de la Technologie Houari Boumediene (U.S.T.H.B.), B.P: 32 El-Alia, 16111 Bab-Ezzouar, Alger, Algeria

<sup>2</sup> Inst. of Condensed Matter and Nanosciences (IMCN) – Division Molecules – Solids and Reactivity (MOST), Croix du Sud 2/17, Université catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium

<sup>3</sup> Laboratoire de Chimie des Matériaux Inorganiques (CMI), I.S.I.S, Facultés Universitaires Notre-Dame de la Paix (FUNDP), 61 rue de Bruxelles, B-5000 Namur, Belgium

<sup>4</sup> Laboratoire de Génie Chimique, B6a, Université de Liège, B-4000 Liège, Belgium  
a. Corresponding author ( s\_benadji@yahoo.fr, )

In Keggin type phosphovanadomolybdate acids, vanadium appeared to be the most crucial element for oxidative processes and the strong acidity of HPAs is known to be favourable to functionalization of alkanes. However, the major drawback of this type of materials is their low surface area ( $< 10 \text{ m}^2/\text{g}$ ). This disadvantage can be bypassed by supporting them on suitable materials with large surface area. The mesoporous silicates are known to have large surface area and high pore volume with uniform mesopores and high thermal stability.

In this work, we selected SBA-15 mesoporous silicate, for support, a series of Keggin-type heteropolyacids,  $\text{H}_{3+x}\text{PMo}_{12-x}\text{V}_x\text{O}_{40}.n\text{H}_2\text{O}$  ( $x=0-3$ ). All systems were characterized by different techniques and their catalytic properties were compared to those of bulk ones in the propene oxidation at  $350 \text{ }^\circ\text{C}$ .

This study showed that the presence of HPAs modifies the textural properties of SBA-15 material without destroying its structure. The interaction support-heteropolyacid leads to the formation of  $(\equiv\text{SiOH}_2^+)(\text{H}_{2+x}\text{PMo}_{12-x}\text{V}_x\text{O}_{40}^-)$  which appear to be the active sites in the propene oxidation. The supported HPAs exhibit higher catalytic activity and favoured the formation of acrolein, acetaldehyde and acetic acid, compared to the bulk catalysts that lead only to the formation of  $\text{CO}_x$ .

## **THE DISPERSION PROPERTIES OF MICRONIZED MARBLE SUSPENSIONS IN THE PRESENCE OF INORGANIC AND POLYMERIC DISPERSANTS**

Selçuk Koltka<sup>1</sup>, Sinem Güvercin<sup>2</sup>, Tuba Ekelik<sup>2</sup>, Orhan Özdemir<sup>3</sup>, Eyüp Sabah<sup>2a</sup>

1. Ermas Marble Tourism Industry Trade Co., Ula-Muğla, Turkey
2. Afyon Kocatepe Univ., Mining Eng. Dept., Afyonkarahisar, Turkey
3. Istanbul Univ., Mining Eng. Dept., Avcilar, Istanbul, Turkey
- a. Corresponding author (esabah@aku.edu.tr)

Calcium carbonate ( $\text{CaCO}_3$ ) is the most widely used filler and/or extender material in paper, paint, plastic, sealant, adhesive and several other industries, each of which requires specific product characteristics in terms of chemical purity, particle size distribution, shape and surface area, whiteness, and rheological behavior etc. Ground and precipitated calcium carbonates (GCC and PCC) are the two main sources. GCC is extracted through mining in the form of limestone, marble, dolomite or chalk, and it is wet or dry ground depending on the final product requirements. Even though cheaper, dry grinding is often limited to a minimum particle size of 2-3  $\mu\text{m}$ . More expensive wet grinding, which usually yields finer material, may be the required form of grinding when the final product must be in slurry form (i.e. in paper or paint applications). When GCC or PCC is in slurry form, solid concentration should be maximized to reduce transportation and drying costs without sacrificing the viscosity and stability of the slurry. Use of dispersants is the preferred method for achieving this. Electrokinetic studies in the literature showed that slurry stability is affected significantly by the zeta potential of calcium carbonate and its impurities.

## **ANALYSIS OF SWELLING BEHAVIOUR OF CLAY MINERALS BY DISCRETE NUMERICAL SIMULATION**

Hamed Bayesteh<sup>1</sup>, Ali Asghar Mirghasemi<sup>2,a</sup>

1. School of Civil Eng., College of Eng., Univ. of Tehran, Iran
2. School of Civil Eng., College of Eng., Univ. of Tehran, Iran
3. Author\_3's Institution, Dept., City, Country
- a. Corresponding author (aghasemi@ut.ac.ir)

The development of physically meaningful mathematical models for describing the geotechnical engineering behavior of expansive soils requires an understanding at the particle level. The discrete element method (DEM) framework has been previously shown to accurately model clay behavior at the microscopic level. Based on micromechanical calculation, a discrete element model for expansive soils has been developed by considering the following inter-particle forces present in the clay-water-electrolyte system: electrical double-layer repulsive force and mechanical force. The analytical solution is used to calculate the repulsive force and the assembly is assumed to be two-dimensional. The results of numerical tests using this model have been described and discussed. Simulations include the effect of pore fluid chemistry on the swelling behaviour of the clays and their microfabric anisotropy. The results of these simulations show that by increasing electrolyte concentration, the swelling pressure reduces. Also, the fabric anisotropy increases by increasing swelling pressure. The proposed model appear to capture the microscopic response on expansive soils patterns consistent with theoretical considerations especially the Gouy-Chapman diffuse double layer theory, serve to verify the validity of physico-chemical theories employed and help interpret experimental data more fundamentally in terms of the system variables.

## **PROCEDURE FOR CONTACT DETECTION BETWEEN PLATY COHESIVE PARTICLES**

Hamed Bayesteh<sup>1</sup>, Ali Asghar Mirghasemi<sup>2,a</sup>

1. School of Civil Eng., College of Eng., Univ. of Tehran, Iran
2. School of Civil Eng., College of Eng., Univ. of Tehran, Iran
3. Author\_3's Institution, Dept., City, Country
- a. Corresponding author (aghasemi@ut.ac.ir)

The discrete element method framework has been previously shown to accurately model cohesive soil behavior at the microscopic level. The most important step in the simulating cohesive particles process is contact detection. An applicable contact detection algorithm should be devised based on the micromechanical behaviour of the cohesive soils at the particle scale. This paper presents a new method for the detection of platy cohesive particles contact. The proposed method considers not only the mechanical contacts, but also the diffused double layer (DDL) repulsion between clayey minerals. The particles in mechanical contact and the particles in DDL repulsion are recognized by separate algorithms. The detection is designed by a sequential step-by-step process, bringing the focus onto the micromechanical interactions between clay minerals. Each interparticle force is individually calculated in the local system and transferred to the global system by a mathematical expression. Attempts are made to devise a clear algorithm to embed in discrete element method computational programming based on the clay's micromechanics. Based on the proposed algorithms, a new 2D DEM code has been programmed and a verification example is addressed. Also, one-dimensional compressibility behaviour of the clayey soils has been simulated and the results are compared with theoretical expectations.

## **EFFECT OF PORE CHARACTERISTICS ON THE PERMEATION PROPERTIES OF SINTERED DIATOMITE**

Jang-Hoon Ha, Eunji Oh and In-Hyuck Song

Powder and Ceramics Division, Korea Inst. of Materials Science, 797 Changwondaero, Seongsan-gu, Changwon, Gyeongnam 642-831, Republic of Korea  
a. Corresponding author (hjhoon@kims.re.kr)

Porous ceramic membranes have lately become a subject of special interest due to their outstanding thermal and chemical stability. We investigated whether a sintered diatomite support layer could also serve as a separation layer to minimize processing difficulty, and also whether the support layer and the separation layer could be made from the same material to avoid thermal mismatch during high temperature sintering process. We prepared sintered diatomite as a porous ceramic membrane for microfiltration, because diatomite particles are inherently porous and irregular. The air permeation properties of the sintered diatomite support layers could be enhanced by tailoring the pore structures. Furthermore, the largest pore sizes of the sintered diatomite support layers could be controlled by adopting a diatomite separation layer. These findings show the feasibility of using sintered diatomite as a porous ceramic membrane for microfiltration. The pore characteristics of the sintered diatomite specimens were studied by scanning electron micrographs, mercury porosimetry, and capillary flow porosimetry.

## **EFFECT OF HIGHLY POROUS EXPANDED SILICA GEL ADDITION ON THE PROPERTIES OF SiC-C BASED COMPOSITE ABLATION MATERIAL**

M.Serhat Başpınar

Afyon Kocatepe Univ., Technical Education Faculty, Turkey

a. Corresponding author:(sbaspinar@aku.edu.tr)

The main objective of this study was to investigate the processing of SiC-C based ablation material and optimization potential of the properties by the addition of highly porous expanded silica gel beads. SiC powders were bonded by Phenol formaldehyde type Novolac resin with hardener Hexamethylenetetramine (Hexamin) under single axis pressing. Samples were cured at 200 °C and graphitized at 1300 °C. To increase the carbon yield of the resin after graphitization, carbon flakes were added to the mixtures. Expanded silica gel beads which have different size and porosity were added to the mixtures at different amounts. Physical and mechanical properties of the composite were examined. Microstructural development were investigated and related with properties. Ablation rate of the samples were also measured under high velocity oxy-gas flame. Lowest bulk density of 1.56 gr.cm<sup>-3</sup> composites were produced by this method. Addition of the porous expanded silica gel beads decreases the ablation rate of the composite. However, this behaviour strongly depends on the mineralogical composition of the beads especially cristobalite content.

## **LOADED POLYMER FOAM MATERIAL FOR MICROWAVE ABSORPTION**

R. Benzerga<sup>1,a</sup>, V. Laur<sup>2</sup>, A. Sharaiha<sup>1</sup>

1. IETR, UMR CNRS 6164, Université de Rennes 1, IUT de Saint-Brieuc, 18 rue Henri Wallon, 22004 Saint-Brieuc, France.

2. Lab-STICC, UMR CNRS 6285, Université de Bretagne Occidentale, 6 av. Le Gorgeu, 29238 Brest, France.

a. Corresponding author:( ratiba.benzerga@univ-rennes1.fr)

The recent evolutions of telecommunications led to an increasing deployment of microwave and radiofrequency systems in our environment. These systems generate unwanted electromagnetic (EM) radiations which can cause devices malfunctions and create health risks. To overcome and eliminate these problems, absorber materials, based on loaded polyurethane, silicon or epoxy resin.....are usually used. In our work, we propose to study the EM attenuation performance of a composite obtained from polymer foam loaded with carbon fibers or particles.

Microwave characterizations of loaded polymer foams were achieved with a rectangular waveguide in the microwave frequency range. These measurements show that the highest dielectric losses are obtained with the carbon fiber reinforcement. This result is probably related to the dimension of the absorber filler (a few mm). Furthermore, values of permittivity and dielectric losses, of loaded foam, significantly and linearly increase with the load mass percentage and with the foam density. Moreover, a numerical simulation of the electromagnetic attenuation has been done with a 2cm-thick layer. Interesting attenuation values have been obtained. Indeed, attenuation of electromagnetic waves of 0.18 and 41.2 dB have been found for the unloaded and loaded absorbers with 0.6% by weight foam samples, respectively.

## MICROWAVE ABSORBING PROPERTIES OF REINFORCED FOAM-GLASSES DESIGNED FOR BUILDING INDUSTRY

R. Benzerga<sup>1,a</sup>, F. Benhoua<sup>2</sup>, V. Laur<sup>3</sup>, L. Le Gendre<sup>1</sup>, A. Ayadi<sup>2</sup>, A. Sharaiha<sup>1</sup>

1. IETR, UMR CNRS 6164, Univ. de Rennes 1, IUT de Saint-Brieuc, 18 rue Henri Wallon, 22004 Saint-Brieuc, France.
2. UR:MPE, Faculté des Sciences de l'ingénieur, Univ. M'Hamed Bougara, Avenue de l'Indépendance, Boumedes, Algérie.
3. Lab-STICC, UMR CNRS 6285, Université de Bretagne Occidentale, 6 av. Le Gorgeu, 29238 Brest, France.
  - a. Corresponding author: (ratiba.benzerga@univ-rennes1.fr)

This work concerns the development of a low-cost composite material for building industry, combining a porous matrix (foam-glass: thermally and acoustically efficient) to an electromagnetic (EM) absorbing material.

Foam glass samples have been elaborated with a reference composition of 99% cullet and 1% of limestone. A large range of loads (carbon and mineral oxides) has been added to the mixture with different weight percentages (from 0.1 to 5.0%). A study of the influence of glass foams elaboration parameters (namely the particle size of the raw material, the process temperature, the dwell time and the heating rate) on their thermal and acoustic properties has been performed in order to improve materials performance. Relevant results on the influence of temperature on the porosity of the foam glass have been obtained. Otherwise, dielectric characterizations of loaded foam glass were performed in the [8 – 12] GHz frequency range. The results show that the best performances (high dielectric losses) are observed with the carbon fiber reinforcement. This result is probably related with the dimension of the absorbent filler. Based on dielectric measurements, a numerical simulation of the EM attenuation has been done. Interesting attenuation values compared to standard insulator building materials have been obtained.

## THE EFFECT OF PARTICLE SIZE ON THE SINTERING OF UHMWPE POWDER

R. Hosseini-zhad, M. Rezaei\* and S. Talebi

Dept. of Polymer Eng., Sahand Univ. of Technology, Tabriz, Iran.

a. Corresponding author: (rezaei@sut.ac.ir)

Ultra high molecular weight polyethylene (UHMWPE) is commonly used in artificial joints because of its high wear resistance. Due to its extremely high molecular weight, resulting in poor processability, it is difficult to consolidate that via conventional melt-mixing and so it is commonly sintered. UHMWPE particles with cauliflower morphology (nodular- fibrillar structure) are too much porous. Particle size is one of the most important variables used to optimize sintering process. In this study we investigated the effect of particle size on the sintering rate of three different grades of UHMWPE powders, at temperatures 230°C and 240°C. Particle size distributions were estimated by light microscopy and neck growth was determined as a function of time, for different sizes from each polymer grade at isothermal sintering conditions. It was found that as the size of particles decreased, the time required for the onset of sintering process as well as the time required to reach the 99% of complete neck growth, decreased. Moreover the rate of sintering for all UHMWPE grades increased with decreasing the particle size. These results confirmed that the smaller the particle size leads to the greater sintering surface area and coalescence thermodynamic driving force.

## **SIMULATION OF MICRO-PERMEABILITY DURING SOLIDIFICATION OF Al-3%Si MUSHY ALLOY AS A DYNAMIC POROUS MEDIA**

Sadegh Firoozi, Seeyed Mohammad Hossein Mirbagheria, Hossein Baiania, Mohtaba Barzegaria

a. Corresponding author:(s.firoozi@aut.ac.ir)

The mushy alloys generally are solidified as equiaxed dendrite with random distributions and different sizes and morphologies. Ability of interdendritic liquid flow is described with permeability parameter calculated using Darcy's law. In this paper interdendritic liquid flow during nucleation and grain growth are simulated. The numerical simulation procedure includes two stages; first, numerical evolution of the shape, number, size, and distribution of dendrites during solidification using a novel Cellular Automaton Finite Volume (CA-FV) method, and second, numerical determination of the micro-permeability by a Computational Fluid Dynamics (CFD) technique. Subsequently, the effect of some critical factors, such as Reynolds number, the cooling rate and the solidification rate on the micro-permeability factor, during solidification are investigated on a 1000x1000 micron domain. Results showed it is possible to propose a mathematical model to relate the Reynolds number as a non-dimensional micro liquid flow and the micro-permeability during non-constrain solidification.

## **KINETIC STUDY OF MAJOR COMPONENTS AND ANTIBACTERIAL ACTIVITY OF THE ESSENTIAL OIL from LEAVES OF INULA VISCOSA (L.) GRUEUTER**

Nafila Zouaghi<sup>1</sup>, Boubakeur Nadjemi<sup>1</sup>, Imène Beldjoudi<sup>1</sup>, Sihem Acef<sup>1</sup>, karima Hamza<sup>2</sup>

<sup>1</sup>Laboratoire d'étude et de développement des techniques de traitement et d'épuration des eaux et de gestion environnementale. Ecole Normale Supérieure, Kouba. Algeria

<sup>2</sup>Laboratoire de biologie des systèmes microbiens. Ecole Normale Supérieure, Kouba. Algeria

a. Corresponding author (zouaghinafila@yahoo.fr)

Algerian *Inula viscosa* essential oil yield evolution during water distillation has been investigated as a function of grinding leaves. GC/MS analysis helped to determine the extraction kinetics of the major components of this essential oil. The results show that there are two kinetic types. We have tried to correlate this kinetic type with the essential oil location in the vegetable material and chemical composition. The microscopic observations show that most of the essential oil is localized in parenchyma but there are some in glandular hairs. The water distillation of grinding leaves offers important advantages over the whole leaves: shorter isolation times (50 min against 5 h for hydrodistillation). The activity of the essential oil of whole leaves was evaluated against four Bacteria ( 2 Gram-positive: *Bacillus Subtilis*, *Staphylococcus Aureus*, and 2 Gram-negative : *Klebsiella Pneumonia*, *Enterobacter Cloacae*), and two fungi ( *Aspergillus Niger* and *Candida Albicans*). Result showed was the oils exhibited moderate antibacterial activity and significantly not active of antifungal.

## **ELECTROMAGNETIC WAVE ABSORPTION PROPERTIES OF MAGNETIC NANOWIRES GROWTH IN NANOPOROUS ANODIC ALUMINA TEMPLATE**

Majid Ebrahimzadeh, Hossein Ghaforyan, Mohammad Reza Zeidiyam

a. Corresponding author (pasiran@gmail.com)

Magnetic nanowire arrays were prepared by electrodeposition into nanopores of anodic alumina template using a two-electrode electrochemical cell. The morphology of the samples was investigated by means of scanning electron microscopy (SEM). The microwave absorption characteristics of the samples were examined using hp network analyzer. Result show that arrays of magnetic nanowires have 66 nm in diameter. The electromagnetic wave reflection loss values of the Ni nanowire/paraffin composite sample are lower than -20 dB when the thickness of then a nanowire/paraffin composite is adjusted, and an optimal reflection loss value of -40.2382 dB is obtained at 14.356 GHz with an absorber thickness of 1.8mm, suggesting that the nickel nanowire composites are promising candidates as microwave absorbers.

## **EFFECT OF USAGE OF FLY ASH AND SILICA FUME AT CONCRETE PRODUCTION OVER QUALITY AND COST OF CONCRETE**

Süleyman Uluöz<sup>1,a</sup>, Selahattin Düzbasan<sup>2</sup>, Erol Yakıt<sup>3</sup>, Tolga Uluöz<sup>4</sup>

1.Ilgaz Cons. Trade Ştd Co, Quality Control Manager , Adana, Turkey

2.Ilgaz Cons. Trade Ştd Co, General Manager , Ankara,Turkey

3.Railone Ilgaz Sleeper Factory, General Manager, Polatlı – Ankara, Turkey

4. Politechnika Warszawska , Faculty of Civil Eng., Warsaw, Poland

a. Corresponding author (uluozsuleyman@hotmail.com)

While it is one of the biggest problems of plant managers to dispose fly ash which emerges during the activities of thermal plants, fly ash and silica fume have been started to be used as a result of R&D studies performed in building sector and so the production cost has been decreased and quality of concrete has been increased. In production of 1 ton CEM I cement, approximately 900 kg CO<sub>2</sub> gas emerges. So there is a positive effect over environmental pollution of usage of fly ash and silica fume in cement and concrete production.

Silica fume particle is 100 times finer than cement so silica fume is preferred especially in marine structures. By this means, silica fume enters into cavities which are not filled by concrete and so no other chemical substances inside sea water can enter into concrete, corrosion of reinforced concrete is prevented. In production of 202 ea precast beam for terminal structure at Yumurtalık section of BTC (Baku Tbilisi Ceyhan Raw Oil Pipe Line), 112,8 ton silica fume and 24 ton super plasticizer concrete chemical including naphthalene sulphonate group so these precast beams have not been affected from sea water.

## **THE ROLE OF THE ZEOLITE STRUCTURE ON THE ACTIVITY IN GAS-PHASE DIHYDROXYBENZENES PRODUCTION VIA PHENOL OXIDATION BY N<sub>2</sub>O**

Larisa Pirutko, Dmitry Ivanov, Gennady Panov

*a.* Corresponding author (pirutko@catalysis.ru)

Zeolites represent the most important inorganic materials for catalysis and find applications in many fine chemical synthesis. Gas-phase selective oxidation of phenol to dihydroxybenzenes by N<sub>2</sub>O is an example of such reaction. This reaction was shown successfully proceed on zeolite MFI structure with participation of so called  $\alpha$ -sites, the complexes of admixed or specially introduced iron into zeolite matrix.

This work is devoted to investigation of the title reaction over zeolites with different channel architecture, specifically MTT, MFI, BEA and MOR, optimized on chemical composition and content of active sites. Effect of the zeolites structural features, in particular, size of channels and their dimensionality, on activity, selectivity and stability of obtained catalysts was studied. The best of catalysts demonstrated high activity with a selectivity of N<sub>2</sub>O conversion toward DHB formation of 90-95%. Also the strong influence on isomers distribution of dihydroxybenzenes (hydroquinone and catechol ratio) was revealed that allows you to regulate the composition of the reaction products.

The results stimulate the search of new type of zeolites for using as base of catalysts for this new and ecologically friendly route to dihydroxybenzenes synthesis using N<sub>2</sub>O oxidant.

## **THE MECHANISM OF ANTIBACTERIAL PROPERTIES OF CERAMIC GLAZING POWDER MATERIALS**

Mehmet Hancer<sup>a</sup>, Hasan Hüseyin Ipekçi,

*a.*Corresponding author (mhancer@erciyes.edu.tr)

Most recently, the ceramic materials with antibacterial and antioxidant properties are found to be sold by the companies. Furthermore, in some developing countries legislations were introduced for the mandatory usage of these products in the public buildings due to their superior hygienic and health benefits. In this work, the antibacterial effectiveness of some common powder materials used in ceramic glazing industry such as albite, wollastonite, zircon, along with model aluminium silicates like montmorillonite and zeolite against *Escherichia coli* were demonstrated using the salts of silver, copper and zinc. Active ionic species of which provide anti-bacterial properties were incorporated into the glazing recipes by ion exchange and by high temperature processing. The surface charge measurement were used to explain the adsorption mechanism of active salts on the negatively charged powder glazing raw material surfaces as a function of concentration (up to 0.1 M) and pH (at acidic and alkaline). Antibacterial activities were found to enhance at alkaline pH due possibly to the formation of metal hydroxy complexes on the surface of those glazing raw materials. It seems antibacterial affinities of raw powder materials diminishes at sintering temperatures (>1000°C) with the exception of zeolites.

# **A STUDY FOR ANISOTROPY OF POROUS AND POWDER MATERIALS FROM A DIFFERENT PERSPECTIVE: USE OF ORTHONORMAL PARTS OF ELASTIC CONSTANT TENSOR**

Çiğdem Dinçkal<sup>1</sup>

1. Çankaya Univ., Dept. of Civil Eng., Ankara, Turkey  
a. Corresponding author: (cdinckal@cankaya.edu.tr)

Many porous and powder materials in engineering are anisotropic and inhomogeneous due to the varying composition of their constituents. For a deep understanding of physical properties of these materials, use of tensors is inevitable. In this paper, an innovational general form and more explicit physical property of elastic constant tensor in terms of its orthonormal parts are presented. As applications, numerical examples from various porous and powder materials are given.

Furthermore norm and norm ratio concepts are introduced to measure and compare the anisotropy degree for different porous and powder materials with the same or different anisotropic elastic symmetries. For these materials, norm and norm ratios are computed. It is suggested that norm may be used as a criterion for comparing overall effect of the properties of anisotropic materials and norm ratios can be used as a criterion to represent the anisotropy degree of materials.

To summarize, main contributions of this work are to investigate the elastic and mechanical properties of an anisotropic porous and powder material from a different perspective, determine anisotropy degree of that material and also anisotropic elastic symmetry type for a porous and powder material given from an unknown symmetry.

## **A NOVEL TECHNIQUE TO DETERMINE SURFACE POTENTIAL DISTRIBUTION OF ALUMINA SINGLE CRYSTAL SUBSTRATE SURFACES IN AQUEOUS MEDIUM**

Gulnihal Ozek Yelken, Mehmet Polat

a. Corresponding author: (gulnihalyelken@iyte.edu.tr)

Van der Waals(vdW) and electrical interaction forces between colloidal particles play an important role in control and manipulation of numerous physicochemical systems in mineral, ceramic, and environmental sciences since they determine stability, rheology, and forming characteristics [1,2,3]. Interaction forces between a silicon nitride tip and alumina surfaces were measured using AFM under different pH conditions. The force data was compared with electrophoretic measurements using the DLVO theory assuming constant potential or constant charged surfaces [4]. In calculating the electrostatic component of the interaction, a newly developed method which is suitable for arbitrarily charged surfaces was employed [5]. The paper includes a detailed description of the procedures used for obtaining the raw force data, conversion of it to force-distance curves and comparing it with the theory for various charging conditions. The surface potential at the point of measurement could then be determined from the electrostatic component. Multiple AFM force measurements on carefully selected locations on the surface could be used to generate a surface charge/potential map of the surface using appropriate theories [6,7,8]. The results were confirmed with separate electrokinetic measurements obtained with alumina surfaces.

## **SYNTHESIS OF 2,4,5-TRIPHENYL IMIDAZOLE DERIVATIVES USING 1,4-DIMETHYL PIPRAZINIUM HYDROGEN SULFATE AS GREEN REUSABLE CATALYST**

Vagif M. Abbasov<sup>1</sup>, Adel A. Marzouk<sup>2\*</sup>, Avtandil H. Talybov<sup>1</sup> and S. Z. Kazimova<sup>1</sup> and Orkhan. A. Aydemirov<sup>1</sup>

<sup>1</sup>Mamedaliev Inst. of Petrochemical Processes, National Academy of Sciences of Azerbaijan, Baku, Azerbaijan

<sup>2</sup>Pharmaceutical Chemistry Dept., Faculty of Pharmacy, Al Azhar Univ., Egypt

a. Corresponding author: (adel\_marzouk77@yahoo.com)

Imidazoles are a class of heterocyclic compounds that contain nitrogen and are currently under intensive focus due to their wide range of applications, because they have many pharmacological properties and play important roles in biochemical processes. The potential and wide range of application of the imidazole pharmacophore may be attributed to its hydrogen bond donor–acceptor ability as well as its high affinity for metals. Many of the substituted imidazoles are known as inhibitors of p38 MAP kinase, fungicides, herbicides, plant growth regulators, antibacterial, antitumour, pesticides and therapeutic agents. In recent years, alkylated imidazoliums are substantially used in ionic liquids that have been given a new approach to ‘Green Chemistry’. The imidazole compounds were also used in photography as photosensitive compound. They also serve as useful building blocks for the synthesis of other classes of compounds. Owing to the wide range of pharmacological and biological activities, the synthesis of imidazoles has become an important target in current years. Among them, tri- and tetrasubstituted imidazoles have received. There are several methods reported in literature for the synthesis of imidazoles. Ionic liquid (IL) technology offers a new and environmentally benign approach toward modern synthetic chemistry. Ionic liquids have interesting advantages such as extremely low vapor pressure, excellent thermal stability, reusability, and talent to dissolve many organic and inorganic substrates. Ionic liquids have been successfully employed as solvents and catalyst for a variety of reactions, which promise widespread applications in industry and organic syntheses.

1,4-Dimethyl Piprazinium Hydrogen sulfate as Brønsted acidic ionic liquid was used as an efficient and reusable catalyst for the one-pot synthesis of 2,4,5-trisubstituted imidazoles that achieved by three component cyclocondensation of 1,2-dicarbonyl compound, aromatic or aliphatic aldehyde and ammonium acetate under thermal solvent-free conditions. The key advantages of this process are cost effectiveness of catalyst, reusability of catalyst, easy work-up and purification of products by non-chromatographic methods, excellent yields and very short time reactions. Many of the synthetic methods for imidazoles suffer from one or more disadvantages such as low yields, harsh reaction conditions, prolonged time period and application of hazardous and expensive catalysts. Therefore the development of greener

We report herein, a simple synthesis of 2,4,5-trisubstituted imidazoles in high yields using Brønsted acidic ionic liquid, 1,4-dimethyl Piprazinium Hydrogen sulfate as a catalyst for the first time. Products were characterized by melting point, <sup>1</sup>H, <sup>13</sup>C NMR and IR spectroscopy.

## **DEVELOPMENT OF NOVEL BORON NITRIDE NANOTUBE SYNTHESIS METHOD**

Şaban Kalay<sup>1</sup>, Zehra Yılmaz<sup>1</sup> and Mustafa Culha<sup>1,a</sup>

1. Dept. of Genetics and Bioengineering, Yeditepe Univ., Atasehir, Istanbul, Turkey

a. Corresponding author (mculha2@gmail.com)

In this study, the synthesis of BNNTs are achieved from a boron ore and Fe catalyst under NH<sub>3</sub> atmosphere for the first time. The synthesized BNNTs have single crystalline hexagonal boron nitride lattice, multi-walled and randomly oriented at uniform structure at 10-30 nm outer diameter and 5 nm wall thickness. High-resolution transmission electron microscopy revealed that the distance between the BNNT walls is 3.4 Å.

## **SURFACE MODIFICATION OF BIOIMPLANT MATERIALS THROUGH NANOSTRUCTURING AND HYDROXYAPATITE COMPOSITE COATINGS**

G. Bahar Basim, Roxana Family, Zeynep Ozdemir  
a. Corresponding author: (Bahar.Basim@ozyegin.edu.tr)

Titanium implants are commonly coated with hydroxyapatite (HA), a bioceramic which resembles the mineral constituents of human bones and teeth. The use of HA is promising in that, it has very similar chemical and crystallographic structures to those of the human bone, which effectively promotes biocompatibility. However, HA is brittle, low in tensile strength and fracture toughness. To improve on these properties, nano composites of HA with Al<sub>2</sub>O<sub>3</sub> and Si<sub>3</sub>N<sub>4</sub> are used to reinforce its mechanical properties. In this study functionally graded HA-Al<sub>2</sub>O<sub>3</sub>-Si<sub>3</sub>N<sub>4</sub> coatings were prepared on nanostructured Ti implants by sol-gel process using calcium nitrate and diammonium hydrogen phosphate dissolved in deionized water. HA-Al<sub>2</sub>O<sub>3</sub>-Si<sub>3</sub>N<sub>4</sub> coating sols were orderly dip coated on the substrates and pyrolyzed in air. Crystallization of the coatings were determined by X-ray diffraction and Atomic force microscopy as a function of the induced surface roughness after annealing. Results showed that the bending strength of nanohydroxyapatite was improved significantly by the addition of Si<sub>3</sub>N<sub>4</sub>-Al<sub>2</sub>O<sub>3</sub>.

## **TEXTURAL PROPERTIES OF NANOPOROUS CLAYS AND DYES ADSORPTION FROM AQUEOUS SOLUTIONS**

Zenon Sarbak  
a. Corresponding author: (sarbak@amu.edu.pl)

Natural aluminosilicates mined in the form of clays make an important and cheap material used in many branches of practical applications. Depending on the site of mining, the composition and layer structure of the clays are different, which determines the interlayer distances. The differences are also manifested in the concentration and localisation of the surface hydroxyl groups and the number and type of ion-exchange cations determining the texture and chemical activity of the clays. To characterise selected clays mined in Poland the study was undertaken to determine their structural properties and texture. The ion-exchange capacity of the clays was also estimated. The adsorbing properties of selected clays were tested in the process of adsorption removal of organic dyes from water environment. The dyes used in the tests were of different types, including thiazine ones (methylene blue), triarylmethane (methylene violet), azomethine (aniline golden yellow), azo (acidic orange II) and anthraquino (synthene blue).

## **THE ANALYSIS OF ALGINATE NANOCARRIERS WITH NOVEL CROSS-LINKERS: THE EFFECT OF CROSS-LINKER ON DRUG RELEASE AND BIOLOGICAL ACTIVITY**

Umran Aydemir Sezer<sup>1,2</sup>, Yasemin G. Isgor<sup>1</sup>, Belgin S. Isgor<sup>1,a</sup>

1 Dept. of Chemical Eng. and Applied Chemistry, Faculty of Eng., Atilim Univ., Ankara, Turkey

2 Dept. of Biomedical Eng., Middle East Technical Univ., Ankara, Turkey

a. Corresponding author (bisgor@atilim.edu.tr)

Nanoparticles as drug carriers can provide sustained release of encapsulated drug to the target cells. For this purpose, biocompatible polymers appear to be advantageous, and of these, alginate is usually produced via ionic cross-linking with calcium ion. For stable alginate nanoparticles, ANP, a new method has been proposed with use of Aerosol OT<sup>TM</sup> (AOT) as surfactant in addition to cross-linker ions. Using this new approach, doxorubicin (Dox) loaded manganese (Mndox) and zinc (Zndox) cross-linked ANPs were prepared for the first time, in addition to previously described calcium cross-linked ANPs (Cadox), in the present study. The controls were zinc, manganese and calcium cross-linked ANPs without Doxorubicin. Morphological characteristics, particle size distribution and zeta potential of these particles were investigated together with their drug release behavior. ANPs were found with a size range of 200-400 nm and negative values of zeta potential in the range of 34-65. The drug carriers demonstrated sustained release of Dox under in vitro conditions. These ANPs are still under evaluation via acellular and cellular in vitro assays to reveal the effect of cross-linker metal ions on drug uptake and effectiveness, considering that Mn and Zn are the essential cofactors of enzymes in drug metabolism and cellular functioning.

## **CHARACTERIZATION AND BIOACTIVITY OF SOL-GEL DERIVED BIOACTIVE GLASSES: COMPARISON OF MESOPOROUS AND MICROPOROUS POWDERS**

Saeed Hesaraki, Mehri Sohrabi, Asghar Kazemzaded, Masoud Alizadeh

Nanotechnology and Advanced Materials Dept., Materials and Energy research center, Alborz, Iran

a. Corresponding author: (S-Hesaraki@merc.ac.ir)

In this study, bioactive glass based on CaO-SiO<sub>2</sub>-P<sub>2</sub>O<sub>5</sub> system was produced through sol-gel technique at two different processing methods in which micro- or meso-porous were achieved: single step sol-gel route in which precursors are hydrolyzed to oxides in an acidic medium and gelation occurs at a long period of time (which yielded microporous material) and quick alkali-mediated method in which hydrolyzed precursors form a gel network quickly, due to the use of ammonia solution (which provides mesoporous powder). Specific surface area/adsorption-desorption isotherms and morphology of the powders were determined by BET and TEM techniques, respectively. For surface reactivity measurements, the powders were immersed in simulated body fluid (SBF) for different intervals and then characterized by XRD and FTIR. The results of TEM and BET measurements showed that both methods provided nano-clusters of bioactive glass. The glasses produced through quick alkali-mediated methods had mesopores with smaller particles, but higher specific surface. Precipitation of apatite phase was confirmed on surfaces of glasses though the rate of precipitation was higher for the mesoporous glass. It seems that the surface reactivity (and hence bone bonding ability) of bioactive glass materials can be controlled using appropriate processing techniques.

## COMPOSITION AND ANTIMICROBIAL ACTIVITY OF VOLATILE ISOLATES FROM LEAVES AND STEMS OF *Inula viscosa* (L.) Grueuter

N. Zouaghi <sup>1</sup>, C. Bellal<sup>1</sup>, C. Cavaleiro <sup>2</sup>, B. Nadjemi <sup>1</sup>, M. Yousfi <sup>3</sup>

<sup>1</sup>Laboratoire d'étude et de développement des techniques de traitement et d'épuration des eaux et de gestion environnementale. Ecole Normale Supérieure, Kouba, Algeria.

<sup>2</sup> Centro de Estudos Farmacêuticos / Faculdade de Farmácia, Universidade de Coimbra, Portugal.

<sup>3</sup>Laboratoire des Sciences Fondamentales, Université Amar Telidji, Laghouat, Algeria

a. Corresponding author: (zouaghinafila@yahoo.fr)

The composition of the isolates obtained by water distillation from the leaves and stems of *Inula viscosa* (plant material collected at Bainam forest, at northwest from Alger, Algeria), were analyzed by GC and GC-MS. The isolate for stems (yield 0.036% w/w), is mainly composed of diterpenoids (69.1%), being E-totarol (18.1%),  $\alpha$ -cedrol (16.7%), ferruginol (16.6%), isoabienol (12.1%), abienol (8.3%), isopimaradiene (5.1 %), abietatriene and manoyl oxide (3.6%), the major components differently, the isolates from leaves (yield 0.29% w/w) is rich in oxygen containing sesquiterpenes (40.7%) namely: caryophyllene oxide (10.4%), fokienol (9.6%),  $\alpha$ -eudesmol (7.6%), E-nerolidol (7.0%) and  $\gamma$ -eudesmol (6.2%).

Isolates were also tested against four bacteria ( *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*), and two fungi (*Saccharomyces cerevisiae* and *Candida albicans*). using the Kirby Bauer disk-diffusion method. All bacteria were susceptible to the *Inula viscosa* volatile isolates

## STUDY OF ADSORPTION CAPACITY RECOVERY IN DIFFERENT ADSORBENTS FOR NITROGEN REMOVAL FROM DIESEL

Souza, W. C. <sup>a</sup>; Baia, L. V. <sup>a</sup>; Figueiredo, M. A. G. <sup>b</sup>; Chiaro, S.S.X. <sup>c</sup>

<sup>a</sup> Eng. and Technology of Petroleum and Petrochemicals Laboratory– Inst. of Chemistry – State Univ. of Rio de Janeiro,

<sup>b</sup> Operation and Industrial Process Dept., Chemical Inst. – State Univ. of Rio de Janeiro, Maracanã – CEP: 20550-900 – Rio de Janeiro – RJ – Brasil.

<sup>c</sup> PETROBRAS/ CENPES/ HPE, Cidade Universitária - CEP: 21941-915, Rio de Janeiro – RJ –Brasil

a. Corresponding author (mgaya@uerj.br)

The adsorption technique is a promising alternative to be employed in the removal of nitrogenous contaminants existing in diesel fuel in order to reduce the severity of Hydrotreating. However, the regeneration step of the adsorbent employed is very important for enabling industrially, the adsorption process. It was studied the following steps: adsorption and desorption [1] (by displacement with gas, by washing with solvent, by burning, by burning and a washing with solvent). It was tested clays and commercial activated carbon. It was found that the family of clays showed, in general, better performance in removing nitrogen compounds. In the desorption process by displacement with inert gas, carried out at two different temperatures, it was found that at a temperature of 200°C, the efficiency of clays showed a recovery efficiency greater than that obtained at 400°C. Desorption, by washing at room temperature, gave evidence that the methyl tert-butyl ether (MTBE), among the solvents tested, was what allowed greater recovery. The desorption process by burning at 450°C, without washing the adsorbent, showed a slight improvement compared to the burning eluted using the adsorbent. In tests for reuse, it was concluded that the clay presented good results showing a sharp decrease in adsorption capacity after the third series of washing, however recovering partially adsorption capacity after a controlled burning. Thus, desorption by displacement with gas and by burning obtained the best results, but they consume

## PREPARATION AND CHARACTERIZATION OF UNIFORM TiO<sub>2</sub> MEMBRANE ON POROUS 316L STAINLESS STEEL SUBSTRATE

Fatemeh Mohamadi<sup>1,a</sup>, Nader Parvin<sup>1</sup>, Amir\_Reza\_Azadmehr<sup>1</sup>

1. Dept. of Mining and Metallurgical Eng., Amirkabir Univ. of Technology (Tehran Polytechnic), Hafez Street, Tehran, Iran

a. Corresponding author (fmohamadi@aut.ac.ir)

In this work the preparation and characterization of a membrane containing a uniform mesoporous Titanium oxide top layer on a porous stainless steel substrate has been studied. The supported membrane was a suitable metallic-ceramic composite membrane which incorporated desirable properties of both ceramic membrane and porous metallic substrate. The 316L stainless steel substrate was prepared by powder metallurgy technique and modified by soaking-rolling and fast drying method. The mesoporous titania membrane was fabricated via the sol-gel method. Morphological studies were performed on both supported and unsupported membranes using scanning electron microscope (SEM) and field emission scanning microscope (FESEM). The membranes were also characterized using X-ray diffraction (XRD) and N<sub>2</sub> –adsorption / desorption measurement (BET analyses). It was revealed that a defect-free anatase membrane with a thickness of 1.6 μm and 4.2 nm average pore size can be produced. In order to evaluate the performance of the supported membrane, single – gas permeation experiments were carried out at room temperature with nitrogen gas. The permeability coefficient of the fabricated membrane was 4×10<sup>-8</sup> lit s<sup>-1</sup>pa<sup>-1</sup>cm<sup>-1</sup>. The prepared titania membrane can be utilized in nano filtration and separation.

## CORROSION INHIBITION OF CARBON STEEL IN OIL FIELD FORMATION WATER CONTAINING CO<sub>2</sub> BY SOME SURFACTANTS FROM THE TYPE OF FATTY ACIDS

V. M. Abbasov<sup>1</sup>, Hany M. Abd El-Lateef<sup>1,2</sup>, L. I. Aliyeva<sup>1</sup>, I. T. Ismayilov<sup>1</sup>

Mamedaliev Inst. of Petrochemical Processes, National Academy of Sciences of Azerbaijan, AZ1025 Baku, Azerbaijan

<sup>2</sup>Chemistry Dept., Faculty of Science, Sohag Univ., 82524 Sohag, Egypt

a. Corresponding author (Hany\_shubra@yahoo.co.uk)

In this work the performance of commercial surfactants from the type of fatty acids, using rotating cylinder electrodes (RCE) has been investigated. The investigations have been conducted on **carbon** steel electrodes in CO<sub>2</sub>- saturated oilfield formation water (1 bar CO<sub>2</sub> pressure) at the temperature 50 °C. The **corrosion** process was monitored by weight loss and linear polarization resistance corrosion rate.

The experimental results showed that the synthesized surfactants are a good corrosion inhibitors and the inhibition efficiency increased with the increase of surfactant concentration. This trend may result from the fact that adsorption and surface coverage increases with the increase in concentration; thus the surface is efficiently separated from the medium.

The data shows that, the inhibition efficiency in the case of studied inhibitors increases with increasing concentration of the inhibitor reaching maximum values of 93.82 and 96.22%, respectively, around their critical micelle concentrations. The inhibition efficiency of metal slightly changes when the surfactant concentration exceeds the critical micelle concentration. This behavior may be due to saturation of the surfactant adsorbed layer at the critical micelle concentration.

The inhibitor protection efficiency is assumed to be associated with the degree of inhibitor adsorption at the metal surface, and adsorption isotherms have been calculated for the inhibitors in the concentration range 100-600 ppm. A Langmuir isotherm was found to give the best fit of the experimental data. The thermodynamic parameters ( $K_{ads}$ ,  $\Delta G_{ads}^o$ ) of adsorption for the studied compounds are calculated from their adsorption isotherms. From the thermodynamic point of view, the adsorption process is spontaneous and chemisorption.

## **Composites “a binary salt system inside a porous matrix”: intent design of the adsorbents for particular applications**

A.D. Grekova, L.G. Gordeeva\*  
a. Corresponding author: (gordeeva@catalysis.ru)

An attractive way to enhance the efficiency of adsorption technologies is harmonization of the adsorbent properties with the operating conditions of the particular process. Composites “salt inside porous matrix” (CSPM) are considered promising for various applications owing to their high sorption capacity (0.6-1.4 g/g) and wide opportunities to manage their sorption behavior. Sorption of vapour V on the CSPMs includes reaction of the salt S with V resulting in the complex  $S^*nV$  formation. The confinement of two active salts S1 and S2 inside the porous matrix gives a fresh opportunity to control the equilibrium pressure  $P^*$  of complex  $S1S2^*nV$  formation, and consequently the sorption properties of the CSPMs. For a number of CSPMs based on various binary salts ( $LiCl + LiBr$ ,  $CaCl_2 + CaBr_2$  and  $BaCl_2 + BaBr_2$ ) and matrices (silica, vermiculite) it was shown that the formation of salts solid solution resulted in a shift of isotherms (isobars) of water, methanol and ammonia sorption regarding to the isotherms for the single-salt composites. The intelligent selection of appropriate salts and their content allows precise tuning the sorption properties of the composites. Using the developed method, novel composite sorbents were intently tailored for particular adsorption cooling cycles that gave a significant enhancement of their efficiency.

## **INVESTIGATION OF THE BAND SPEED PARAMETERS IN FILLING PROCESS OF PORE TRAVERTINES**

Sevgi Gürcan<sup>a</sup>, Ilgın Özgen, Zeki Karaca  
a. Corresponding author: (sgurcan@aku.edu.tr)

The filling performance of a pore travertine is influenced by a variety of operational parameters such as band speed, feed rate, head pressure and also the properties of pore size of travertine. This study was carried out with the intent of establishing the band speed parameters effecting filling performance in the pore travertine. To achieve this goal, two different travertine samples were selected for the filling of pore with cement. Using a filling machine, it was used in Alimoglu Marble Factory (AMF), filling experiments of the studied travertine were applied different band speed under constant head pressure and head rotation for samples having 60x30x1 cm dimension. Filling performance was determined by scanning electron microscopy (SEM) and polarizing microscope. Filling experiments and microscopic analysis indicated that, with a few exceptions, band speed increased with decreasing filling performans. It was also concluded that the amount of pores present in the samples, as well as their distribution.

## **PRODUCTION OF FINE CHEMICALS FROM GLYCEROL, BYPRODUCT OF BIODIESEL, VIA MESOPOROUS MCM-41 SUPPORTED CATALYSTS**

E. Ekinçi , N. Oktar\*

Dept. of Chemical Eng., Gazi Univ., 06570, Ankara, Turkey

\* Corresponding author (nurayoktar@gazi.edu.tr)

Glycerol is the major side product of biodiesel production, environmental concerns and the economics of biodiesel production enforces the conversion of glycerol to valuable products. The esterification of glycerol with acetic acid can be a good choice for utilization of side product of glycerol. Main products of this reaction are; monoacetin, diacetin and triacetin that have many applications in cryogenics, cosmetics, fuel additive and etc.

In the presented study; esterification reaction of glycerol with acetic acid has been studied in the presence of silicotungstic acid (STA) and zirconia ( $ZrO_2$ ) incorporated MCM 41. MCM-41 was synthesized by hydrothermal synthesis method and STA and  $ZrO_2$  was added to the catalyst structure by wet-impregnation. XRD patterns of bare MCM-41 synthesized by direct hydrothermal route showed (100), (110), (200) reflections at  $2\theta$ ; 2.3, 3.74 and 4.32. By impregnation  $ZrO_2$  and STA to the MCM-41 peak intensities are decreased. Adsorption-desorption isotherms showed type IV (IUPAC classification) isotherm of adsorption isotherms typical of mesoporous solids.

Reaction studies were performed in an autoclave reactor at 105 °C and initial molar ratio of the reactants Glycerol/Acetic acid; 1/6 over 0.5 g catalyst. MCM-41 supported catalysts showed a 86% glycerol conversion in a reaction time of 245 minutes.

## **EFFECT OF Nb ON Zr-Ti FOAMS FOR IMPLANTS**

María Inés Luppó, Abner Eduardo Aguilar Maya, Daniel Rodolfo Grana, Alfredo Hazarabedian, Gabriel Adrián Kokubu, Gustavo Vigna

a. Corresponding author: (luppó@cnea.gov.ar)

One way of achieving a bone substitute is to use a porous material, so that new tissue, and ultimately new bone, can grow into the pores and help to prevent loosening and movement of the implant. There are only five elements that have been identified as producing no adverse tissue reaction: Nb, Zr, Ta, Pt and Ti. In the present study, Zr–Ti–Nb foams with two amounts of Nb (1.6 and 5.5%) were fabricated starting from hydride-dehydride powdered metal using space-holding fillers. The characterization of the porous alloys was carried out using optical, scanning electron microscopes and X-ray diffraction. Densities were determined using a helium pycnometer and compression tests were carried out to evaluate their mechanical properties. Biocompatibility studies were performed in Wistar rats. A high porosity (60% - 70%) and an interconnected porous structure were obtained. Young's modulus (0.3 and 1.4 GPa) and compressive plateau stress (11 and 32 MPa) not only depend on the porosity but also on the amount of Nb in the foam. The foam with 1.6%Nb exhibited a ductile fracture while the foam with 5.5%Nb exhibited more brittle fracture morphology. Both alloys showed an excellent biocompatibility in subcutaneous as well as in bone tissues.

## **ADAPTING NANOPOROUS SILICA MATERIALS FOR MOLECULAR FILTRATION AND THERMAL INSULATION**

Ebenezer Twumasi<sup>1,a</sup>, Christer Sjöström<sup>1,2</sup>, Dr. Peter Norberg<sup>2,3</sup>

1. KTH/Royal Inst. of Technology, Building Science, Stockholm, Sweden

2. Svenska Aerogel AB, Gävle, Sweden

3. Univ. of Gävle, Gävle, Sweden

a. Corresponding author (twumasi@kth.se)

This article presents investigations on the physical and adsorption properties of a new class of nanoporous materials for use as molecular filter media. The set out aim was to tailor the adsorption performance, through modification of the nanoporosity and via incorporation of trapping chemicals or co-adsorbents. An additional aim was to contribute a better understanding of filtration performance in relation to the physical and adsorption properties that are essential for the selection of nanoporous materials (as better adsorbents) to meet the needs of commercial filter media application. Secondly is presented R&D to explore and develop the new class of nanoporous materials with regard to its physical and porosity properties that are essential for the applicability as a thermal insulation material. The paper concludes by a brief address on some of the technology and commercial areas presently being focused, and the technology challenges emanating.

## **SIMULATION OF FLOW IN METAL FOAM: THE ENTRANCE REGION**

Nihad Dukhan\* and Ahmed S. Suleiman

Dept. of Mechanical Eng., Univ. of Detroit Mercy, 4001 W. McNichols Rd.

Detroit, MI 48334, USA

a. Corresponding Author: (ndukhan@att.net)

Open-cell metal foam is a class of modern porous materials that has large accessible surface area per unit volume and high porosities (often greater than 90%). The random internal structure of the foam produces a complex flow field, flow reversal and vigorous mixing. These attributes make metal foam a very attractive core for many applications, e.g., heat exchange, filtration and reactors. The actual architecture of the foam is virtually impossible to capture exactly. In this paper, we present a geometrical model to study transport of air inside commercial aluminum foam having 10 pores per inch, and porosity of 91.2%. The Navier-Stokes equations are solved directly and velocity and pressure fields are obtained for various approach velocities using COMSOL, in the entrance region of the foam. The pressure drop results are compared to experimental data, and the length of the developing region is determined. Good agreement between the modeling and experimental results are obtained. The results are encouraging and lend confidence to the modeling approach, which paves the way for investigating other phenomena inside the foam.

## **MICROSTRUCTURE AND ELECTRICAL PROPERTIES OF Cu-TiC COMPOSITES PRODUCED BY HOT PRESSING METHOD**

Serkan Islak<sup>1,a</sup>, Soner Buytoz<sup>2</sup>, Özkan Eski<sup>3</sup> and Durmuş Kır<sup>4</sup>

1. Kastamonu Univ., Faculty of Eng. and Architecture, Dep. of Materials Science and Nanotech. Eng., Kastamonu, Turkey
  2. Firat Univ., Faculty of Technology, Dep. of Metallurgy and Materials Eng., Elazig, Turkey
  3. Kastamonu Univ., Faculty of Eng. and Architecture, Dep. of Mech. Eng., Kastamonu, Turkey
  4. Kocaeli Univ., Hereke Vocational High School, Kocaeli, Turkey
- a. Corresponding author (serkan@kastamonu.edu.tr)

The TiC particle reinforced Cu matrix composite materials were successfully produced using hot pressing method. The TiC quantity was changed as 1 wt.%, 3 wt.%, 5 wt.%, 10 wt.% and 15 wt.%. Cu and Cu-TiC powder mixtures were hot-pressed for 4 min at 700 °C under an applied pressure of 50 MPa. Phase composition, microstructure, relative density, hardness, and electrical conductivity of the hot pressed composites were investigated. Phase composition and microstructure of the composites were characterized by X-ray diffraction, scanning electron microscope, and optic microscope techniques. Microstructure studies revealed that TiC particles were distributed uniformly in the Cu matrix. With the increasing addition of TiC, hardness of composites changed between 58.6 HV<sub>0.1</sub> and 87.8 HV<sub>0.1</sub>. The highest electrical conductivity for Cu-TiC composites was obtained in the Cu-1 wt.% TiC composite, with approximately 81.2 % IACS.

## **THE TRANSVERSE RUPTURE STRENGTH OF HOT PRESSED SEGMENTS WITH B4C**

Serkan Islak<sup>1,a</sup>, Durmuş Kır<sup>2</sup>, Halis Çelik<sup>3</sup>

1. Kastamonu Univ., Faculty of Eng. and Architecture, Dep. of Materials Sci. and Nanotech. Eng., Kastamonu, Turkey
  2. Kocaeli Univ., Hereke Vocational High School, Kocaeli, Turkey
  3. Firat Univ., Faculty of Technology, Dep. of Metallurgy and Materials Eng., Elazig, Turkey
- a. Corresponding author (serkan@kastamonu.edu.tr)

In this paper, the effect of sintering temperature on transverse rupture strength (TRS) of diamond cutting segments with boron carbide produced using hot pressing process was investigated. The boron carbide addition quantity was changed as 2, 5 and 10 wt %. The hot pressing process was carried out under a pressure of 35 MPa, at 600, 650 and 700 °C, and for a sintering time of 3 minutes. The TRS of segments were determined using three-point bending test. A Scanning Electron Microscopy was used to analyze the fractured surfaces of the segments. With increasing of the sintering temperature, the TRS values of segments increased.

## **CONTROLLED CRYSTALLIZATION OF 0.25Li<sub>2</sub>O.2SiO<sub>2</sub>-0.75BaO.2SiO<sub>2</sub> GLASS**

Burcu Ertuğ<sup>1 a</sup>, Burcu Nilgün Çetiner<sup>2</sup>, Hasan Gökçe<sup>1</sup>, Z. Engin Erkmen<sup>2</sup>,  
M. Lütfi Öveçoğlu<sup>1</sup>

1. Istanbul Technical Univ., Dept. Of Metallurgical and Materials Eng., 34469 Maslak, Istanbul, Turkey.
2. Marmara Univ., Dept. of Metallurgical and Materials Eng., 34722 Göztepe, Istanbul, Turkey.  
a. Corresponding author (burcuertug@gmail.com)

In the present study, the crystallization behaviour of 0.25Li<sub>2</sub>O.2SiO<sub>2</sub>-0.75BaO.2SiO<sub>2</sub> glass was investigated. DTA curves of 0.25Li<sub>2</sub>O.2SiO<sub>2</sub>-0.75BaO.2SiO<sub>2</sub> glass exhibited a small endothermic peak, which shows the glass transition temperature, T<sub>g</sub> and a broad exothermic peak, which shows the crystallization of both lithium disilicate and barium disilicate phases together. The optimum nucleation temperature and time were determined by Marotta method. After the nucleation heat treatment, the glass showed amorphous phase separation as shown by optical images. The glass was heat treated at 675, 720 and 765°C for 1h. The glass-ceramic's microstructures were examined by SEM. It was concluded that the crystallization temperature has a great effect on the morphology of the glass-ceramic phases formed.

## **VICKERS MICROHARDNESS (HV) AND INDENTATION FRACTURE TOUGHNESS (KIC) OF 0.25LI<sub>2</sub>O.2SIO<sub>2</sub>-0.75BAO.2SIO<sub>2</sub> GLASS AND GLASS-CERAMIC**

Burcu Ertuğ<sup>1 a</sup>, Burcu Nilgün Çetiner<sup>2</sup>, Hasan Gökçe<sup>1</sup>, Z. Engin Erkmen<sup>2</sup>,  
M. Lütfi Öveçoğlu<sup>1</sup>

1. Istanbul Technical Univ., Dept. Of Metallurgical and Materials Eng., 34469 Maslak, Istanbul, Turkey.
2. Marmara Univ., Dept. of Metallurgical and Materials Eng., 34722 Göztepe, Istanbul, Turkey.  
a. Corresponding author (burcuertug@gmail.com)

In the present study, the mechanical properties of 0.25Li<sub>2</sub>O.2SiO<sub>2</sub>-0.75BaO.2SiO<sub>2</sub> glass and glass-ceramic were investigated. The glass samples were nucleated in the temperature range of 490-550°C for 1h. After the optimum nucleation temperature was determined by DTA analysis, the glass samples were heat treated at a nucleation duration range of 0.5-3h. By the peak temperatures derived from DTA curves, the nucleated samples were crystallized at 675, 720 and 765°C. After as-cast, nucleated and crystallized samples were surface finished, Vickers indentation test was carried out using 200gr. load and indentation fracture toughness was calculated by measuring the crack length, c using 500gr. load. The effect of nucleation temperature on Vickers microhardness and indentation fracture toughness was minor. The crystallization temperature affected the mechanical properties dramatically.

## **Al-Si BASED SYNTACTIC FOAMS BY USING POROUS SILICA GELS via VACUUM CASTING: CELL SIZE vs STRENGTH AND ENERGY ABSORBANCE BEHAVIOUR**

Ibrahim Yavuz<sup>1</sup>, M.Serhat Başpınar<sup>2,a</sup> and Hüseyin Bayrakçeken<sup>3</sup>

1. Afyon Kocatepe Univ., Technical Education Faculty, Automotive Edu.Dept. Afyonkarahisar, Turkey
2. Afyon Kocatepe Univ., Technical Education Faculty, Metal Edu. Dept., Afyonkarahisar, Turkey
3. Afyon Kocatepe Univ., Faculty of Eng., Automobile Eng.Dept, Afyonkarahisar, Turkey  
a. corresponding author (sbaspınar@aku.edu.tr)

There has recently been an increase in interest in the use of cellular materials in various structural and functional applications. Syntactic foams defined as a composite material with hollow or porous ceramic particles embedded in a continuous polymer or metal matrix. Metal matrix syntactic foams are a relatively new class of material with higher densities than traditional open or closed-cell metallic foams produced. They are not only used for structural applications but also used in functional applications such as low density heat sink and heat exchangers. In this study, the processing of aluminum-based syntactic foams by a newly developed vacuum casting method was studied. Macroscale (larger than 1 mm diameter) fillers (space holders) were used rather than the powder fillers of previous syntactic foam studies. This paper presents SiO<sub>2</sub>-based porous expanded silica gels used as fillers in the processing of syntactic foams by a vacuum-based infiltration method. Effect of cell-size (space holder diameter) on the density-strength relations and energy absorbance behaviour were investigated. Lowest relative density was measured as 0.31 gr.cm<sup>-3</sup>. It was concluded that; expanded silica gel density and size determines the strength-density relation. It also effect the cell wall thickness and shape.

## **PROPERTIES OF ZNO NANO POWDERS SYNTHESIZED BY GLYCINE-NITRATE GEL COMBUSTION**

Ömer YILDIZ<sup>a</sup>, Ali Murat SOYDAN<sup>b</sup>, Erdem Fettah İPÇİZADE<sup>b</sup>, Duygu AKIN<sup>b</sup>

<sup>a</sup> Kocaeli Univ., Faculty of Eng., Dept. of Metallurgical and Materials Eng.,  
41380 Kocaeli, Turkey

<sup>b</sup> Gebze Inst. of Technology, Faculty of Eng., Dept. of Material Sciences and Eng., TR-41400  
Gebze/Kocaeli, Turkey.

a. Corresponding author: (oemeryildiz@gmail.com)

ZnO has a wide range of usage in high technology applications such as varistor, gas sensors, catalysts, electrodes for solar cells, pigments & etc. . At large scale powder manufacturing, morphology, particle shape, size and distribution and microstructure of ZnO starting nano powders are highly crucial for obtaining a desired final product. ZnO or the other oxide nano powders with high purity and quality can be synthesized with various chemical techniques depending on the process control parameters. The powder characteristics strongly depend on the manufacturing process and process parameters. Precipitation and sol-gel techniques are widely used chemical processes in ZnO and other oxide powders synthesis. Powders obtained by sol-gel process represents improved powder characteristics (high purity, spherical particle morphology, low particle size) compared to the powders synthesized by precipitation. On the other hand, precipitation technique which carries low cost and simplicity is extensively preferred instead of complex, slow & expensive technique sol-gel.

Glycine-nitrate gel combustion is a very simple, fast and low cost process for the manufacturing of oxide nano powders. Powder properties can be easily controlled by changing the process parameters (pH, ratio of glycine-nitrate and the condition of reactor vessel). ZnO nano powders with changing morphology and microstructure were synthesized from Zn(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O and glycine by gel-combustion process. Synthesized powders were characterized by SEM, DTA-TG, XRD and Nanosizer. Obtained powders represented a formless tufa/ash like, soft agglomerated structure with varying nano particle size (Nano Sizer: 50-500 nm and TEM: 5-300 nm) depending on the glycine-nitrate ratio.

## **EFFECTS OF THE SINTERING PARAMETERS ON MECHANICAL PROPERTIES OF FE-BASED POWDER METAL PARTS**

Can ÇIVI<sup>1,a</sup>, Göksan AKPINAR<sup>2</sup>, Enver ATIK<sup>3</sup>

1. Celal Bayar Univ. Eng. Faculty Mechanical Eng. Dept., Manisa, Turkey
  2. Celal Bayar Univ. Eng. Faculty Mechanical Eng. Dept., Manisa, Turkey
  3. Celal Bayar Univ. Eng. Faculty Mechanical Eng. Dept., Manisa, Turkey
- a. Corresponding author: (can.civi@cbu.edu.tr)

Sintering is one of the most important step of the production of powder metal parts, because it brings into desired values the mechanical properties of pressed metal powder according to usage area. Generally sintering of powder metal parts is made classical sintering furnaces. Induction sintering method is an important alternative of classical sintering method because of lack of time and energy consumption in sintering. In this study, changing of mechanical properties of induction sintered Fe based components included Cu and Graphite were investigated according to the exchange of sintering time. For this purpose Vickers hardness, change of volume, mass, and surface roughness values of sintered powder metal parts by induction for 8.4, 15 and 30 minutes were investigated and compared with each other and micro structural investigation was applied to powder metal parts.

## **IN SITU DIFFRACTION STUDIES OF GAS STORAGE MATERIALS ON A LABORATORY X-RAY DIFFRACTION SYSTEM**

Sommariva M.<sup>1</sup>, Narygina O.<sup>1</sup>, van Weeren H.<sup>1</sup>, Gertenbach J.<sup>1</sup>, Resch C.<sup>2</sup>, Pein A.<sup>2</sup>; Filinchuk Y.<sup>3</sup> Smith V.J.<sup>4</sup>, Barbour L.J.<sup>4</sup>

<sup>1</sup>PANalytical B.V., Almelo, The Netherlands

<sup>2</sup>Anton Paar GmbH., Graz, Austria

<sup>3</sup> Université Catholique de Louvain, Louvain-la-Neuve, Belgium

<sup>4</sup> Stellenbosch Univ., Matieland, South Africa

a. Corresponding author: (jan.gertenbach@panalytical.com)

One of the key subjects in materials research for clean energy are sorption processes for storage of gases such as H<sub>2</sub> and CO<sub>2</sub>. Disruption to the crystal structure during the sorption processes and details of reaction mechanisms can be studied in situ by X-ray diffraction (XRD) in dedicated sample environments.

To date in situ high-pressure XRD studies have mainly been performed using synchrotron facilities or on dedicated instruments. Recent developments have extended the application area of high-pressure studies to the laboratory systems where: (i) the availability of a commercial chamber for X-ray diffractometers allowing gas pressures up to 100 bar and temperature as high as 900 °C; (ii) the availability of hard radiation on a laboratory system, in this case molybdenum radiation and (iii) multi-dimensional X-ray detectors. In this contribution we present structural transformations that were studied under high-pressures of H<sub>2</sub> and CO<sub>2</sub> using a standard laboratory X-ray diffraction system.

Suitable materials have been selected for studying both H<sub>2</sub>- and CO<sub>2</sub>-storage materials, in particular the reversible structural transformation of ammonia borane (NH<sub>3</sub>BH<sub>3</sub>)<sup>1</sup> is reported.

The phase transitions recorded during the in situ measurements are instrumental in the understanding of the desorption and/or sorption properties as well as reaction mechanisms. Furthermore, fast detection of XRD patterns allows the determination of intermediate phases, onsets of reactions and reversibility of sorption processes.

## **MOF HYBRID MATERIALS: STEPWISE LAYER-BY-LAYER GROWTH OF MOF THIN FILMS ON CONFINED SURFACES: MESOPOROUS SILICA FOAM AS A FIRST CASE STUDY**

Osama Shekhah, Liling Fu, Emmanuel P. Giannelis and Mohamed Eddaoudi

Advanced Membrane & Porous Materials; King Abdullah Univ. of Science and Technology, Thuwal  
23955-6900, Kingdom of Saudi Arabia

Dept. of Materials Sci. and Eng., Cornell Univ. Ithaca New York 14853, USA

a. Corresponding author: (osama.shekhah@kaust.edu.sa)

Rational synthesis of ordered MOF hybrid materials will exploit the unique MOF-intrinsic structural and chemical properties in key research areas necessitating MOF growth on a solid support, e.g. MOF-based composites for enhanced gas/liquid separations, catalysis and chemical sensors. The methods explored to date for MOF thin films preparation were mainly based on the direct in-situ crystallization, which unfortunately have rather limited scope and suffer from many drawbacks, like inhomogeneity and difficulty to control growth.[1] Recently, the introduction of the stepwise layer-by-layer (LBL) method has paved the way for the fabrication of homogenous MOF films with controllable thickness on flat substrates.

In this work we have demonstrated, for the first time using the stepwise LBL method, the possibility to synthesis and control the growth of two different homogenous MOF thin films (HKUST-1 and ZIF-8) on mesoporous silica foam substrate. The newly constructed hybrid materials, MOFs on mesoporous silica foam, were characterized and evaluated using different techniques including PXRD, SEM and TEM, which showed formation of highly crystalline and homogenous coatings of the MOFs. This study confirms the unique potential of the LBL method for the controlled growth of desired MOF coatings on various substrates, which permits rational construction of hierarchical hybrid porous systems for given applications.

## **A STUDY ON PARTICLE SIZE OF TITANIUM NANOPARTICLES PRODUCED BY ELECTROMAGNETIC LEVITATION MELTING METHOD**

Armin Vahid Mohammadi<sup>1,a,\*</sup>, Mohammad Halali<sup>1,b</sup>, Mohsen Hajipour<sup>1,c</sup>  
<sup>1</sup> Dept. of Materials Sci. and Eng., Sharif Univ. of Technology, Azadi Street,  
Tehran, P.O. Box 11365-9466, Iran

a. Corresponding author: (avmohammadi@alum.sharif.edu)

In this study, particles size of pure titanium nanoparticles produced by Electromagnetic Levitation Melting method was investigated and effect of gas flow rate and sample temperature was studied. Pure titanium samples were melted by electromagnetic levitation technique in a silica tube and high purity Argon (Ar) and Helium (He) with different flow rates were employed as carrier gases and cooling agents. Particle size, morphology, and Purity of the produced nanoparticles were studied by Field-Emission Scanning Electron Microscopy (FE-SEM), X-ray Diffraction (XRD), Dynamic Light Scattering (DLS), X-ray fluorescence (XRF), and ICP-AES analysis. The FE-SEM, DLS and XRF studies confirmed narrow size distribution of almost spherical shape pure titanium nanoparticles under both inert gas atmospheres. Titanium nanoparticles synthesized under He atmosphere had smaller particle size with narrower particle size distribution compared to those produced in Ar. Moreover, results showed that at higher gas flow rates and sample temperatures particle size of the produced titanium nanoparticles were decreased.

## **CHROMATOGRAPHIC MONOLITHS – POROUS MATERIAL TAILORED FOR DOWNSTREAM PROCESSING OF BIOPHARMACEUTICAL PRODUCTS**

Nika Lendero Krajnc<sup>1,2</sup>, Aleš Savnik<sup>1</sup>, Aleš Podgornik<sup>1,2</sup>, Janez Jančar<sup>1</sup>, Urh Černigoj<sup>1</sup>, Mateja Simonič<sup>1</sup>,  
Miloš Barut<sup>1,2</sup>, Aleš Štrancar<sup>1,2</sup>

<sup>1</sup> BIA Separations d.o.o., Mirce 21, Ajdovscina, Slovenia

<sup>2</sup> The Centre of Excellence for Biosensors, Instrumentation and Process Control-COBIK, Solkan,  
Slovenia

a. Corresponding author: Nika Lendero Krajnc

Rapid development in molecular and cell biology in past twenty years has led to new technologies for the large scale production of bio-therapeutics, like antibodies, RNA molecules, plasmid DNA and viruses that have the potential to assist in human health care in the areas of diagnostics, prevention and treatment of diseases. To satisfy the severe requirements placed on the purity of biopharmaceutical products demanding several-step purification processes have to be developed. An integral part of purification downstream processing is the chromatographic unit operation.

During purification of large macromolecules several issues have to be considered. To gain as high productivity as possible chromatographic stationary phase material should exhibit high dynamic binding capacity, high purification yield, high selectivity and low degradation of target macromolecule at high linear velocity and preferably at low pressure drop.

In this work, most important properties of the chromatographic materials for purification of large biological compounds will be discussed. The difference between particle based and porous material made from one piece (monolith) will be described. The characterization methods used for determination of mechanical, chemical and chromatographic properties of the chromatographic monoliths will be presented and linked to the purification process of various biologicals.

## **SUPERIOR PERFORMANCE OF COPPER BASED MOF AND AMINATED GRAPHITE OXIDE COMPOSITES AS CO<sub>2</sub> SEPARATION MEDIA AT AMBIENT CONDITIONS**

Yunxia Zhao, Mykola Seredych, and Teresa J. Bandosz<sup>1\*</sup>

a. Corresponding author: (tbandosz@ccny.cuny.edu)

New composites Cu-BTC MOF and graphite oxide modified with urea (GO-U) were developed and tested as CO<sub>2</sub> adsorbents at ambient conditions. The composite containing GO-U with the highest nitrogen content exhibits an excellent CO<sub>2</sub> uptake (4.23 mmol g<sup>-1</sup>) at dynamic ambient conditions. The incorporation of GO-U into MOF changes the chemistry and microstructure of the parent MOF and results in synergistic features beneficial for CO<sub>2</sub> retention on the surface. To identify these features the initial and exhausted materials were extensively characterized from the points of view of their porosity and chemistry. Although the adsorption forces are relatively strong, the results indicate that CO<sub>2</sub> is mainly physisorbed on the composites at dry dynamic conditions at ambient temperature and pressure. The primary adsorption sites include small micropores specific for the composites, open Cu sites and cage window sites.

## UTILISATION OF PAPERMILL WASTEWATER SLUDGE IN PRODUCING INSULATION MATERIALS

Arif Karademir<sup>a</sup>, Hülya Varlıbaş, Ferhat Yetiş  
a. Corresponding author: (arifkarademir@yahoo.com)

During sheet formation, highly diluted fibre stock (maximum %1 consistency) are directed over endless turning web where water is drained and all solid substances such as cellulose fibre, fillers as well as other added functional chemicals are tried to be hold over wire mesh (retention) to create wet paper mats. Full retention is almost impossible since especially inorganic small substances and fibre debris are quite difficult to be hold. Wastepaper processing mills generally give dirtier wastewater than that of producing printing grade papers. In this study, wastewater sludges taken from a wastepaper processing papermill was tried to be transformed to basic plates via wet formation and controlled drying. Some plates were also kept in an oven to see if some extra porous structure was possible to be generated. Numerous sample plates were made with using various combinations of ingredients in sludges. Samples were tested to determine density, porosity, insulation and some mechanical properties. Results may suggest some new ideas to industry and related parties.

## PREPARATION OF COAL-BASED ACTIVATED CARBON BY ACTIVATION WITH $K_2CO_3$

F. Karacan

Turkish Atomic Energy Authority, Sarayköy Nuclear Research and Training Center, Istanbul Road 30 km., 06983 Saray, Ankara, TURKEY.

a. Corresponding author: (karacanf@yahoo.com)

Activated carbon is a well known as porous material, with large specific surface area, which is useful in adsorption of both gases and solutes from aqueous solution. Therefore, it has been widely used for separation of gases, recovery of solvents, removal of organic pollutants from drinking water and a catalyst support. The micropore and mesopore volume is the key index of activated carbon besides its adsorption characteristics. More micropores are required for activated carbon used for gas phase adsorption because diameters of most gaseous pollutant molecules are less than 1.0 nm. As environmental pollution is becoming a more serious problem, the need for activated carbon is growing. Considerable information is available in the open literature on the preparation of activated carbons from different carbonaceous precursors. In addition to inherent structural characteristics of the carbonaceous precursors, carbonization and activation processes play important roles in the evolution of porosity in carbon adsorbents. Chemical activation has been shown as a efficient method to obtain carbons with high surface area and narrow micropore distribution. Activated carbon can be prepared from any cellulosic or lignocellulosic material. Bituminous coal or lignite is one of these types of materials that can be used to manufacture activated carbon because of its inherent microstructure. Because of its availability and cheapness, coal is the most commonly used precursor for activated-carbon production. Therefore, in this study, we attempted to prepare activated carbon from Turkish coals by chemical activation with potassium carbonate ( $K_2CO_3$ ). Tunçbilek lignite and Amasra bituminous coal were used to prepare activated carbon potassium carbonate ( $K_2CO_3$ ) as activating agent. The influence of chemical treatment, coal type and preparation conditions such as carbonization temperature and the impregnation ( $K_2CO_3$ :Coal) ratio on the yield and the development of surface characteristics of resulting carbons were investigated. Pyrolytic thermal treatments without  $K_2CO_3$  and chemical treatments using  $K_2CO_3$  chemical reagents were applied to the different rank coal samples in a temperature range of 600–900 °C at 1 h under  $N_2$  flow. Results showed that in all cases, increasing the carbonization temperature and impregnation ratio, the yield decreased, while the adsorption of  $N_2$  increased, progressively. Specific surface area of activated carbon was maximum about 512  $m^2/g$  and 216  $m^2/g$  at 800 °C with activation duration of 1 h and at an impregnation ratio of 2.0 for Tunçbilek lignite and Amasra coal, respectively. Increasing temperature resulted in more decrease in textural properties such as surface area, total and micropore volume for ACs obtained Tunçbilek lignite according to Amasra coal because of the destruction of porosity by external ablation of carbon particles.

## **THERMAL ENERGY STORAGE CHARACTERISTICS OF POROUS CLAYS/XYLITOL ESTER COMPOSITES AS FORM-STABLE PHASE CHANGE MATERIALS**

Cahit Bilgin<sup>a</sup>, Alper Biçer, Ahmet Sarı  
a. Corresponding author: (cahit\_bilgin@hotmail.com)

In this work six new kinds of building composite phase change materials (BCPCMs) were prepared by adsorption of xylitol pentalaurate (XPL) ester as phase change materials (PCMs) into diatomite, perlite and vermiculite as porous clay matrices. The SEM and FT-IR analysis showed that the ester compound was adsorbed uniformly into these clay materials due to capillary forces. The highest adsorption ratio of XPL ester into perlite, diatomite, and vermiculite were found to be 71, 52 and 40wt.%, respectively. The prepared composite PCMs were identified as form-stable BCPCMs because it does not allow the leakage of PCM from the composite surface even if they are heated over the melting temperatures of the PCMs. Differential scanning calorimetry (DSC) results indicated that the form-stable BCPCMs had suitable phase change temperatures and good latent heat energy storage for thermal energy storage in buildings. Thermogravimetric (TG) investigations showed that the BCPCMs had good thermal endurance even above their phase change temperatures. Thermal cycling test showed that the BCPCMs exhibited almost same chemical and phase change characteristics after 1000 heating-cooling cycles.

## **REMOVAL OF COPPER FROM DILUTE SOLUTIONS USING SDS AIDED ACTIVE CARBON ADSORPTION**

Karhan Özdenkci<sup>1</sup>, Cagri Siretli<sup>1</sup>, Hurriyet Polat<sup>2</sup> and Mehmet Polat<sup>1,a</sup>

1. Izmir Inst. of Technology, Dept. of Chemical Eng., Izmir, Turkey

2. Izmir Inst. of Technology, Dept. of Chemistry, Izmir, Turkey

a. Corresponding author (mehmetpolat@iyte.edu.tr)

This study investigates a novel technique for heavy metal removal from dilute waters. The basis is using a complexing surfactant to initially tie the heavy metal and then adsorption of the surfactant-metal complex onto a suitable substrate by hydrophobic attraction. The experiments investigated dilute levels of Cu (16 to 256 ppm). Active Carbon (AC) and Sodium Dodecyl Sulphate (SDS) were selected as the substrate and the surfactant. Copper removal was investigated at natural and various adjusted pH values, and in the presence and absence of SDS. Even though dilute wastewater typically causes capacity and efficiency issues, the proposed technique is more efficient in dilute solutions and has fast kinetics.

## **NANOPOROUS CARBON FIBERS FROM NATURAL CELLULOSIC PRECURSORS**

Dušan Berek, Ivan Novák,

Polymer Inst. of the Slovak Academy of Sciences, 84541 Bratislava, Slovakia

a. Corresponding author: (Dusan.Berek@savba.sk)

Original procedures for preparation of nanoporous carbon fibers, C-fibers, with different properties were developed. The starting materials are cellulose fibers from different plants. These are subject to controlled carbonization in presence of appropriate porogens, typically distinct inorganic salts. In dependence of the size and properties of starting cellulose fibers and the carbonization process, C-fibers exhibit different length and diameter, flexibility and pore structure. Mechanical properties of nanoporous carbon fibers such as mechanical strength, flexibility and surface activity could be manipulated in the desired way. The yield of carbonization was increased by addition of the auxiliary carbon containing additives, which exhibit synergetic effect. A series of distinct nanoporous carbon fibers was prepared with surface areas ranging from less than one  $\text{m}^2\text{g}^{-1}$  up to almost  $2,000 \text{m}^2\text{g}^{-1}$ . The fibers in the lower part of surface area scale are expected to possess pores large enough to accommodate macromolecules, while the fibers with narrow pores and large surface area could be used for purification of water and products of chemical syntheses. The surface of fibers can be chemically modified so that their adsorptive, interactive and catalytic properties would be adjusted for particular application. A surface layer of metal, for example silver, ensures their electro-conductivity.

## **MICROSTRUCTURAL AND OPTICAL PROPERTIES OF POROUS ALUMINA ELABORATED ON GLASS SUBSTRATE**

W.Zaghdoudi AND R.Chtourou

Photovoltaic Laboratory, Research and Technology Centre of Energy, Borj-Cedria Science and Technology Park, BP 95, 2050 Hammam-Lif, Tunisia.

a. Corresponding author: (walid\_inrst@yahoo.fr)

A transparent porous anodized aluminum oxide (AAO) nanostructure was formed on a glass substrate using the anodization of a highly pure evaporated aluminum layer. A parametric study was carried out in order to achieve a fine control of the microstructural and optical properties of the elaborated films.

The microstructural and surface morphologies of the porous alumina films were characterized by x-ray diffraction and atomic force microscopy. Pore diameter, inter-pore separation, and the porous structure as a function of anodization conditions were investigated. It was then found that the pores density decreases with increasing the anodization time. Regular cylindrical porous AAO films with a flat bottom structure were formed by chemical etching and anodization. A high transmittance in the 300-900 nm range is reported, indicating a fulfilled growth of the transparent sample (alumina) from the aluminum metal. The data showed typical interference oscillations as a result of the transparent characteristics of the film throughout the visible spectral range.

The thickness and the optical constants ( $n$  and  $k$ ) of the porous anodic alumina films, as a function of anodizing time, were obtained using spectroscopic ellipsometry in the ultraviolet-visible- near infrared (UV-vis-NIR) regions.

## **DISCRETE ELEMENT MODELING OF SPHERICAL COPPER POWDER COMPACTION PROCESS**

Faruk GÜNER<sup>1,a</sup>, ÖmerNecati CORA<sup>2</sup> and Hasan SOFUOĞLU<sup>2</sup>

1. Bayburt Univ., Dept. of Mechanical Eng., Bayburt, Turkey
2. Karadeniz Technical Univ., Dept. of Mechanical Eng., Trabzon, Turkey
- a. Corresponding author (fguner@bayburt.edu.tr)

Three main approaches are available in literature to numerically analyze the powder compaction process. Those are 1) Continuum media approach, 2) Micromechanics approach, 3) Discrete element method (DEM). Current study aimed for understanding deformation and tribological behavior of spherical copper powder in cold compaction process by using DEM. Prior to finite element modeling, powders 200 micron in diameter were randomly distributed into a die cavity for resembling the actual process. Each powder was then modeled individually as deformable body with 3-D tetragonal elements. Different material models including von Mises, Cam-Clay, Shima-Oyane, and Mohr-Coulomb models were utilized for comparison purposes. The results showed that material models made important changes on the flow behavior of the copper powder.

## **RAW VERMICULITE AND MANGANESE OXIDE-MODIFIED VERMICULITE FOR SILVER ADSORPTION FROM AQUEOUS SOLUTION: EQUILIBRIUM, THERMODYNAMIC AND KINETIC STUDIES**

Cahit Bilgin, Ahmet Sarı, Mustafa Tüzen, Güngör Şahinoğlu, Alper Biçer

- Dept. of Chemistry, Gaziosmanpaşa Univ., 60250, Tokat, Turkey.
- a. Corresponding author (cahit\_bilgin@hotmail.com)

In this work, the surface of raw vermiculite (RV) clay was modified using manganese oxide. The RV clay and manganese oxide modified vermiculite (Mn-MV) was characterized chemically and morphologically by using SEM and FT-IR analysis methods. The surface area of RV clay was increased about ten times by modification due to the increase in negative charge onto the clay surface. The adsorption potential of RV clay and Mn-MV clay for the removal of silver ions from aqueous solution was examined using batch method. The effects of initial pH of solution, initial silver ion concentration, modifying agent concentration and temperature of solution on the adsorption efficiency were investigated systemically. The maximum adsorption capacity of RV and Mn-MV clays was found as 46.2 and 69.2 mg g<sup>-1</sup>, respectively. The Dubinin-Radushkevich (D-R) model indicated that the adsorption process onto modified sorbent was taken place mainly by chemical ion exchange. The Mn-MV clay had good reusability performance after 10 adsorption-desorption cycles. The calculated thermodynamic parameters showed that the adsorption process of Ag(I) onto Mn-MV clay was feasible, spontaneous and exothermic. The kinetic evaluation also suggested that the adsorption process followed well the pseudo-second-order kinetic model.

## SYNTHESIS AND CHARACTERIZATION OF 1, 3-BIS (4-BROMOPHENYL)-5-ISOPROPYL-1, 3, 5-TRIAZINANE

Leila. Lefrada<sup>\*</sup>, Ahsen. Bouchemma, Mustapha. Bouhenguel, Mahmoud Chabbah and Amel Farahti

<sup>\*</sup>Univ. Larbi Ben M'hidi of Oum El Bouaghi, Rue de Constantine, 04000, Algeria.

<sup>\*</sup>Corresponding author at: Laboratory of Applied Chemistry and Materials Technology, Chemistry Inst., Univ. Larbi Ben M'hidi of Oum El Bouaghi, Rue de Constantine, 04000, Algeria.  
a. Corresponding author: (aliel\_2011@yahoo.fr)

In this work, we processed to the synthesis of the 1, 3-bis (4-bromophenyl)-5- (isopropyl)- 1, 3, 5-triazinane starting from condensation of an isopropylamine and or an 4-bromoaniline with formaline. The identification of these products was made by C.C.M, IR, RMN <sup>1</sup>H, RMN <sup>13</sup>C

## DESIGN OF NANOSTRUCTURED SURFACES OF THE DNA-ACTIVE FILM-LIKE ACRYLAMIDE/N-(2-DIBENZYLAMINO-ETHYL)-ACRYLAMIDE

Olga Sinitsyna<sup>1</sup>, Nadejda Davydova<sup>1,a</sup>, Vladimir Sergeev<sup>1</sup>, Elena Laukhina<sup>2</sup>,  
Alexei Khokhlov<sup>1</sup>

1. A.N. Nesmeyanov Inst. of Organoelement Compounds Russian Academy  
of Sciences, Moscow, Russian Federation

2. The Biomedical Research Networking center in Bioengineering, Biomaterials and Nanomedicine,  
Barcelona, Spain

a. Corresponding author( davydova@ineos.ac.ru)

Synthesis of multifunctional macromolecules has become an important topic as advances are made in biological sensing technology. Various templates that may be quantified with presentation of bioactive molecules and control over their density and orientation are required. The paper shows that a dewetting process may be successfully utilized for engineering nanostructured surfaces of the thin films based on the DNA-active copolymer acrylamide/N-(2-dibenzylamino-ethyl)-acrylamide (**1**). The morphology of the film surfaces was studied using Atomic Force Microscopy (AFM). By a variation of the concentration of **1** in its water solutions, two types of surface morphology were installed. The optimum concentration of **1** in water, which allows regular porosity patterning of the surface of the nanostructured **1**-based films, was found. Therefore, the films of **1** offer promise for applications where structural nanometer scale bio-sensing is required.

## **CHEMICAL COMPOSITION, ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF THE ESSENTIAL OIL OF SANTOLINA CHAMAECYPARISSUS L. FROM ALGERIA**

Ahmed NOUASRI, Tahar DOB, Dahmane DAHMANE

a. corresponding author: (a\_nouasridz2001@yahoo.fr)

The aim of this study was to investigate at first time the chemical composition of essential oil of *Santolina chamaecyparissus* L. cultivated in Algeria. The chemical composition of hydrodistilled essential oil in a yield of 1.67% from flowering aerial parts has been analyzed by GC and GC/MS techniques<sup>1</sup>. Thirty-six components accounting more than 82% of the total oil were identified. Oxygenated monoterpenes was the main fraction (54.66%) and was represented by artemisia ketone (40.33%) as major component of this oil. The other major constituents were Z-thujone (9.82%), (2Z,6E)-farnesol (7.30%) and limonene (6.87%). , the antioxidant activities conducted by DPPH test and B\_carotin bleaching test showed for DPPH 79,55% with Ic 50 of 49,11. And 70,20 % at 120'. Furthermore this oil exhibited in vitro growth inhibition activity by disc diffusion methods<sup>2</sup> against five gram positive strains, four negative gram strains and four moistures this activity was ranging from 10mm to 24mm with the lowest MIC value between 0,070µg/ml and 9µg/ml. However, there is some of this microorganism mostly resistant Ex: *Pseudomonas aeruginosa* and *Aspergillus flavus* The results provided evidence that the studied plant might indeed be potential sources of natural antioxidant and antimicrobial agents.

## **X-RAY MICROTOMOGRAPHY OF GEOLOGICAL SOFT SEDIMENT SAMPLES: REDUCTION OF MOTION ARTIFACT BY RESIN CONSOLIDATION**

Yoshito Nakashima

National Inst. of Advanced Industrial Science and Technology (AIST),

Central 7, Higashi 1-1-1, Tsukuba, Ibaraki 305-8567, Japan

a. Corresponding author (nakashima.yoshito@aist.go.jp)

X-ray microtomography (XRM) is useful to obtain three-dimensional microstructure of powder/porous materials, and has been applied to geological samples. When applied to soft or unconsolidated geological samples (e.g., sea bottom sediments), however, undesirable sample deformation occurs due to the relative displacement of fine sediment particles, for example, during the sample rotation in an X-ray chamber (motion artifact). This sample deformation can be serious because it destroys the original pore structure, reducing the reliability of any post XRM outcomes obtained using the images. As a solution to the problem, sample preprocessing was performed using resin to consolidate the soft samples before the XRM operation. Via alcohol replacement of the pore water in the sediment, the pore space was completely filled with solid resin to increase the rigidity of the sample. This technique was applied to bottom fine sediment samples from Tokyo Bay, Japan, and the three-dimensional XRM images without motion artifact were successfully obtained.

## **SYNTHESIS, CHARACTERIZATION AND LUMINESCENCE PROPERTIES OF XEROGELS DOPED WITH MIXED LANTHANIDE TUNGSTATE**

Beata Grobelna,<sup>1</sup> Anna Synak<sup>2</sup>, Piotr Bojarski<sup>2</sup>, Aneta Lewkowicz<sup>2</sup>, Karol Szczodrowski<sup>2</sup>

<sup>1</sup> Faculty of Chemistry, Univ. of Gdańsk, Sobieskiego 18/19, 80-952 Gdańsk, Poland

<sup>2</sup> Inst. of Experimental Physics of Gdańsk, Wita Stwosza 57, 80-952 Gdańsk, Poland

a. Corresponding author: (beata@chem.univ.gda.pl)

Among all the luminescent materials, tungstates have attracted great attention because they are perfect hosts for accommodating lanthanide ions. Lanthanide tungstates can form a large family of inorganic compounds with the general formula  $\text{Ln}_2(\text{WO}_4)_3$ . Additionally, in view of the high cost of preparing tungstate crystals, we report significantly cheaper sol-gel process to prepare the mixed tungstate doped with lanthanide ions and entrapped in silica xerogel.

The sol-gel process is a convenient and versatile method for preparation of transparent optical phosphors due to good mixing of starting compounds at low temperature. Besides, the method offers a new level of control over microstructure. This is very important in view of material engineering, since the performance of micro and nano scale devices can be determined by the local structure around the optically active lanthanide ion.

In this work, we report the preparation of novel phosphors consisting of mixed lanthanide tungstate entrapped in a silica xerogel matrix. Spectroscopic properties of the materials presented are discussed. In particular, energy transfer from  $\text{WO}_4^{2-}$  to  $\text{Ln}(\text{III})$  ion is observed.

## **SPECTROSCOPIC PROPERTIES OF RHODAMINE B ENTRAPPED IN HYBRID POROUS NANOLAYERS**

Piotr Bojarski,<sup>a</sup> Aneta Lewkowicz,<sup>a</sup> Anna Synak,<sup>a</sup> Beata Grobelna,<sup>b</sup>

a Inst. of Experimental Physics of Gdansk, Univ. of Gdansk,  
Wita Stwosza 57, 80-952 Gdansk, Poland

b Faculty of Chemistry, Univ. of Gdansk, Sobieskiego 18/19, 80-952 Gdansk, Poland

a. Corresponding author: (fizpb@ug.edu.pl)

The sol-gel derived materials can be exploited for different applications, including luminescent materials, potential active media for compact tunable lasers, or functional bioinspired nanomaterials.

A comparison has been made between three kinds of matrices: titanium dioxide ( $\text{TiO}_2$ ), silica dioxide ( $\text{SiO}_2$ ) and  $\text{TiO}_2/\text{SiO}_2$  in the form of thin films as hosts for Rhodamine B at different concentrations of the dye. These matrices were produced using the sol-gel method.

The pronounced effect of the dye concentration on the absorption and fluorescence spectra as well as on time-resolved fluorescence spectra was found. In particular, it was found that the aggregation of the guest dye in  $\text{TiO}_2$  is significantly weakened. The existence of residual water in silica dioxide matrix is responsible for the stronger formation of aggregates than in  $\text{TiO}_2/\text{SiO}_2$  and  $\text{TiO}_2$  matrices. The results show that the titanium dioxide matrix offers opportunities in optoelectronics, photocatalysis, or during the construction of solar cells, due to the reduced dye susceptibility to aggregate.

## **SPECTROSCOPIC PROPERTIES OF MEROCYANINE 540 ENTRAPPED IN TITANIUM DIOXIDE THIN FILM**

Anna Synak,<sup>a</sup> Aneta Lewkowicz,<sup>a</sup> Piotr Bojarski,<sup>a</sup> Beata Grobelna,<sup>b</sup>  
Dawid Jankowski<sup>a</sup>

<sup>a</sup> Inst. of Experimental Physics of Gdansk, Univ. of Gdansk Wita Stwosza 57,  
80-952 Gdansk, Poland

<sup>b</sup> Faculty of Chemistry, Univ. of Gdansk, Sobieskiego 18/19, 80-952 Gdansk, Poland  
*a.* Corresponding author: (a.synak@ug.edu.pl)

Merocyanines are fluorescent dyes, very sensitive to environmental changes. Therefore, they have been widely used as molecular probes or as compounds effective in destroying viruses. They also play an important role in research on cancer treatment. Titanium dioxide is a very important material, due to the biocompatibility of the interface between the titanium implants and the human body. Titanium dioxide can be used as a material for implants after resection of cancer.

We present photophysical properties of thin titanium dioxide films doped with merocyanine 540 dye produced using sol-gel technique.

The absorption and luminescence properties of the material depend on dye concentration suggesting the formation of fluorescent aggregates. Steady-state and time resolved luminescence spectroscopy measurements have been supported by results of SPCE (Surface Plasmon Coupled Emission) experiments.

## **SURFACE MODIFICATION OF CALCIUM CARBONATE WITH DIFFERENT FATTY ACIDS AND ITS USAGE IN POLYETHYLENE COMPOUNDS**

Ilhan OZEN<sup>a</sup>, Suleyman SIMSEK  
*a.* Corresponding Author: (iozen@erciyes.edu.tr)

Calcium carbonate has been used as a filler in plastics since it is abundant in nature and a very cheap mineral. More than 80% of the fillers used in thermoplastics are based on calcium carbonate minerals. Uncoated calcium carbonate having a mean particle size of 1.6 microns and a top cut of 8 microns was provided commercially and it was dry and wet coated with saturated fatty acids whose carbon numbers vary between 14 and 18. Coating amount was adjusted to 0.5-2%. After characterization of the coated calcium carbonates, they were incorporated into linear low density polyethylene (LLDPE) in changing amounts using a twin screw extruder. Particle size and particle size distribution of the calcium carbonates before and after coating were investigated using Sympatech Helos particle size analyser. In order to obtain quantitative information about coating, thermal analyses (Thermogravimetric Analysis (TGA) and Differential Scanning Calorimeter), Fourier Transform Infrared (FT-IR) spectroscopy, Wide Angle X-Ray Diffraction (WAXD) analyses, Brunauer-Emmett-Teller (BET) surface area analyses, zeta potential measurements and moisture analyses were performed. The effects of coating chemicals, coating conditions and filler amount on composite materials were studied by evaluating the thermal (DSC and TGA) and appearance (Scanning Electron Microscope (SEM)) analyses.

## **DEPENDENCY OF THERMAL DEGRADATION ON MINERAL CONTENT AND PROCESSING TYPE IN POLY(ETHYLENE TEREPHTHALATE)/ORGANOCLAY NANOCOMPOSITES**

Ilhan OZEN<sup>a</sup>, Yusuf Ziya MENCELOGLU

a. Corresponding author: (iozen@erciyes.edu.tr)

The scope of this work consists in studying the thermal decomposition behavior of the poly(ethylene terephthalate) (PET) and its nanocomposites generated with organically modified clays using different processing methods. To achieve this goal, an intercalating agent was synthesized and montmorillonite type clay modified with this intercalating agent was mixed with the PET by employing melt extrusion and high shear mixing method. We then compared the nanocomposites in terms of dispersion and thermal stability properties. Our results showed that changing the processing type from extruder to thermokinetic mixer reduced the clay particle size substantially. The results from the SEM analyses are in excellent agreement with those obtained from the investigation of XRD data. Larger shear rates induced during thermokinetic mixing process were revealed to be responsible for a better dispersion of the clay mineral. The results show that manganese in the raw clay –though chemically bound- leads to decreased IV values, i.e. decreased molecular weight in PET/organoclay nanocomposites. It was revealed that working on the thermokinetic mixer provided substantial contributions such as shorter processing times elimination of drying step before melt processing, less thermal degradation more homogeneous and better dispersion of the clay particles in PET matrix phase.

## **THE EFFECT OF BORONIZING PARAMETERS AND SURFACE ROUGHNESS ON WEAR BEHAVIOR OF FE BASED MATERIALS PRODUCED BY P/M METHOD**

Demet Bulut<sup>a</sup>, Hakan Çetinel<sup>a,1</sup>

<sup>a</sup> Celal Bayar Univ., Faculty of Eng., Dept. of Mechanical Eng., Muradiye Campus, Manisa 45140  
TURKEY

a. Corresponding author: (hçetinel@cbu.edu.tr)

Fe based materials produced by P/M method have a widespread use in industry because they do not need any machining process and have net or near net shape. After sintering process, low alloy P/M products may be subjected to surface hardening treatments such as carburizing, nitriding and boronizing according to different purposes for the aim of use. In this study, the effect of boronizing duration and surface roughness on wear behavior of the coatings for different P/M products with Fe-4Ni-1.5Cu-0.5Mo chemical compositions was investigated. In this purpose, 2 groups of P/M products with different density and surface roughness were produced by cold pressing and sintering at 1120°C for 30 minutes. All of the specimens were subjected to boronizing process at 950°C for 2, 4 and 6 hours. The effect of boronizing duration and surface roughness on wear behavior was determined. The wear test was performed under the load 4 and 10 N with a pin on disk device.

## AMMONIUM REMOVAL FROM AQUATIC ENVIRONMENTS BY ACINETOBACTER CALCOACETICUS STB1 IMMOBILIZED CELLULOSE ACETATE NANOFIBERS

Ömer Sarıoğlu, Öncay Yaşa, Aslı Çelebioğlu, Tamer Uyar, Turgay Tekinay  
a. Corresponding author (vedatdeniz@hitit.edu.tr)

A novel biomaterial was developed by immobilizing an efficient ammonium oxidizing bacterial strain, *Acinetobacter calcoaceticus* STB1, on porous cellulose acetate (CA) nanofibers. Porous CA nanofibers display a highly biodegradable and biocompatible nature that renders them advantageous in biological applications, and were chosen as an immobilization medium due to their higher surface to volume ratio compared to pore-free nanofibers. Ammonium removal characteristics of bacteria-immobilized CA nanofibers were determined at varying initial ammonium concentrations (50, 100 and 200 mg L<sup>-1</sup>) and high ammonium removal rates (100%, 95.5% and 72%) were observed within 48 h for all samples tested. Ammonium removal capability of bacteria-free CA nanofibers was found to be minimal, suggesting that ammonium removal in bacteria-immobilized CA nanofibers is mainly facilitated by bacterial nitrogen metabolism. Trace amounts of metabolized ammonium were converted to nitrite or nitrate. A reusability test was performed to determine the effectiveness of bacteria-immobilized CA nanofibers for repeated use and results indicate that, at an initial ammonium concentration of 100 mg L<sup>-1</sup>, the biomaterial described can be reused for at least 5 cycles with an average removal ratio of 85%. SEM imaging after reusability evaluations reveals that bacteria strongly adhere to nanofiber surfaces by biofilm formation.

## COMPARISONS OF FINE DRY GRINDING OF TWO DIFFERENT POROUS POWDERS: AMORPHOUS SILICA AND DIATOMITE

a. Vedat Deniz<sup>1a</sup>,  
Yakup Umucu<sup>2</sup>

1. Hitit Univ., Dept. of Polymer Eng., Çorum, Turkey
  2. Süleyman Demirel Univ., Mining Eng., Isparta, Turkey
- b. Corresponding author (vedatdeniz@hitit.edu.tr)

Powders of amorphous silica and diatomite have recently recognized in the industry. Therefore, the grinding properties of natural amorphous silica and diatomite were studied. Firstly, the Standard Bond Work Index tests were made for the amorphous silica and diatomite samples. Latter, kinetic breakage behaviours of each two sample were studied with the emphasis on a kinetic study in a ball mill. The model parameters ( $a_T$ ,  $\alpha$ ,  $\phi_j$ ,  $\gamma$  and  $\beta$ ) were compared for the two different porous powder samples. In this investigation, the specific rates of breakage of the diatomite were better than the amorphous silica at the same experimental conditions. The breakage parameters obtained showed that the diatomite is broken faster than amorphous silica. However, although porous samples have different properties with respect to abrasive behavior, the primary breakage of each two porous samples gave close to relative production rate of fines for especially smaller particle sizes. In this study, a relationship between the Bond Work Index and breakage parameters of grinding kinetic on two porous samples was not fully obtained. Reason of this different result is due to different geological origin and properties of internal porosity of porous materials.

## **CONTROLLED DRUG RELEASE FROM TITANIUM IMPLANTS VIA ADJUSTABLE SURFACE POROSITY**

Cem Bayram<sup>1</sup>, Ebru Erdal<sup>1</sup>, Emir Baki Denkbaş<sup>2</sup>

<sup>1</sup>Hacettepe Univ., Nanotechnology and Nanomedicine Division, Beytepe, Ankara, Turkey

<sup>2</sup>Hacettepe Univ., Chemistry Dept., Beytepe, Ankara, Turkey

a. Corresponding author: (denkbas@hacettepe.edu.tr)

Titanium and its alloys are widely used in orthopaedic, dental and cardiovascular implants and after the implantation procedure a subsequent drug therapy is required to control complications such as inflammation, infection and clotting in the post operation period. The administration of drugs such as oral or intravenous routes have well known disadvantages like systemic toxicity and low efficiency to point area. Drug release from implant material is a recent and effective strategy to overcome aforesaid disadvantages by using polymer and/or ceramic coatings containing various drugs; but the coatings are often open to ruptures due to mechanic dynamics in body fluid and/or tissues. The more recent approach in drug release from implant surface is polymer free techniques. A porous layer consisting of nanotubular shaped cavities can be generated on titanium surface with anodic oxidation procedure. These nanotube structures can be filled with relevant drugs and the release period can be extended up to a couple of weeks via adjusting nanotube diameter and length by tuning anodization procedures. Here in this study a well known and widely used antibiotic, vancomycin, was selected as model and the releasing time was investigated.

## **MUSSEL-INSPIRED SYNTHESIS OF POROUS VATERITE MICROSPHERES AND HYDROXYAPATITES BY CO<sub>2</sub> MINERALIZATION**

Chan Beum Park\*, Sungin Kim, Jong Wan Ko

Dept. of Materials Sci. and Eng., Korea Advanced Inst. of Science and Technology (KAIST), 335 Science Road, Daejeon 305-701, Korea

a. Corresponding author: (parkcb@kaist.ac.kr)

One of most unique and fascinating features of natural biomineralization processes is the controlled growth and hierarchical organization of inorganic minerals along with organic materials, which give excellent physicochemical properties to biomaterials. For example, it was found that collagen fibrils and dentin matrix proteins facilitate the nucleation and growth of apatite minerals, resulting in the formation of bone tissue and dentin, respectively. In this regard, researchers have focused on understanding the mechanism of biomineralization in natural systems and attempted to mimic the biomineralization phenomena over the last two decades. However, none of previous studies have offered a practical and generalized methodology that can integrate natural inorganic crystals (e.g., hydroxyapatite) into a wide variety of synthetic materials to create the next generation of hybrid biomaterials. Therefore, the design of biointerfaces, where natural components can be readily integrated into diverse synthetic biomaterials, remains as a key challenge in chemistry, materials science, and tissue engineering. In this talk, I will present a 'universal' biomineralization strategy that can integrate inorganic hydroxyapatite crystals with versatile materials using polymerized dopamine coating. Considering that the current market for bone tissue engineering is enormous, the universal biomineralization approach should become an innovative breakthrough with high impact.

## **SCALE UP AND FUNCTIONALIZATION OF METAL-ORGANIC FRAMEWORK MATERIALS FOR ADSORPTION AND SEPARATION APPLICATION**

David Sholl, Krista Walton

a. Corresponding author: (david.sholl@chbe.gatech.edu)

Adoption of metal-organic framework materials in practical applications has been strongly limited by materials availability. We will discuss methods for reliably scaling production of these materials to kg quantities and present examples of using this capability to develop industrial applications. One of the advantages of metal-organic framework materials is that they can be modified in chemically specific ways via ligand functionalization. We will show how ligand functionalization can lead to surprising changes in crystal structure. We have developed quantitative modeling methods that can account for these structural changes.

## **AMPICILLIN NANOPARTICLES PRECIPITATION VIA GAS ANTISOLVENT PROCESS**

Nadia Esfandiari, Seyyed M. Ghoreishi

Dept. of Chemical Eng., Isfahan Univ. of Technology, Isfahan 84156-83111, Iran

a. Corresponding author: (n.esfandiyari@ce.iut.ac.ir)

Micronization of Ampicillin via gas antisolvent (GAS) process was studied. Ampicillin has been precipitated from a dimethyl sulfoxide (DMSO) solution using carbon dioxide as antisolvent. The mean particle size and particle size distribution strongly controlled with effective GAS parameters such as pressure, temperature, antisolvent addition rate and initial solute concentration. The effect of antisolvent flow rate (1.6, 2 and 2.4 ml/min), temperature (34, 40 and 46°C) and pressure (9, 12 and 15 MPa) were investigated on particle size and particle size distribution. The precipitation particles were analyzed with SEM and Zetasizer Nano ZS. Analysis indicated that decreasing the temperature, meanwhile increasing the antisolvent rate and pressure led to a decrease in ampicillin particle size.

## **INFLUENCE OF REGIME PARAMETERS TO THE HYDROCRACKING PROCESS OF GOUDRON IN THE PRESENCE OF SUSPENDED NANOSIZED CATALYSTS**

G.A. Mukhtarova, N.Kh. Efendiyeva, Z.A. Gasimova, H.C. Ibrahimov, V.M. Abbasov  
Azerbaijan NAS Inst. of Petrochemical Processes, Azerbaijan, Baku  
a. Corresponding autor (gulermuxtarova@yahoo.com)

At the present stage, the main task of petroleum refining industry is to raise the depth of oil processing involving heavy oil residues into processing with a view to increase the motor fuels production. In this article are presented the main results of the study of the process of hydrogenation processing of goudron from a mixture of Baku crude oils under low pressure in the presence of suspended nanosized catalysts with a view to increase the motor fuels production and increasing the depth of petroleum refining. As a microcatalytic additive, natural clayey minerals were used in the amount 1.0-2.5 % of goudron mass. Chemical treatment of natural clayey minerals allows to obtain microporous materials.

It was investigate the influence of temperature and pressure to hydrocracking process of tar. It was determined that with increasing of temperature from 400<sup>0</sup>C to 440<sup>0</sup>C (0.5 MPa pressure) the yield of light oil products increased from 31,39 to 61% mass. With increasing of pressure from 0.5 MPa to 4 MPa the yield of light oil products increased from 47,0 to 58% mass. So that, the yield of gasoline decrease from 30 % to 27%, but the yield of diesel fraction increased from 16 % to 30,52 %. Further, at the increasing pressure from 4 MPa to 6 MPa the yield of light oil products increased a few, but amount of cock is decrease from 13 % to 9 %. The change of temperature and pressure also influence to the hydrocarbon composition of obtaining products. So that, with increasing of emperature from 430 <sup>0</sup>C to 440 <sup>0</sup>C (0.5 MPa pressure) and with increasing of pressure from 0.5 MPa to 6.0 MPa ( temperature-430 <sup>0</sup>C) amount of sulfur, iodine number, aromatic hydrocarbons containing in the gasoline decrease. The viscosity, amount of resins, amount of sulfur and iodine number of diesel fraction are decrease.

The gasoline fraction produced at hydrocracking of goudron with the catalytic additive is characterized by a good colour, a low content of unsaturated hydrocarbons and octane number 65-67 points according to the research method. Diesel fraction is also characterized by the low content of aromatic hydrocarbons, what defines its high cetane number of 45-46 points. The analysis of the quality of gasoline and diesel fractions shows that after the additional light hydrotreatment the obtained products can be recommended as component to fuels.

## **BIPOLAR NANOFILTRATION MEMBRANES BASED ON PLASMA MODIFIED MICROFILTERS**

Marek Bryjak, Irena Gancarz, Ilona Duraj  
a. Corresponding author: (marek.bryjak@pwr.wroc.pl)

Fabrication of nanofilters with good selectivity towards multivalent ions is highly important for boiler water technology. Replacement of ion-exchange resins by nanofiltration has gained the search for high permeable membranes with good ion rejection. It seems that bipolar nanofiltration membranes with alternately arranged layers can show the requested properties. The contribution shows method for membrane preparation and properties of obtained filters. Track-etched membranes were used as support for deposition of plasma polymerized layers and formation of bipolar filtration membranes. The 75 KHz plasma reactor was applied for deposition of polymers. Three kinds of monomers were plasma polymerized: n-butylamine, allylamine and acrylic acid. It was determined that acrylic acid deposited at the largest rate, then allylamine and finally n-butylamine. The obtained membranes showed good rejection properties towards sulfate and carbonate ions with still large volumetric flux. It was shown that the sequence of deposited layers did not affect the separation properties. For some investigated membranes carbonate and sulfate rejection reached 50-80% value. Support of WRC EIT+ under the project "The Application of Nanotechnology in Advanced Materials" - NanoMat (POIG.01.01.02-02-002/08) is acknowledged.

## **PLASMA MODIFIED MEMBRANES FOR DONNAN DIALYSIS**

Marek Bryjak, Ilona Duraj

a. Corresponding author: (marek.bryjak@pwr.wroc.pl)

Among different membrane methods, Donnan dialysis (DD) can be useful for removal of traces amounts of harmful ions from aqueous solutions. The key factor for efficient Donnan dialysis process is well-selected membrane that can be prepared by 1) blending of functional and standard polymers followed by shaping the membranes. 2) the use of porous polymer support, ultrafiltration or microfiltration membranes, and inter polymerization of gel-like polymers within their pores. The important feature of the dialysis membranes is their good ion permeability that results from locking functional polymers into the network of pores, and stability by the support constrains. The goal of the contribution is to show the preparation route that allows to turn porous membrane to dialytic membranes by plasma activation and layer by layer deposition of polyethyleneimine. It was shown that salts fluxes through new membranes were larger than fluxes of the same salts across commercial FumaTech anion-exchange membranes. However, the collapse of polyethyleneimine chains, generated by higher ionic strength of solution, caused poor selectivity of the grafted membranes and their weak selectivity in the Donnan dialysis process. Support of WRC EIT+ under the project "The Application of Nanotechnology in Advanced Materials" - NanoMat (POIG.01.01.02-02-002/08) is acknowledged.

## **SMART POROUS POLYMER MEMBRANES**

Marek Bryjak, Katarzyna Smolinska-Kempisty

a. Corresponding author: (marek.bryjak@pwr.wroc.pl)

Membranes with environmentally-sensitive polymers have become intensively studied lately. They are prepared by two methods: i) blending of responsive polymer with standard polymer and processing the blend to prepare membranes with embedded responsive elements or ii) attaching responsive polymer to a porous substrate. The last method can be conducted by grafting of polymer brushes to pore walls or by in situ polymerization of polymers on the pores surface. Now, plasma modification becomes very attractive method for alteration of surface properties. There are two features justifying that interest: production of small amounts of by-products and extremely short time of modification. The presented studies deal with comparison of the temperature and pH responsibility of permeation flux for polymer membranes prepared by grafting of poly(acrylic acid), PAA, and/or poly(N-isopropylacrylamide), PNIPAM, to polypropylene support. The studies have revealed that NIPAM grafted membranes were sensitive to change of temperature only and membranes with PAA showed both temperature and to pH responsibility effects. Similar phenomenon was observed for grafted copolymers PAA-PNIPAM. It was concluded that the obtained membranes can be used as stimuli response nano-valves. Support of WRC EIT+ under the project "The Application of Nanotechnology in Advanced Materials" - NanoMat (POIG.01.01.02-02-002/08) is acknowledged.

## AN EXPERIMENTAL STUDY ON HOT FORMABILITY OF CLOSED CELL METALLIC FOAMS

Emrah ERSOY<sup>1,a</sup>, Yusuf ÖZÇATALBAŞ<sup>2</sup> ve Ersin BAHÇECİ<sup>3</sup>

1. Gazi Univ., Graduate School of Natural and Applied Science, Ankara, Türkiye
  2. Gazi Univ., Technology Faculty, Metallurgical&Materials Eng. Dept., Ankara, Türkiye
  3. Kastamonu Univ., Cide VHS, Kastamonu, Türkiye
- a. Corresponding author (emrahersoy06@gmail.com)

The purpose of this study is to investigate formability of Al based closed cell metallic foams at high temperature. Rectangular section foam specimens were produced from AlMg1Si0.6TiH<sub>2</sub>0.8 alloy preform material under stationary experimental conditions. By means of a mechanism placed in foaming furnace, free bending test with the effect of gravity and force bending test were performed to foam specimens. As a result of force bending test applied in different deformation rates in 600 and 625 °C, specimens ruptured after angular deformation of nearly 11°. In free bending tests which lasted up to 75 minutes in 635-656 °C temperature intervals, high deformation rates could be achieved. During this test, the time-angular deformation relationships based on temperature were determined. Angular deformation of 82° was achieved without macro defect at 656 °C temperature via free bending method. The importance of a critical temperature and deformation rate was emphasized in maintaining the deformation.

## STIMULI CONTROLLED IONS TRANSPORT THROUGH SMART MEMBRANES

Marek Bryjak, Katarzyna Smolinska-Kempisty  
a. Corresponding author: (marek.bryjak@pwr.wroc.pl)

Smart polymers, SPs, are materials that can change their properties in response to such external impulses as temperature, pH, ionic strength etc. The most frequently used poly(N-izopropylacrylamide), PNIPAM, is thermosensitive while poly(acrylic acid), PAA, is pH-sensitive smart polymer. When the SP chains are end-capping with suitable ligands, their rearrangement within membrane pores create transport paths for ions and acceleration of membrane permeability Di(ethylene glycol)methyl ether methacrylate, DEGMEM, or methacrylate ester of hydroxyl methyl crown ether, MEC6, can interact with ions and facilitate their transport. When PNIPAM or PAA is copolymerized with DEGMEM or MEC6 the membrane pores are filled with temperature or pH/temperature sensitive gel. In consequence the membrane gets ion-gating properties with proper selection of pore diameter, properties of SPs and kind of end-capping ligand. The effect of plasma activated grafting of PNIPAM and PAA based smart polymers and separation efficiency for alkaline ions have been discussed. It was shown that DEGMEM derivative of PAA improved lithium separation of about 33% with the change of pH and about 20% for temperature alteration when gel is formed by PNIPAM. Ligand MEC6 was not effective in separation. It bound ions and did not allow them to pass through membrane.

## **NANOSTRUCTURING OF BIOIMPLANTS THROUGH CHEMICAL MECHANICAL POLISHING**

Zeynep Ozdemir<sup>1</sup>, G. Bahar Basim<sup>1,a</sup>

1. Özyeğin Univ., Mechanical Eng., Istanbul, Turkey  
a. Corresponding author (Bahar.Basim@ozyegin.edu.tr)

Implant surface composition and structure are critical design factors affecting the rate of osseointegration that is accepted as an indication of biocompatibility. The goal of this study is to induce Chemical Mechanical Polishing (CMP) based nano-scale random surface modification of titanium substrates to improve their biocompatibility. CMP is a novel way for processing the surface of biomaterials to manipulate the nature of the surface at an atomic scale. The CMP process involves both chemical and mechanical actions to lead material removal from the surface layer while inducing nano-scale surface structure simultaneously. In this study pure titanium plate surfaces are modified with various CMP pads composed of different structures including the standard microelectronic pads to much rougher abrasive papers with different particle sizes by using slurries with varying oxidizer concentrations. After the CMP applications the titanium surfaces were characterized through surface wettability by measuring contact angles with body serum and surface roughness evaluation by Atomic Force Microscopy (AFM). Bacteria growth tests were applied to evaluate the preliminary biocompatibility on the processed Ti samples.

## **UTILIZATION OF FINE AND POROUS MATERIALS IN A HYBRID PROCESS FOR ENVIRONMENTAL CLEAN-UP**

Nalan Kabay<sup>1</sup>, Marek Bryjak<sup>2</sup>

<sup>1</sup>Ege Univ., Izmir, Turkey

<sup>2</sup>Wroclaw Univ. of Technology, Wroclaw, Poland

Corresponding author: (nalan.kabay@ege.edu.tr)

Today, the hybrid processes combining sorption and membrane filtration becomes a powerful separation tool for water treatment. They allow to remove and/or to recover some species that can exist in water even at trace amounts. In the first step of the hybrid process, the target component is bound to the coupling agent and, as a large complex, it is retained by the membrane. The complex is decomposed in the second step by the using a suitable stripping solution followed by the membrane separation that recycles the coupling agent.

The recent achievements in the materials science offer new types of sorbents and binding agents that include organic and inorganic sorbents, chelating and ion exchange resins, molecularly imprinted polymers and coordinating agents, micelles and colloids. They can be used in the hybrid processes when their particle diameter is small enough – usually from few nanometers to dozens of micrometers.

In this presentation, some general classification of hybrid processes as well as some case studies on the application of some inorganic or organic materials in such hybrid processes for environmental clean-up will be discussed.

## MODELING OF THE ELECTRONIC STRUCTURE AND STABILITY OF MIXED COBALT CLUSTERS.

H. Meghezzi\*<sup>a</sup>, N. Guechtouli<sup>a</sup>, J.-Y. Saillard<sup>b</sup>, S. Kahlal.<sup>b</sup>  
a:Corresponding author: (hmezghezzi@yahoo.fr)

The purpose of our work is to present a theoretical study of neutral or ionic tetra cobalt clusters, characterized by the same cluster electron count of 68, bearing 8 skeletal electron pairs (SEP). Experimentally, a large number of structures with core Co<sub>4</sub>E<sub>2</sub> with this account has been characterized. In order to understand the factors that determine their skeletal shape, we have optimized the geometries and calculated the relative energies of all the possible isomer of structures **A**, **B**, **C**, **D** and **E** of the series [M<sub>4</sub>(CO)<sub>12</sub>E<sub>2</sub>]<sup>q</sup> (M= Co; E=CH, N, P, NH, PH, S) in which the charge q is adjusted to maintain the total cluster electron count equal to 68 (8 SEPs). **A** is the closo structure, The nido structure **B**, in which the E...E edge is open, The nido structure **C** in which the M...M edge is open, the nido structure **D** in which the E...E and M...M edges are open and the arrangement **E** can be described as an octahedron of which two M...E edges are open. With cobalt metal, DFT calculations are used.

## OPTIMISATION OF THE EMULSION FORMULATION WATER IN OIL

R. Chemini<sup>(1)</sup>, S. Benkhaled<sup>(2)</sup>, F. Bentahar<sup>(3)</sup>

(1,3) Laboratoire Phénomènes de Transfert, Faculté de Génie Mécanique et de Génie des Procédés, Université des Sciences et de la Technologie Houari Boumediene, USTHB 16111 Alger-Algérie.

(2) Institut Algérien du Pétrole, Avenue du 1<sup>er</sup> novembre, 35000 Boumerdes-Algérie

a. Corresponding author: (rchemini@usthb.dz)

The aim of our study is to optimise the composition of emulsion water in oil. An optimum experimental design has been used to modelise, by linear programming, the properties of these emulsions and to estimate the effect of each component on these properties.

This method is applied for the emulsion formulation by the dispersion of a salt aqueous phase (water, nitrate of sodium, ammonium nitrate) in an oil phase (surfactant, fuel oil, solid paraffin). The volume fraction of the aqueous phase (dispersed phase) is 90%.

A series of non ionic surfactants (derived esters, ethers and amides) are tested in laboratory at the same operating conditions (agitated speed, temperature, composition). A mixed surfactants DEHYMULUS PGPH (HLB<4) and WITCONOL14 (HLB=6) gives better stability of emulsion water in oil at temperature 60°C during 28 days.

An application for explosive emulsion is studied by adding microspheres (content 2% to 4%) at this stable emulsion. The results give the proprieties (density, TRAUZL) observed and calculated, as well as the optimum of the emulsion composition. The thermochemical characteristics are compared with commercial emulsion.

## **POROUS PHOTOELECTRODE OF PHOTOELECTROCHEMICAL SOLAR CELL BASED ON ONE-DIMENSIONAL TiO<sub>2</sub> NANOSTRUCTURES**

A. Irajizad<sup>a,b,\*</sup>, R. Mohamadpour<sup>b</sup> and F. Chizari<sup>a</sup>

<sup>a</sup>Dept. of Physics, Sharif Univ. of Technology, Tehran, P.O. Box 11155-9161, Iran

<sup>b</sup> Inst. for Nanoscience and Nanotechnology, Sharif Univ. of Technology, Tehran, P.O. Box 11155-8639, Iran

a. Corresponding author: (irajizad@sharif.edu)

A dye-sensitized solar cell is a low-cost solar cell belonging to the group of thin film solar cells. It is a photoelectrochemical system based on a nanostructured photo-sensitized anode and an electrolyte. The most crucial element that controls the performance of solar cell is the mesoporous electrode. A monolayer dye molecules coated on the surface of nanostructured electrode. Photons striking the dye with enough energy to be absorbed create an excited state of the dye, from which an electron can be injected directly into the conduction band of the TiO<sub>2</sub>. Consequently, having enough effective surface area for dye absorption and also straight forward pathway for electrons are vital for mesoporous TiO<sub>2</sub> electrode. Here we have employed 2-step hydrothermal method to fabricate one-dimensional nano-fibers decorated with nanoparticles and nanobranches. These novel mesoporous electrodes provide straight channel for electrons to go through it. On the other hand, the adequate surface area of modified nanofibers enable photoelectrode for sufficient dye absorption so it offers superior light harvesting. Employing this novel structures in nanoparticulate photoelectrode, we have got 9% power conversion efficiency. Our studies show that the photoelectrode based on nanofibers have superior optical and electrical characteristics in comparison to conventional electrodes.

## **REMOVAL OF ENDOCRINE DISRUPTING COMPOUNDS (DEP AND DMP) FROM WATER BY A POROUS POLYMER ADSORBENT IN ADSORPTION-MEMBRANE FILTRATION HYBRID SYSTEM**

Seyhan Solak<sup>1</sup>, Müşerref Arda<sup>1</sup>, Nalan Kabay<sup>2</sup>, Mithat Yüksel<sup>2</sup>

<sup>1</sup>Ege Univ., Chemistry Dept., Izmir, Turkey

<sup>2</sup>Ege Univ., Chemical Eng. Dept., 35100 Izmir, Turkey

a. Corresponding author: (nalan.kabay@ege.edu.tr)

Over the last two decades, there has been increasing concern about the likely impacts of exposure to some chemical compounds with endocrine disrupting activity in the environment. They are active even at low concentrations and disturb hormone activities. These endocrine disrupting compounds (EDCs) consist of many natural and synthetic organic compounds, but they are mostly man-made products. Phthalates and their degradation intermediates are toxic, mutagenic and also potential endocrine disrupters.

In this study, utilization of a commercial porous polymer adsorbent Dowex L493 in an adsorption-membrane filtration hybrid system for removal of some phthalates such as diethyl phthalate (DEP) and dimethyl phthalate (DMP) was investigated. The hybrid process combines the delivery of feed solution and fresh polymer adsorbent suspension into the suspension tank with the subsequent removal of the loaded adsorbent from the tank at the same flow rate. The permeate is collected by the filtration of the adsorbent-solution suspension through the hollow fiber UF membrane module submerged into the suspension tank. The goal of this work is to investigate the effects of process parameters such as adsorbent concentration, particle size of the adsorbent, speeds of adsorbent replacement and permeate flow rate on removal of DEP and DMP from model solutions.

## **ENERGY EFFECTIVE GRANULE PREPARATION IN PORCELAIN TILE PRODUCTION**

Ayşe Tunali<sup>1,a</sup> and Neslihan Tamsü Selli<sup>1,a</sup>

1. Eczacıbasi Building Product Co., VitraA Innovation Centre, Bilecik, Turkey

a. Corresponding authors: ayse.tunali@eczacibasi.com.tr; neslihan.tamsu@eczacibasi.com.tr

In this study, the effect of polymeric dispersant was investigated in ceramic powder blend of porcelain tile to determine the best dispersing formulation. The aim is to outperform the currently used dispersing formulation (sodium silicate) in order to directly save energy and production time (higher slurry solids at same viscosity). Polymeric dispersant was tested in formulation with sodium silicate at different ratios. Finally, by using 0,25% dispersing agent in the ratio of 90% sodium silicate to 10% polymeric dispersant the best value was achieved. Compared to the current dispersant system it allows increasing the solids by 2% (from 65% for the current dispersing system to 67% with polymeric dispersant.) By increasing the solid ratio, the energy spent for preparation of granule in spray drier is decreased.

## **SYNTHESIS OF GRAPHENE NANOSHEETS THIN FILM FOR GAS SENSING APPLICATIONS**

M. Ghezellou<sup>1</sup>, M. Najafi<sup>1</sup>, H. Haratizadeh<sup>1</sup>

<sup>1</sup>Dept. of Physics, Shahrood Univ. of Technology, 3619995161, Shahrood, Iran

a. Corresponding author: (m.ghezellou@gmail.com)

Gas sensing properties of a Graphene nanosheets (GNSs) thin film has been studied for detecting the carbon containing gases with different concentrations. The Graphene oxide has been prepared by a Hummer method from  $\text{KMnO}_4$ ,  $\text{H}_2\text{SO}_4$  and natural graphite as the starting materials. Graphene nanosheets thin film were formed by drop-casting of the aqueous solution of graphene oxide on a substrate with the temperature of  $200^\circ\text{C}$ . X-ray diffraction and scanning electron microscopy (SEM) analysis confirm the formation of porous graphene multilayers nanosheet thin film.

Sensor devices have been prepared by using silver paste wiring of the GNS thin films for the carbon containing gas sensing. The results exhibit a pretty good sensitivity in the case of ethylene emitted from the fresh fruits which means that GNS sensors have been promised the capability for fruit ripening applications in food industries.

## SEPARATION OF METHANE AND CARBON DIOXIDE BY ADSORPTION USING NANOPOROUS CU-BTC POWDER

T. Asadi, M. R. Ehsani

a. Corresponding author: (ehsanmr@cc.iut.ac.ir)

Natural Gas (NG) is used both as a process gas as well as a fuel. It is a mixture of Methane(C1), with heavier hydrocarbons such as ethane, propane, and also impurities components such as Carbon-Dioxide, Hydrogen Sulfide. Removal of CO<sub>2</sub> from the natural gas may be required in order to meet pipeline standards and prevent corrosion. It can be adsorbed by several adsorbent materials. In this work, adsorption equilibrium of CO<sub>2</sub> and CH<sub>4</sub> on nanoporous metal organic framework Cu-BTC powder was measured in a magnetic suspension microbalance in the pressure range of 0 to 7 bar at three different temperatures; 308, 343, and 373 K. Also, experimental data were fitted with the Langmuir model. Isosteric heats of adsorption were obtained 22.8 and 14.9 kJ/mol for CO<sub>2</sub> and CH<sub>4</sub> on Cu-BTC powder respectively, which indicates a strong adsorption of carbon dioxide on this adsorbent. Also, the adsorption capacity of powder is 1.44 mol/ kg for methane and 6.39 mol/ kg for carbon dioxide at 2 bar and 308 K, respectively with selectivity about 4.43. So, the preferential adsorption capacity of CO<sub>2</sub> on nanoporous Cu-BTC powder indicates that this material can be used for methane purification from natural gas.

## EFFECT OF MODIFICATION OF MORDENITE CATALYST ON THEIR ACTIVITY FOR N-BUTANE CONVERSION

Dilgam Tagiyev, Safa Abasov, Roman Starikov, Ayten Iskenderova  
Inst. of Petrochemical Processes of Azerbaijan NAS, Baku, Azerbaijan

a. Corresponding author: (dtagiyev@hotmail.com)

Isomerization of n-alkanes to the isoalkanes is the important industrial process for different alkylates production. In this contribution results on the modification of mordenites active at low temperature conversion of n-butane and the comparison of this dates with the Dubinin-Radushkevich adsorption isotherm parameters.

The adsorption of benzene vapors were gravimetrically determined in volumetric-vacuum unit. The isotherms obtained are satisfactorily described by Dubinin-Radushkevich equation.

$$\ln a = \ln W_o \rho - BRT \ln(P_o/P)^2$$

(W<sub>o</sub> – volume of adsorption accessible for adsorption; B – isotherm angle of slope).

It should be noted that as distinct from HM<sub>17</sub> to ZrO<sub>2</sub>/HM<sub>17</sub> and SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>/ HM<sub>17</sub> increases catalysts activity (isoparaffins yield 18.6, 21.5 and 25.3 % at 250, 220 and 190<sup>0</sup>C). It was found that W<sub>o</sub> and B values for catalysts HM<sub>17</sub>, ZrO<sub>2</sub>/HM<sub>17</sub> and SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>/ HM<sub>17</sub> are increases (W<sub>o</sub> from 0.07 to 0.11 sm<sup>3</sup>/g and B from 0.03 to 0.08).

Such regularity of W<sub>o</sub> change corresponds to the arrangement of these zeolites in a row by their adsorption capacity and B by the sizes of inlet windows to the large channels. Hence, W<sub>o</sub> and B parameters are the reflection of their microporous structure. HM<sub>17</sub> modification with simultaneously zirconium and sulfat ions leads to increase of B parameter and increases isoparaffins yield.

## MESOPOROUS MATERIALS FROM A NOVEL SILICA SOURCE

Sujitra Wongkasemjit<sup>1,a</sup>, and Rujirat Longloilert<sup>1</sup>

1. Chulalongkorn Univ., Petroleum and Petrochemical College, and Center of Excellence for Petrochemical and Materials Technology, Bangkok 10330, Thailand  
a. Corresponding author: dsujitra@chula.ac.th

Generally, mesoporous silicas are synthesized via sol-gel process using structure directing agent, catalysts (acid or base), solvent, and commercially available silica source (mainly TEOS). The commercially available silica sources are mostly found to be easily hydrolyzed, resulting in amorphous silica rather than forming mesoporous silica. A novel silica source with a moisture stable, known as silatrane, was employed to the synthetic process. Since the mesoporous silicas themselves are deficiently employed as a catalyst, the incorporation of hetero atoms to their structures can solve this drawback. The extraordinary mesoporous silicas as well as the metal loaded mesoporous silicas using moisture-stable silatrane, the properties, and their applications will be discussed.

## THE ESTIMATION OF PORE ANISOTROPY AND ITS RELATIONSHIP WITH MORPHOMETRIC PROPERTIES OF POROUS SOLIDS

Eleni T.Tsaousi<sup>1</sup>, Gerasimos S. Armatas<sup>2</sup> and Philippos J. Pomonis<sup>1a</sup>

<sup>1</sup>Dept. of Chemistry, Univ. of Ioannina, Ioannina 45110, Greece.

<sup>2</sup>Dept. of Materials Science and Technology, Univ. of Crete, Heraklion 71003, Crete, Greece.

a. Corresponding author (ppomonis@cc.uoi.gr)

The concept of pore anisotropy  $b=L/D$  corresponds to the ratio between the pore length  $L$  and diameter  $D$  and can be estimated using standard  $N_2$  physisorption data. This work outlines the following points: (i) It will be shown how we can estimate  $b$  in porous materials with organized or random nanoporosity. (ii) Since in real materials the pores are connected to, and intercepted by, other pores, forming a complex network, it will be shown how the pore anisotropy  $b$  is affected by the mean connectivity  $c$  of pores. (iii) Since the length of mesopores is usually intercepted by various micropores, it will be shown how the pore anisotropy  $b$  is influenced by the extent of microporosity (%micro) of porous domains. (iv) It will be shown that the methodology for estimating  $b$  is directly related to the fractal dimensionality  $D$  of adsorption – desorption phenomena. (v) A comparison will be attempted between the phenomenology describing the development of surfactant micelles in synthesis of organized mesostructured materials, like MCM and SBA-type silicas, and the mechanism affecting the most common example of anisotropic development in nature, which is the plant cells.

## ZnO/MESOPOROUS SUPPORT COMPOSITES OBTAINED BY NANOCASTING METHOD

Florica VAJA (DUMITRU)<sup>1,2\*</sup>, Denisa FICAI<sup>1</sup>, Anton FICAI<sup>1</sup>, Ovidiu OPREA<sup>1</sup>, Cornelia. GURAN<sup>1</sup>

<sup>1</sup>Politehnica" Univ. of Bucharest, Faculty of Applied Chemistry and Material Science, Bucharest, Romania

<sup>2</sup>Research Inst. for Advanced Coatings-ICAA, Bucharest  
a. Corresponding author (florydumitru@yahoo.com)

In this research we present the results obtained in the synthesis of some ZnO composites using as supports mesoporous ordered silicate SBA-15 and mesoporous disordered silicate KIT-6.

The ZnO/mesoporous support composites were prepared using nanocasting method realized by incorporating zinc nitrate (precursor) into the channels of mesoporous ordered silica SBA-15 and mesoporous disordered silicate KIT-6.

The mesoporous ordered silica SBA-15 and mesoporous disordered silicate KIL-6 were synthesized using a block copolymer (polyethylene oxide–polypropylene oxide) as soft template and tetraethyl orthosilicate (TEOS) as silicate source.

The as prepared composites were morphologically and structurally characterized by XRD diffraction, SEM, IR, UV-Vis spectroscopy and elemental analysis (EDAX).

These composites will be investigated as additive in coatings for improvement the UV resistance.

## STATISTICAL ANALYSIS OF INDENTATION FRACTURE TOUGHNESS ( $K_{IC}$ ) OF 0.25Li<sub>2</sub>O.2SiO<sub>2</sub>-0.75BaO.2SiO<sub>2</sub> GLASS AND GLASS-CERAMIC

Burcu Ertuğ<sup>1 a</sup>, Burcu Nilgün Çetiner<sup>2</sup>, Hasan Gökçe<sup>1</sup>, Z. Engin Erkmen<sup>2</sup>,  
M. Lütfi Öveçoğlu<sup>1</sup>

1. Istanbul Technical Univ., Dept. Of Metallurgical and Materials Eng., 34469 Maslak, Istanbul, Turkey.

2. Marmara Univ., Dept. of Metallurgical and Materials Eng., 34722 Göztepe, Istanbul, Turkey.

a. Corresponding author (burcuertug@gmail.com)

In the present study, in order to determine the indentation fracture toughness ( $K_{IC}$ ) data for 0.25Li<sub>2</sub>O.2SiO<sub>2</sub>-0.75BaO.2SiO<sub>2</sub> glass and glass-ceramic, Vickers microhardness test was carried out on the samples. To calculate  $K_{IC}$ , Young's modulus, E and the hardness,  $H_v$  values were used. The mean crack half-length,  $\bar{c}$  and the mean fracture toughness,  $\bar{K}_{IC}$  were measured and calculated, respectively along with the coefficient of variations. The cumulative probability,  $P_i$  was expressed versus normalized crack length,  $c / \bar{c}$ . Using  $K_{IC}$  and  $P_i$  values,  $\ln[1/(1-P)] - \ln K_{IC}$  graph was drawn according to well-known two parameter Weibull distribution equation. By this graph, Weibull modulus, m and scale parameter,  $K_0$  were determined and compared with each other.

## EXPERIMENTAL AND THEORETICAL STUDY ON STYRAX OFFICINALIS ACTIVATED CARBON ADSORPTION OF LEAD AND ZINC FROM AQUEOUS SOLUTION

Tolga Depci<sup>1,a</sup>, Ali Riza Kul<sup>2</sup>, Keith A. Prisbrey<sup>1</sup>, Yunus Onal<sup>3</sup> and Jan D. Miller<sup>1</sup>

1. Univ. of Utah, Dept. of Metallurgical Eng., Salt Lake City, UT, USA
  2. Yuzuncu Yil Univ., Dept. of Chemistry, Van, Turkey
  3. Inonu Univ., Dept. of Chemical Eng., Malatya, Turkey
- a. Corresponding author (tdepce@gmail.com)

Activated carbon derived from *Styrax Officinalis* seeds (Balikesir, Turkey) was investigated as an alternative low-cost adsorbent for the removal of lead and zinc from aqueous solution. Activated carbon (AC) was produced chemically with a reasonable yield (38 %) and was found to have a remarkable surface area (1212 m<sup>2</sup>/g) with a well-developed pore structure. To determine the nature of the adsorption process, the effects of initial metal concentration (20 – 50 mg/L) was investigated using a batch adsorption technique. The adsorption isotherm data were best fitted by Langmuir model and the adsorption capacity for Pb (II) was found to be higher than adsorption capacity for Zn (II) at 298 K. Preliminary ab-initio simulations (using Gaussian 09) were also performed for both Pb and Zn adsorption. The reactivity calculations from molecular orbital theory reveal that lead has a higher reactivity towards the graphite surface in comparison to zinc. Independent Gibb's free energy calculations (using MOPAC) further reinforce the fact that lead has a higher tendency to adsorb at the graphite surface than zinc at 298K.

## MECHANICAL AND THERMAL PROPERTIES OF NANO-CALCIUM CARBONATE FILLED POLYPROPYLENE COMPOSITES

Esin Kiziltepe<sup>1</sup>, Bertan Beylergil<sup>1</sup>, Metin Tanoglu<sup>1\*</sup> and Murat Muduroglu<sup>2</sup>

<sup>1</sup>Dept. of Mechanical Eng., Faculty of Eng., Izmir Inst. of Technology, Gulbahce Campus, 35437 Urla, Izmir, Turkey

<sup>2</sup>Adacal Endustriyel Mineraller San. Tic. A.Ş., Emirdag, Afyon, Türkiye  
a. Corresponding author: (metintanoglu@iyte.edu.tr)

Nano-sized particle filled polymer composites has engaged the attention of scientists in recent years due to their unique properties, including high mechanical strength, thermal and solvent resistance compared to the other conventional composite materials. In this study, nano- sized CaCO<sub>3</sub>/ polypropylene blends were prepared using a co-rotational twin screw extruder with a particle content of 10-30% by weight. Nano-CaCO<sub>3</sub> powders, with and without stearic acid (SA), were characterized by means of differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), scanning electron microscopy (SEM), X-ray diffraction (XRD) and surface area analysis (BET). Composite test coupons were produced by injection moulding. The microstructure, thermal, mechanical and impact properties of CaCO<sub>3</sub>/PP systems with and without surface treatment were determined according to standard methods.

## **THE ADVANTAGES OF USING ADACAL<sup>®</sup> NANO PCC(PRECIPIATED CALCIUM CARBONATE) IN PRODUCTION OF COATED CARTON**

M.Müdürođlu<sup>1</sup>, Z.Arsoy<sup>1</sup>

<sup>1</sup>Adaçal Endüstriyel Mineraller San.Tic.A.Ş., Afyon  
a. Corresponding author: (arsoy@adacal.com.tr)

PCC, produced synthetically from limestone, has superior specifications with high CaCO<sub>3</sub> ratio and low impurities, availability of production in different morphologies and nano size compared to GCC and other industrial minerals used as filler in industry. PCC, with these superior specifications, is used as functional filler in many different industries such as paper, coatings, plastic, etc. especially abroad.

Considering consumer demand, costs and environmental factors, the improvements which will meet different requirements are needed in carton production. The carton should both have enough resistance to rupture, bursting, tear and enough liquid absorption, folding endurance at the same time for all the process during and after carton coating. Coating process of the carton surface is very important to improve print quality.

This experimental study has been conducted with adaCAL nano PCC instead of grinded GCC which is used as filler in coating mixture applied on the surface of base carton. Hiding power, whiteness, ink absorption and physical strength of the coating on carton surface have been examined together with zeta potential and SEM (Scanning Electron Microscope) images. Also, an optimum coating mixture formula has been determined for an ideal surface of carton.

## **SYNTHESIS OF STIMULI-RESPONSIVE HYBRID SOL-GEL FILM FOR CONTROLLED RELEASE OF TRYPTOPHANE**

Erdal Serin<sup>1</sup>, Orhan Güney\*<sup>1</sup>

Dept. of Chemistry, Istanbul Technical Univ., Istanbul 34469, Turkey  
a. Corresponding author: (eserin@itu.edu.tr)

Since Tryptophan (Trp) is one of the 20 essential amino acids found in human body consists of proteins. A lack of Trp contributes to coronary artery spasm and Hartnup disease. General symptoms of Trp deficiency as basically similar to serotonin deficiency and include: anxiety and panic, mood disorders, irritability, insomnia, aggressiveness.

Ideal drug delivery system has to be inert, biocompatible, capable of achieving high drug loading, easy to fabricate and sterilize, free of leachable impurities. Sol-gel materials are the best candidate to design an artificial drug model for controlled drug release. Stimuli-responsive or smart polymers are macromolecules that display a significant physicochemical change in response to small changes in their environment such as temperature, pH, light, magnetic field, ionic factors, etc.

In this work, modified hybrid sol-gel was developed for the controlled release of molecules depending on combination of solvent mixture. For this reason, tryptophan was tested as a model drug. In order to find the effect of the modified group on loading and release of the drug, various modified hybrid sol-gels were used. In addition, the effect of some factors such as pH, pore size, functionalized groups, time of loading and release were investigated.

## **SOLVOTHERMAL SYNTHESIS OF FE<sub>3</sub>O<sub>4</sub>-MULTI-WALLED CARBON NANOTUBES**

Ali Can Zaman, Figen Kaya, Cengiz Kaya

a. Corresponding author: (alicanzaman@gmail.com)

There must be a suitable environment for the synthesis of hybride materials in which components could be dispersed throughly. In this context, aim of this study is to find a suitable solvent and aid combination to disperse nanotubes and at the same time provide room for the synthesis of magnetic particles. Solvothermal synthesis was employed in an autoclave using pristine multi walled carbon nanotubes, iron nitrate as a precursor, sodium dodecyl benzenesulfonate and hydrazine as an aid and isopropanol and butanol as solvents, respectively. SEM and TEM investigations were used to determine the structure of the materials. FT-IR and XRD measurements were also conducted to determine the presence of functional groups and crystal structure of nanoparticles. The magnetic nanoparticles are around 100nm in size having low aspect ratio (SEM measurements) and in the crystal structure of maghemite or magnetite (XRD studies). Raman, ESR and magnetic measurement (on as synthesized and calcined samples) studies are underway to distinguish the present crystals (and their magnetic properties) in the structure more precisely.

## **DETERMINATION OF ADSORPTION EQUILIBRIA AND MASS DIFFUSIVITY OF ZEOLITE-WATER PAIR**

Sefika Cagla Gundogan<sup>a</sup>, Moghtada Mobedi<sup>b</sup>, Semra Ulku<sup>c,\*</sup>

<sup>a</sup>Energy Eng. Program, Izmir Inst. of Technology, Urla, 35410 Izmir, Turkey

<sup>b</sup>Chemical Eng. Dept., Izmir Inst. of Technology, Urla 35430, Izmir, Turkey

<sup>c</sup>Mechanical Eng. Dept., Izmir Inst. of Technology, Urla 35430, Izmir, Turkey

a. Corresponding author: (moghtadamobedi@iyte.edu.tr)

In the analysis of adsorption process, two properties, adsorption equilibria and mass diffusivity, should be well known. Estimation of water adsorption properties of an adsorbent has a special value; not only due to its importance in drying, energy recovery and heat pump applications, but also related to the effect of water adsorption on the application of adsorbents in the other processes. Although several systems have been designed and constructed for the estimation of the adsorption equilibria and kinetic properties, further work is necessary to overcome the technical difficulties in the accurate measurements of the temperature, pressure and adsorbate concentration during adsorption.

In this study, a volumetric system, which consists of liquid and vapor vessels and adsorbent bed connected to each other by pipes, was constructed, and the manually controlled valves were mounted between the vessels and bed to provide pressure impulses. Experiments were performed for zeolite –water pair at 35, 45, 55, 65 and 75°C. The data collected was used in the determination of adsorption equilibrium relationship, and the isotherms were plotted. Moreover, mass diffusivity for zeolite-water pair was calculated from the solution of the limited volume mass transfer equation by using the experimental kinetics data.

## **DOXORUBICIN LOADING, RELEASE AND STABILITY IN DENDRIMER COATED MAGNETIC NANOPARTICLES FOR TARGETED DRUG DELIVERY**

Rouhollah Khodadust<sup>1</sup>, Pelin Mutlu<sup>2</sup>, Serap Yalçın<sup>3</sup>, Gözde Ünsoy<sup>1</sup>,  
Negar T. Pourianazar<sup>1</sup>, Ufuk Gündüz<sup>1</sup>

<sup>1</sup>Dept. of Biotechnology, Middle East Technical Univ., Ankara 06800, Turkey

<sup>2</sup>Central Laboratory Molecular Biology and Biotechnology R&D, Middle East Technical Univ.,  
Ankara 06800, Turkey

<sup>3</sup>Dept. of Food Eng., Ahi Evran Univ., Kırşehir 40100, Turkey

a. Corresponding author: (hodadust\_r@yahoo.com)

Magnetic nanoparticles were synthesized, coated with PAMAM polymer layers to obtain different generations ( $G_2, G_3, G_4, G_7$ ) of DcMNPs. Doxorubicin loading, release and stability efficiencies in these nanoparticles were studied. The drug loading was around 96% with low generations ( $G_2, G_3, G_4$ ) and 29% with high generation ( $G_7$ ) at room temperature, pH 7.2. The reason of low loading on  $G_7$  may be due to the difficulty of drug entrance since the dendrimeric nanoparticles have more compact surface when the generation was increased. The drug loaded magnetic nanoparticles were highly stable (97%) up to 2 months in pH 7. The drug release studies were also performed at pH 5.2 and 4.2. Most of the drug was released within the first 12 hours. Doxorubicin release was 80% at pH 4.2 for  $G_2, G_3$  and  $G_4$  generations. However, in pH 5.2 the release was obtained as 58%, 46%, 41% for  $G_2, G_3$  and  $G_4$  generations respectively. On the other hand, almost all of the loaded drug was released within 1 hour from  $G_7$  generation. The Doxorubicin loading, stability and release were observed most efficiently in lower generations. The results of this study will provide insights to the development of new drug delivery systems for more effective cancer therapy.

## **INVESTIGATION OF LIMESTONE POWDER LAYERING ONTO AMMONIUM NITRATE PRILLS BY PAN PELLETIZATION**

Irina Klimova<sup>1</sup>, Tiit Kaljuvee<sup>1</sup>

1 Tallinn Univ. of Technology, Laboratory of Inorganic Materials, Ehitajate tee 5, 19086 Tallinn,  
Estonia.

a. Corresponding author: (irina.klimova@ttu.ee)

There are several reasons to cover ammonium nitrate (AN) prills with limestone powder: neutralize the acidifying effect of AN on soils; decrease explosivity of the fertilizer; increase pellets' durability under compression that is very significant for transportation, handling and storing.

This study aims to investigate factors that affect limestone powder particles layering onto AN seed prills. Influence of the pelletizing time, amount of the binder and limestone powder on the coating formation has been shown.

It was found that optimum residence time of the pellets in tumbling layer is quite short, 3-4 minutes only. After this the breakage of the formed pellets dominated over the pellets' growth. Also, adding more liquid into the process led to the formation of the stronger pellets. For example, the crush strength of the pellets produced with mass ratio of binder to the limestone powder of 10 and 20% differed from each other notably: 4.3 N and 9.6 N, respectively, at the same time being much stronger than of the initial AN seed prills - 3-4 N. The upper limit of the mass ratio of the binder to the limestone powder was 20%, bigger liquid content led to over-wetting of the tumbling mass.

## **ALGINATE-MONTMORILLONITE COMPOSITE BEADS FOR IN VITRO RELEASE OF RIBOFLAVIN**

H. Kaygusuz, M. Uysal, V. Adımcılar, F. B. Erim  
a. Corresponding author: (kaygusuzh@itu.edu.tr)

Novel alginate-clay composite bead materials were prepared for delivery of riboflavin (Vitamin B2). Alginate is a biopolymer extracted from seaweed and its ability to form hydrogels with divalent cations is used frequently. Riboflavin is an important constituent of living organisms. This work aims the in vitro release of riboflavin via oral route, through the medium of simulated gastric and intestinal fluids. Release measurements were carried out using spectrophotometric method. Swelling ability of beads is also investigated gravimetrically. Beads are characterized by scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR). Results indicate that addition of montmorillonite clay prolongs release characteristics of calcium/barium alginate beads and mechanically strengthens the beads. It is also observed that, clay increases the encapsulation efficiency of riboflavin.

## **SYNTHESIS AND CHARACTERIZATION OF NOVEL MESOPOROUS ACIDIC MCM-41 AND SBA-15 CATALYSTS**

Veli Simsek<sup>(a)</sup>, Levent Degirmenci<sup>(a)</sup>, Kirali Murtezaoglu<sup>(b)</sup>

(a) Bilecik Üniversitesi Mühendislik Fakültesi Kimya ve Süreç Mühendisliği Bölümü, 11210 Gülümbe, Bilecik, Türkiye

(b) Gazi Üniversitesi, Mühendislik Fakültesi Kimya Mühendisliği Bölümü, 06570 Maltepe, Ankara, Türkiye

a. Corresponding author: (levent.degirmenci@bilecik.edu.tr)

In the present study hydrothermal synthesis and characterization of novel mesoporous acidic MCM-41/STA and SBA-15/STA catalysts were conducted. The catalytic activity of MCM-41 and SBA-15 support materials were supplied by silicotungstic acid (STA) addition. The loading amount of STA was determined as 28% for both catalysts based on W/Si w/w ratio. Characterization studies were conducted with BET, XRD, FT-IR, DRIFT and SEM mapping analyses to determine physical properties of the catalysts. XRD results of the support materials revealed characteristic  $2\theta$  values identifying the structure of the support materials. The  $2\theta$  values shifted due to STA addition which indicated a loss of hexagonal symmetry with STA deposition on the edges of the pores of support material. BET results indicated high surface areas ( $>700 \text{ m}^2/\text{g}$ ) of the support materials as expected. The acidic nature of the catalysts were determined by pyridine-DRIFT analysis of the samples. SEM mapping images of the catalysts showed that STA was homogeneously dispersed throughout the catalyst structure.

## **INFLUENCE OF POROUS STRUCTURE ON THE PHYSICAL PROPERTIES OF TRAVERTINE BUILDING STONE**

I. Çobanoğlu, S.B. Çelik

Pamukkale Univ., Dept. of Geological Eng. 20017 Kınıklı Denizli

a. Corresponding author: (icobanoglu@pau.edu.tr)

Porous structure of travertine is more sensitive to water than other carbonated natural stones. As far as water absorption is concerned, water absorption by weight ( $WA_{\text{weight}}$ ), water absorption by volume ( $WA_{\text{volume}}$ ) and capillary water absorption ( $WA_{\text{capillary}}$ ) parameters are in close relation with each other. In this study, the regression analysis for the determination the relationship of porosity with other physical parameters has been investigated. For this purpose, Denizli basin travertines located in western Turkey, one of the major basins of the world's travertine production area, was studied. The  $WA_{\text{capillary}}$  parameter of the samples taken from this region was analyzed and their relationships with other water absorption parameters were determined. Apparent porosity ( $A_p$ ) values of studied travertines are ranging between 0.79 and 20.84 %. Total 212 data were analyzed and following linear relations were determined; the relation between coefficient ( $CWA_{\text{capillary}}$ ) and percentage ( $WA_{\text{capillary}}$ ) of capillary water absorption;  $CWA_{\text{capillary}} = 3.6562 \cdot WA_{\text{capillary}} + 0.2761$ , between apparent porosity ( $A_p$ ) and water absorption by weight ( $WA_{\text{weight}}$ );  $A_p = 2.1163 \cdot WA_{\text{weight}} + 0.4429$ , between capillary water absorption ( $WA_{\text{capillary}}$ ) and water absorption by weight ( $WA_{\text{weight}}$ );  $WA_{\text{capillary}} = 0.9663 \cdot WA_{\text{weight}} - 0.5662$  and finally between capillary water absorption ( $WA_{\text{capillary}}$ ) and apparent porosity ( $A_p$ );  $WA_{\text{capillary}} = 0.4591 \cdot A_p - 0.5662$ .

## **SONO-SYNTHESIS OF BISMUTH FERRITE NANOPARTICLES WITH HIGH PHOTOCATALYTIC ACTIVITY IN DEGRADATION OF RHODAMINE B UNDER SOLAR LIGHT IRRADIATION**

T. Soltani, M.H. Entezari

Dept. of Chemistry, Ferdowsi Univ. of Mashhad, 91775, Mashhad, Iran

a. Corresponding author: (moh\_Entezari@yahoo.com)

In this work, pure bismuth ferrite ( $\text{BiFeO}_3$ ) as a visible-light photo catalyst has successfully synthesized via ultrasonic method in a short time and low temperature. The product was characterized by different techniques. Then, the degradation of Rhodamine B (RhB) was investigated under sunlight irradiation by bismuth ferrites synthesized with ultrasound. The RhB in solution was completely degraded in 35 min under applied conditions in acidic medium. The nanocatalyst did not exhibit significant loss of activity even after four cycles of successive uses. The total organic carbon (TOC) measurements displayed a complete mineralization in 90 min. To determine the mechanism of photocatalytic degradation of RhB, different methods were used. Based on the results, two possible competitive photodegradation pathways proposed: chromophores cleavage and N-deethylation. The hole as a reactive species had a key role in the degradation process. The  $\text{BiFeO}_3$  (BFO) nanoparticles synthesized with ultrasound exhibited higher crystallization, smaller crystallite size and a higher photocatalytic activity than the sample synthesized with sol-gel method in stricter conditions.

## **PREPARATION AND CHARACTERIZATION OF PH AND TEMPERATURE RESPONSIVE NANOCOMPOSITE HYDROGELS**

Meltem Kasapoglu, Murat Ozdemir

a. Corresponding author: (meltem.kasapoglu@gyte.edu.tr)

pH and temperature responsive nanocomposite hydrogels based on sodium alginate (NaAlg) and poly(N-isopropylacrylamide) (PNIPA) crosslinked by inorganic nanoclay were prepared by free radical solution polymerization. The structure, morphology and thermal behavior of the hydrogels were investigated by SEM, XRD and DSC techniques. The effects of pH and nanoclay content on swelling and effect of nanoclay on deswelling behavior were studied.

The NaAlg/PNIPA/Clay hydrogels revealed a highly porous structure in which the pore sizes decreased and the amount of pores increased with increasing the nanoclay content in the hydrogels as suggested by the SEM analysis. XRD studies suggested that the nanoclay sheets are both intercalated and exfoliated in the hydrogel network. DSC studies showed that the  $T_g$  of the dried hydrogels decreased with increasing the NaAlg content, but the nanoclay content did not affect the  $T_g$ . The swelling ratio of the nanocomposite hydrogels increased with increasing the pH from 1.2 to 8 and the maximum swelling occurred at pH=8. The swelling ratio of the hydrogels decreased as the nanoclay increased while the deswelling ratio increased with increasing the nanoclay. These results suggested that it is possible to design a hydrogel with a desired swelling/deswelling behavior by controlling the nanoclay content.

## **REMOVAL OF FLUORIDE FROM WATER BY ZIRCONYL HYDROXIDE COATED MAGNETITE**

Sibel Kirca, Emine Özbunar, Özgür Arar and Ümran Yüksel

Ege Univ. Faculty of Science Dept. of Chemistry, Bornova Izmir

a. Corresponding author: (ozgur.arar@gmail.com)

Fluoride contamination in drinking water due to natural and anthropogenic activities has been recognized as one of the major problems worldwide imposing a serious threat to human health. Among several treatment technologies applied for fluoride removal, adsorption process has been explored widely and offers satisfactory results especially with mineral-based and/or surface modified adsorbents.

The goal of this investigation is to use adsorption/ion exchange method for fluoride removal from aqueous solutions contain 2 mgF/L. The nano size magnetite synthesized and coated with zirconyl hydroxide to remove fluoride from water. The effect of adsorbent dosage, pH, interfering ion and the kinetic of adsorbent has been investigated. Obtained results show that removal of fluoride strongly depends on adsorbent dosage and solution pH. The optimum pH was found as 4-5. Foreign ions also affect the removal rate. In the presence of phosphate removal of fluoride decreased from %100 to %32. Kinetic of adsorbent is very fast. In five minutes concentration of fluoride decreased from 2.0 mg/L to below detection limit.

The analysis of fluoride carried out by spectrophotometrically using alizarin Red S method.

## COORDINATION POLYMER NANOPARTICLES FOR THERANOSTICS

Fernando Novio,<sup>1</sup> Julia Lorenzo,<sup>2</sup> Daniel Ruiz-Molina,<sup>1</sup>

<sup>1</sup>Centro de Investigación en Nanociencia y Nanotecnología, Campus UAB, 08193 Bellaterra (Spain), E-mail: fernando.novio@cin2.es

<sup>2</sup>Unitat d'Enginyeria de Proteïnes i Proteòmica Institut de Biotecnologia i Biomedicina Universitat Autònoma de Barcelona, 08193 Barcelona (Spain)

a. Corresponding autor: (fnovio@cin2.es)

Coordination polymer particles (CPPs) are a fascinating family of nanoscale materials with genuine and highly tailorable properties. These compounds exhibit a high level of structural (size, morphology) and chemical (ligands and metal centers) tailorability that have repercussions in their physicochemical properties enhancing those exhibited by traditional materials.

The successful design of drugs adsorbed in porous metal-organic structures and the good control on their release have opened an interesting research field as revolutionary platforms for drug delivery systems whose design can be tailored at will by means of chemical synthesis.

Our research group has developed the synthesis of multifunctional smart CPPs able to encapsulate a wide variety of substances (e.g. anticancer drugs) and materials (e. g. magnetic nanoparticles). Some of them are smart responsive materials able to tune such release upon external stimuli and exhibit notable cytotoxicity effects, cellular uptake, and targeting. Their properties make them promising materials with application in drug delivery and bioimaging.

## FABRICATION AND CHARACTERIZATION OF CARBON NANOTUBE MEMBRANES FOR NEURAL TISSUE ENGINEERING

Sevde Altuntas<sup>1</sup>, Fatih Buyukserin<sup>2</sup>

<sup>1</sup>Micro and Nanotechnology Graduate Program, TOBB Univ. of Economics and Technology, Ankara 06560, Turkey

<sup>2</sup>Dept. of Biomedical Eng., TOBB Univ. of Economics and Technology, Ankara 06560, Turkey

a. Corresponding author: (fbuyukserin@etu.edu.tr)

Development of effective biomaterials for neural tissue engineering requires the optimization of topographic, chemical and electrical cues that influence the cell-material interactions<sup>1</sup>. Nanoporous anodized aluminum oxide (AAO) membranes are a unique class of biomaterials that allow one to tune such parameters for obtaining improved tissue regeneration. For instance, the native porous structure provides a nanoscale topography upon which improved cell adhesion and matrix formation can be attained<sup>2</sup>. Furthermore, the pores of this biocompatible material can be filled with biochemicals to promote integration. Despite the ability to manipulate such topographic and chemical cues, the research for utilizing AAO membranes for neural tissue engineering studies are still very limited. Here we investigate the use of AAO templates to fabricate carbon nanotube membranes (CNMs) for neural tissue engineering applications. AAO films with ordered nanopores having 100 and 300 nm pore diameter were first synthesized by the two-step anodization method<sup>3</sup> (Figür 1). These films were then coated with carbon via sputtering to create conducting CNMs. The electrical, morphological and chemical characterization of these substrates were conducted . The next set of experiments will involve the cell studies that will compare cell behavior on conducting or nonconducting membranes with different pore topography and pore chemistry.

## **MESO-STRUCTURED BI-FUNCTIONAL CATALYST PAIR FOR DIMETHYL ETHER SYNTHESIS FROM SYNTHESIS GAS**

Ayşegül Bayat, Timur Doğu

Dept. of Chemical Eng., Middle East Technical Univ., Ankara Turkey

a. Corresponding author: (aysegulbyt@gmail.com)

Due to increasing prices of crude oil based transportation fuels and ascending rate of global warming caused by high emission the levels of conventional fuels, development of non-petroleum alternative fuels have attracted major attention. Dimethyl ether (DME) is an alternative clean diesel fuel with low NO<sub>x</sub> formation, smokeless combustion and high cetane number. It may be produced by dehydration of methanol or directly from synthesis gas, which may be obtained by gasification of coal, biomass or by reforming of methane. In this work bi-functional catalyst mixtures composed of Cu-Zn-zirconia/alumina based methanol synthesis and silicotungstic acid (STA) incorporated mesoporous alumina were synthesized and used in direct synthesis of DME from syngas at 50 bar and in the temperature range of 200-300°C. Alumina materials with ordered mesostructure and hierarchical porosity have quite high surface area and are highly stable in the temperature range of this reaction. STA incorporation into its structure considerably enhanced the dehydration activity of this catalyst. Results proved high DME selectivities with minimum side reaction with the catalyst pairs used in this work. Presence of CO<sub>2</sub> in the feed stream was also shown to have a positive effect on DME selectivity.

## **SYNTHESIS OF NOVEL MESOPOROUS SAPO-34-LIKE SOLID ACID CATALYSTS FOR THE ETHERIFICATION OF GLYCEROL WITH ISO-OLEFINS**

Burcin İkizer<sup>1</sup>, Nuray Oktar<sup>2</sup>, Timur Dogu<sup>1</sup>

<sup>1</sup>Dept. of Chemical Eng., Middle East Technical Univ., Ankara, Turkey

<sup>2</sup>Dept. of Chemical Eng., Gazi Univ., Ankara, Turkey

a. Corresponding author: ( burcin.ikizer@gmail.com)

SAPO-34 is a molecular sieve type material comprised of three dimensional networks of silicon, aluminum, and phosphorous. It is considered as an attractive catalyst for the acid catalyzed reactions, such as etherification, esterification, dehydration etc. Conventional SAPO-34 is a microporous material with zeolite structure. Diffusion limitations on the observed reaction rate and deactivation due to coke formation are important problems in such acidic microporous materials. However, mesoporous materials with ordered pore structures are considered to be less prone to coking and transport limitations. The objective of the present study is to develop a new SAPO-34-like material with a mesoporous structure. This material is synthesized following a hydrothermal procedure using different templates. In this presentation synthesis and characterization results (XRD, N<sub>2</sub> adsorption/desorption, SEM, TGA/DTA, pyridine adsorbed DRIFTS etc.) of these materials will be given. These materials are synthesized with the objective of testing them in the etherification of glycerol with isobutylene. Glycerol is the side product of biodiesel production and our earlier studies have shown that its etherification with tert-butyl alcohol gave ethers with excellent transportation fuel properties. Catalytic performance of mesoporous SAPO-34 in glycerol etherification will also be illustrated in this presentation.

## **EFFECT OF SURFACTANTS- SYNTHESIS MEDIUM COMBINATION ON THE STRUCTURE OF NANO SILICA PARTICLES**

Cagri Siretli, Hurriyet Polat, Mehmet Polat, Saniye Saygili  
a. Corresponding author: (hurriyetpolat@iyte.edu.tr)

Porous silica materials are used extensively in such biological applications as drug delivery. Hence, synthesis of silica particles with proper surface properties, pore sizes and structures is still a hot topic of research. This study is aimed at investigating the effect of surfactants on the morphology of nano silica particles depending on the sythesis method used. In the case of based catalysed silica production in alcohol, nonporous materials with controlled size and shape were obtained. Formation of stabilized emulsions with different size distributions and their effect on the size and shape of silica particles was proposed to be the mechanism. Here the effect of surfactants was attributed to their effect on a) the emulsification process and b) silica-silica and silica-surfactant interactions involved during production. In the case of based catalysed silica production in water, however, surfactant micelles were used as tamplates to produce pores. The effect of surfactant type and concentration was attributed to their effect on the CMC, micelle shape and size. Rod-like (~400 nm) at high and spherical (~200 nm) particles at low concentrations were synthesized. Acid catalysed silica production in water was similar. Rod-like (600-800 nm) and cubic (800-1000 nm) nanoparticles were produced.

## **DYE REMOVAL EFFICIENCY OF PUMICE AND HDTMA-MODIFIED PUMICE FROM WATERS**

Sedef DIKMEN, Bahri ERSOY, Ahmet GUNAY  
a. Corresponding author: ( sdikmen@anadolu.edu.tr)

In present study, natural pumice and HDTMA (hexadecyltrimethyl ammonium) modified-pumice was investigated for its efficiency in removing anionic dye, Acid Red 88 (AR88), and cationic dye, Basic Blue 16 (BB16) from waters. Batch adsorption experiments were conducted to study the effects of the adsorbent dosage on the dye removal at constant initial dye concentration (750 mgL<sup>-1</sup>) at room temperature. Powdered pumice with size of -125 µm was used in the study. By natural pumice, dye removal percents from water were 8 and 22% for AR88 and BB16, respectively, while they were 3% and 17% for HDTMA modified-pumice. As a result, when the obtained results are compared with the previous studies, those in the literature, the dye adsorption capacities of various natural adsorbents such as clay e.g., dye adsorption capacities of both pumice and HDTMA-pumice is quite low. It is seen that to use either natural or modified pumice for dye removal from waters is not possible as practically.

## **GRAIN SIZE ASSESSMENT IN SUPERCOARSE HARDMETALS WITH COBALT AND NICKEL BASED MATRICES**

Janusz Richter<sup>1,a</sup>, Katarzyna Harabas<sup>1,b</sup>

1. Silesian Univ. of Technology, Faculty of Materials Eng. and Metallurgy,  
Dept. of Materials Science, ul. Krasińskiego 8, 40-019 Katowice, Poland

a. janusz.richter@polsl.pl

b. katarzyna.harabas@polsl.pl

Set of the supercoarse sintered carbides with nonconventional, nickel based binder has been manufactured. The new chemical composition of a metal matrix might contribute to changes in the sintering process involving occurrence of the eutectic liquid phase. Therefore measurements of WC grain size chord lengths using both classical and automatic methods have been performed. The employed Kolmogorov-Smirnov and Mann-Whitney statistical tests made it possible to compare the investigated sintered carbides with the commercial coarse grained grade and classify the former as supercoarse sinters. The statistical assessment of chord length distributions obtained with both measuring methods showed that the classical and automatic methods are not consistent, which may be attributed to the smallest possible length being measured in each case.

## **MICROSTRUCTURE INVESTIGATION OF SINTERED ASTALOY CrL POWDERS MODIFIED BY SILICONE ADDITION**

Marek Hebda, Helena Dębecka, Jan Kazior

a. Corresponding author: (mhebda@pk.edu.pl)

The development of dual-phase steels has become interesting in the automotive industries, because of a potential weight reduction by using inexpensive alloying without sacrificing mechanical properties. Bainitic-austenitic dual phase steels containing silicon are known to possess high toughness thanks to the presence of a finely dispersed retained austenite in a carbide free bainitic matrix. The absence of carbides in retained austenite is due to the effect of silicon on the bainitic transformation. The toughness of such a microstructure is expected to improve the mechanical properties of porous sintered steels. The aim of this work was to study the microstructural features of commercial prealloyed Astaloy CrL iron powders with 1.0 wt.% , 2.0 wt.% or 3.0 wt.% of silicon addition prepared by Mechanical Alloying process. Powders were added with graphite and pre-consolidated by classic die pressing method or Spark Plasma Sintering. Special sinter-austempering treatment in vacuum was performed. Microstructure and microhardness were investigated. Furthermore, homogeneity of sintered alloys was analyzed by SEM technique.

## UNIAXIAL STRESS-STRAIN BEHAVIOR OF ALUMINUM FOAMS AND ALUMINUM FOAM BASED COMPOSITE SANDWICHES

S. Bahar Baştürk<sup>1,a</sup>, Metin Tanoglu<sup>2</sup>

1. Celal Bayar Univ., Dept. of Materials Eng., Manisa, Turkey
2. Izmir Inst. of Technology, Dept. of Mechanical Eng., Izmir, Turkey
- a. Corresponding author( bahar.basturk@cbu.edu.tr)

Cellular metals, particularly aluminium (Al) foams, have great potential to be used in various engineering applications due to their high specific stiffness and strength, fire resistance, noise reduction, vibration damping and cost efficiency. The microstructural properties as well as densification behavior significantly affect the mechanical performance of Al foams under various loading conditions. In this study, the mechanical characterization of the ALULIGHT-AFS<sup>TM</sup> panels with three different thicknesses (8, 20 and 30 mm) was carried out by uniaxial compression, tension and shear tests. Based on the compression test results of as-received Al foams, the specimens with higher elastic modulus usually exhibited higher collapse strength for each thickness set of foams. It was found that the foam thickness increase generally resulted in collapse strength decrease. As the thickness increases, the structural defects are expected to increase and the lower strength values of thicker foams are attributed to this. Similar trend was also observed for the tension and shear test results and 8 mm foams showed the highest strength values. The foams mentioned above were also integrated with skins composed of Al sheet and glass fiber reinforced polypropylene (GFPP) composite fibre/metal laminates. The mechanical characteristics of these composites fabricated with different techniques were also investigated within this study.

## DYNAMIC BEHAVIOR ANALYSIS OF FML/ALUMINUM FOAM SANDWICH STRUCTURES UNDER SIMULATED BLAST TEST

Bahar Baştürk<sup>1,a</sup>, Metin Tanoglu<sup>2</sup>

1. Celal Bayar Univ., Materials Eng., Manisa, Turkey
2. Izmir Inst. of Technology, Dept. of Mechanical Eng., Izmir, Turkey
- a. Corresponding author( bahar.basturk@cbu.edu.tr)

In this work, the sandwich structures using thermoplastic fiber/metal laminate (FML) skins and metal foam cores were manufactured for the anti-blast applications. The FML system consists of glass fiber/PP fabrics (GFPP) and aluminum (Al) metal sheet act as the skin component and closed cell Al foams with various thicknesses act as the core component in the sandwich panels. The blast responses of the sandwiches were predicted by the application of “simulated blast test”. The principle of this test allows us to simulate the blast loading effects on the panels. For the air blast analysis, the applied force shows dynamic characteristics, however, in the simulated blast test the sandwich panel was assumed as a single-degree of freedom mass spring system to include the dynamic effect. Based on this approach, the light-weight sandwich composites were subjected to compression loading with a very special test apparatus. Liquid soap filled rubber sack below the sandwich panels simulated the characteristics of blast loading with simply supported boundary conditions under quasi-static compressive forces. Based on the pressure-time graphs of the blast waves depending on the explosive amount and stand-off distance, the blast characteristic time (T) was determined. By the calculation of natural frequency ( $\omega$ ) of the panel and characteristic time parameters, the  $f(T\omega)$  product was determined. The peak deflection ( $\delta_{\text{peak}}$ ) of the sandwich structure under blast loading was predicted by considering the dimensionless deflection ( $\delta_{\text{peak}} / \delta_{\text{static}} - f(T\omega)$ ) graph.

## **CAPTURE OF LOW MOLECULAR WEIGHT ORGANIC CONTAMINANT WITHIN MICELLE STRUCTURES IN MEUF**

Gaye Kanaltı<sup>1</sup>, Zeynep Traş<sup>1</sup>, Aybike N. Olcay<sup>2</sup>, Mehmet Polat<sup>1</sup> and Hurriyet Polat<sup>3,a</sup>

1. Izmir Inst. of Technology, Dept. of Chemical Eng., Izmir, Turkey
  2. Izmir Inst. of Technology, Environmental Eng. program, Izmir, Turkey
  3. Izmir Inst. of Technology, Dept. of Chemistry, Izmir, Turkey
- a. Corresponding author (hurriyetpolat.iyte.edu.tr)

Various anionic, cationic and nonionic surfactants were employed to remove Methylene Blue (MB) from water using Micellar Enhanced Ultra-Filtration (MEUF). This study demonstrates that MB can be removed from solution with efficiencies as high as 100%. However, the mechanism of capture was significantly different than that proposed in the literature. It seems that simple surfactants such as Sodium Dodecyl Sulfate (SDS) and Dodecyl Amine (DA) can only attach to MB in their molecular forms. No MB was removed from solution when these surfactant reached their Critical Micelle Concentration (CMC). The behavior was quite different for the non-ionic surfactants of higher molecular weight. It was observed that Ethoxylated Octyl Phenol (Triton X-100) and Polyethylene-Polypropylene-Polyethylene Oxide Block Copolymer (Pluronic 123) was able to remove MB from solution below and above the CMC. These findings are important in the sense that the correct mechanism of capture must be elucidated in order to custom-design surfactant for low molecular weight organic contaminants.

## **ELECTROSPINNING OF NANOFIBROUS MEMBRANES FOR MOLECULAR FILTRATION**

Fatma Kayacı<sup>1</sup>, Aslı Çelebioğlu<sup>1</sup>, Zeynep Aytac<sup>1</sup>, Serkan Demirci<sup>1,2</sup>, Tamer Uyar<sup>1,\*</sup>

<sup>1</sup>UNAM-Inst. of Materials Science and Nanotechnology, Bilkent Univ., 06800 Ankara, Turkey.

<sup>2</sup>Dept. of Chemistry, Faculty of Arts and Sciences, Amasya Univ., 05100 Amasya, Turkey

a. Corresponding author: (tamer@unam.bilkent.edu.tr)

Electrospinning is a very cost-effective and versatile technique for producing multi-functional nanofibers from various materials such as polymers, polymer blends, sol-gels, ceramics, and composite structures. Electrospun nanofibers and their nanofibrous mats have demonstrated huge potential for filtration applications due to their high surface-to-volume ratio and nanoporous structure. It has been reported that electrospun nanofibrous mats are quite effective for particulate separation, liquid filtration, waste vapor treatment as well as desalination. Electrospinning has advantage over conventional membrane production techniques, since variety of functional nanofibrous materials can be easily obtained in the form of nonwoven membranes which can be readily used as a filtering material. In addition, the design flexibility of electrospun nanofibers for specific surface functionality can yield better adsorptive capacity and selective separation performance.

In this study, we have produced functional nanofibers/nanowebs by electrospinning of different kinds of polymeric materials and cyclodextrins for molecular filtration. In addition, we have surface modified electrospun nanofibers for efficient removal of organic waste molecules from water or air. This work summarizes our recent findings on the development of functional nanofibers/nanowebs via electrospinning and their possible applications in nanofiltration for water purification and waste treatment.

## **EFFECT OF TiC PARTICLE SIZE ON SOME PROPERTIES OF Cu-Al/TiC COMPOSITES PRODUCED USING HOT PRESSING PROCESS**

Ertuğrul Çelik <sup>1,a</sup>, Serkan Islak <sup>2</sup> and Durmuş Kır <sup>3</sup>

<sup>1</sup>Tunceli Univ., Faculty of Eng., Dept. of Mechanical Eng., Tunceli, Turkey

<sup>2</sup>Kastamonu Univ., Faculty of Eng. and Architecture, Dept. of Materials Science and Nanotechnology  
Eng., Kastamonu, Turkey

<sup>3</sup>Kocaeli Univ., Hereke Vocational High School, Kocaeli, Turkey  
a. Corresponding author (ecelik@tunceli.edu.tr)

In this study, the Cu-Al/TiC composite materials were produced using hot pressing process. Effect of TiC particle size (0.2, 4 and 44  $\mu\text{m}$ ) on microstructure and hardness properties of these materials was investigated experimentally. Production of Cu-Al/TiC composite was carried out under pressure of 35 MPa, at 700 °C, and for a sintering time of 5 minutes. Optical microscopy studies showed that the TiC grains were relatively homogeneously distributed in the Cu-Al matrix. With the decreasing of TiC particle size, the hardness of composites increased. Moreover, the relative density of composites increased.

## **ADSORPTIVE SEPARATION OF TETRAMETHYLAMMONIUM HYDROXIDE USING ZEOLITE AND MESOPOROUS SILICA**

Syouhei Nishihama, Miuki Murakami, Akane Kawasaki, Yasuhiro Tsutsumi, and Kazuharu Yoshizuka  
a. Corresponding author: (nishihama@kitakyu-u.ac.jp)

Semiconductor industries use and discharge a large amount of water at the production process and the waste water includes tetramethyl ammonium hydroxide (TMAH). The treatment of the waste water should be required, because TMAH is an organic compound having biological toxicity. In the present work, MFI-type zeolite (ZSM-5) and mesoporous silicas (MCM-41 and MCM-48) have been prepared by hydrothermal synthesis and been used as adsorbents for TMAH.

MFI-type zeolite possesses an adsorption capacity for TMAH over the pH range examined, although the adsorption amount slightly decreases at  $\text{pH} > 11$ . Mesoporous silicas also possess an adsorption capacity for TMAH at  $\text{pH} > 6$ , although the amount adsorbed decreases at  $\text{pH} > 10$ . Decrease in the adsorption amount of TMAH at high pH region is due to dissolution of silicate from the zeolite and mesoporous silicas. The adsorption of TMAH with all adsorbents proceeds via the Langmuir adsorption mechanism, and the maximum adsorption amount is of order of MCM-41 (1.02 mmol/g) > MCM-48 (1.33 mmol/g) > MFI-type zeolite (0.593 mmol/g). The MCM-41 is therefore applied for the column adsorption process for the separation and recovery of TMAH. The granulated MCM-41 can quantitatively adsorb and elute TMAH.

## **RELATIONSHIP BETWEEN CELL WALL MORPHOLOGY AND ENERGY ABSORPTION BEHAVIOR OF ALUMINUM FOAMS PRODUCED VIA MELT ROUTE**

Nima Movahedi<sup>1,a</sup>, S. Reza Hoseini<sup>1</sup>

1. Metallurgy Research and Development Dept., Sorouhsanat Co., Isfahan, Iran  
a. Corresponding author (nima.movahedi@gmail.com)

A study was carried out to realize the relationship between cell wall morphology of closed cell aluminum foam and mechanical properties of this material as energy absorbant. For this purpose three aluminum foam samples with closed cell structure were prepared via melt route at different molten aluminum temperatures (650, 675 and 700°C) by adding same amounts of granule calcium as thickening agent and titanium hydride as foaming agent. The fabricated aluminum foams were characterized by scanning electron microscope to determine the cell wall morphology and compression tests of these three aluminum foams with different relative density were tested to obtain energy absorption. The results indicate that molten aluminum temperature during holding step of producing aluminum foam has a dominant role on cell wall morphology. By increasing temperature the flow of aluminum foam inside the crucible during holding would be higher and cellular structure changes from ordered to disordered one and mechanical properties will be decreased.

## **USEAGE OF BORIC ACID AS AN ALTERNATIVE ACTIVATING AGENT TO PRODUCE POROUS CARBONS BY MICROWAVE INDUCED CARBONIZATION**

Gamzenur ÖZSİN<sup>1</sup>, Murat KILIÇ<sup>1</sup>, Ersan PÜTÜN<sup>2</sup>, Ayşe Eren PÜTÜN\*<sup>1</sup>

<sup>1</sup>Chemical Eng. Dept., Anadolu Univ., TURKEY

<sup>2</sup>Materials Sci. and Eng. Dept., Anadolu Univ., TURKEY

a. Corresponding author: (aeputun@anadolu.edu.tr)

Porous carbon materials, especially those containing micropores or mesopores, are extensively being used in important applications such as adsorption and energy storage. Among porous carbons, activated carbon has come into prominence with its unique surface properties for decades. Basically, activated carbon can be produced by carbonization and activation processes which involve the steps of decomposition, evolution of tarry and gaseous products, and finally formation of a solid porous matrix. In recent years, microwave induced production of activated carbon studies draw attention because of the good adsorptive properties of resultant carbon since microwave induced heating processes are different from the conventional ones in the way the heat is generated. There are many studies conducted with different activating agents using microwave activation such as phosphoric acid, potassium hydroxide and potassium carbonate. The objective of this study is to produce of chemically activated carbon from an agricultural waste using boric acid. The novelty of this work arises from using the combination of a new technique as microwave activation and a new activation agent as boric acid to produce activated carbon.

## **ADSORPTION OF METHYLENE BLUE ONTO ACTIVATED CARBON PRODUCED BY MICROWAVE ASSISTED CHEMICAL ACTIVATION OF FILTER COFFEE WASTE**

Gamzenur ÖZSİN<sup>\*1</sup>, Ersan PÜTÜN<sup>2</sup>, Murat KILIÇ<sup>1</sup>, Ayşe Eren PÜTÜN<sup>1</sup>

<sup>1</sup>Chemical Eng. Dept., Anadolu Univ., TURKEY

<sup>2</sup>Materials Sci. and Eng. Dept., Anadolu Univ., TURKEY

a. Corresponding author: (aeputun@anadolu.edu.tr)

Discharging of dyes to wastewaters in high concentration causes serious environmental and health problems because they are chemically stable and decompose difficultly. Therefore, several methods developed for the removal of dyestuffs from aqueous medium but feasible applications of most of the methods are limited. Adsorption process with efficient adsorbents is one of the most suitable methods because of low cost, simplicity of design, ease of operation, insensitivity to toxic pollutants and smaller amounts of harmful substances. In adsorption, activated carbon is one of the most preferred sorbent because of its unique porous structure. The present work was undertaken to investigate the potential of filter coffee waste as a precursor for preparation of activated carbon by microwave induced  $K_2CO_3$  activation and to evaluate the produced activated carbon for methylene blue removal from the aqueous solutions.

## **PRODUCTION OF ACTIVATED CARBON FROM BIOCHAR BY CHEMICAL ACTIVATION USING POTASSIUM HYDROXIDE**

Dilek Angin<sup>1,a</sup>, Hanife Kürkan<sup>1</sup> and Esra Altıntaş<sup>2</sup>

1. Sakarya Univ., Dept. of Food Eng., Sakarya, Turkey

2. Sakarya Univ., Dept. of Chemical, Sakarya, Turkey

a. Corresponding author (angin@sakarya.edu.tr)

In this study, activated carbons were prepared by chemical activation with potassium hydroxide (KOH) of the biochar obtained through pyrolysis of safflower seed press cake. The influence of activation temperature on the yield, surface and chemical properties of the activated carbons were investigated. This purpose, the biochar were activated at temperatures ranging from 600 °C to 900 °C, heating rate of 10 °C/min and a KOH:biochar impregnation ratio of 1:1 under nitrogen atmosphere. The highest BET surface area was achieved as 1277 m<sup>2</sup>/g. The surface morphologies of the activated carbons were examined by scanning electron microscopy (SEM). As a result, it can be said that the biochar can be effectively used as a raw material for the preparation of activated carbon with KOH as activating agents. Also, the activated carbon obtained in this study can be used as a very promising adsorbent for pollution control and other applications.

## **V AND MO INCORPORATED MESOPOROUS CERIA BY EVAPORATION INDUCED-SELF ASSEMBLY FOR OXIDATIVE AND NON-OXIDATIVE DEHYDROGENATION OF PROPANE TO PROPYLENE**

Ozge Aktas Panta<sup>1</sup>, Sena Yasyerli<sup>1</sup>, Gulsen Dogu<sup>1</sup>, Timur Dogu<sup>2</sup>

1. Chemical Eng., Gazi Univ., Ankara, Turkey
  2. Chemical Eng., Middle East Technical Univ., Ankara, Turkey
- Corresponding author: (gdogu@gazi.edu.tr)

Ceria, with its good redox properties and highly mobile capping oxygen atoms on its surface, is considered as a very good oxidation catalyst. Mesoporous ceria (MCe) with high surface area and narrow pore size distribution is considered as a promising catalyst support having low transport limitations. In the present study, V and Mo incorporated mesoporous ceria catalysts were synthesized following both one-pot hydrothermal (V-MCe and Mo-MCe) and impregnation (V@MCe) procedures and these materials were tested in the production of propylene from propane following oxidative and non-oxidative dehydrogenation routes. Mesoporous ceria support material was synthesized by evaporation induced-self assembly method. Characterization results proved that V and Mo were well dispersed within the synthesized mesoporous ceria based materials. Nitrogen adsorption-desorption analysis of the synthesized materials showed that a mesoporous structure was obtained with interconnected pores. Pore diameters of V@MCe and V-MCe were in the range of 10-15 nm. In the oxidative dehydrogenation of propane, catalytic performances of the materials prepared by the incorporation of V into ceria were much higher than the performances of Mo incorporated materials and the activities of V-MCe and V@MCe were comparable. However, V-MCe gave higher propylene selectivity than V@MCe catalyst in the non-oxidative dehydrogenation.

## **GETTING OF POWDER CHROMIUM WITH HIGH IMPACT RESISTANCE**

Igor Slys, Mykola Brodnikovskiy  
a. Corresponding author: (dep53@ipms.kiev.ua)

The aim of this work is to check the possibility to get cheap construction material based on chromium, using the strong dependence of chromium properties on the content of interstitial impurities. The decrease of the total content of interstitial impurities from 0.02 to 0.0001 results in a significant loss of strength and ductility appearance at -196oC. During sintering of powder chromium in the atmosphere of magnesium vapour, its surface layer should be cleaning from interstitial impurities. Such sintering is a way to create a composite material consisting of a hard inductile core of dirty chromium, with 0,2% of interstitial impurities, and soft plastic surface layer of very pure chromium. At the same time the components of such composite are different in chemical composition only by 0.2% of the interstitial impurities: O, N and C.

The method of sintering in an atmosphere of magnesium has been developed. The existence of the surface layer with different properties and composition in comparison with the core material was found and characterized by changing the nature of the fracture, Auger spectroscopy data, increasing resistance to etching in acid and oxidation at high temperatures.

The formation of a frame consisted of thin layers of plastic chrome provided high impact toughness of composite. The obtained value of impact toughness, 160 kJ/m<sup>2</sup>, is in 53 times higher, than that of chromium samples with the same porosity sintered in hydrogen, and in 5 times higher than that of the cast, dense, deformed low-alloyed chromium with 0.02 % of interstitial impurities, which was revealed ductile at tension at room temperature. The fracture toughness of the composite is a little sensitive to the existence of such a frame.

## **ADSORPTION AND REGENERATION OF SILICA AEROGEL AND SILICA AEROGEL-ACTIVATED CARBON COMPOSITES**

Akbar Mohammadi, Jafarsadegh Moghaddas  
Corresponding author: (jafar.moghaddas@sut.ac.ir)

Silica aerogels have high specific surface area, continuous Porosity, open pores and controlablenano scale dimensions, because of this features, silica aerogel and its composites show high rate and capacity in adsorption processes. In this work, nano-meter silica aerogel and silica aerogel- activated carbon composites were synthesized using water glass precursor by ambient pressure drying method. Then, benzene and ethyl benzene adsorption capacity of synthesized adsorbents were measured in batch process. After this, adsorbents were regenerated by solvent extraction-thermal treatment method and after at least 15 times adsorption-desorption cycles, their adsorption capacity was fixed. The results showed that, silica aerogel and silica aerogel- activated carbon composites show high tendency for benzene and ethyl benzene adsorption.

## **ACTIVATED CARBON MODIFICATION FOR REMOVAL OF PHENOL FROM CONCENTRATED AQUEOUS SOLUTIONS**

Mohebat Firoozmandan, Jafarsadegh Moghaddas  
a. Corresponding author: (jafar.moghaddas@sut.ac.ir)

Activated carbon was modified with hydrophobic mesoporous silica aerogel and its potential for removal of phenol from concentrated aqueous solutions (60-100 vol. % of phenol) was studied. The silica aerogel-activated carbon nano composites (with 0.5 and 2 wt. % of activated carbon) were synthesized via water glass precursor and ambient pressure drying route. The physical properties of composites were characterized by Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM) analyses and N<sub>2</sub> adsorption-desorption BET surface analyzer. The adsorption capacity of modified activated carbons was measured by mass adsorption method. The composite materials were found to have strong adsorption ability for phenol compared to activated carbon alone. The maximum adsorption capacity could reach up to 10.35 g/g for 0.5% composite, while it could only reach to 1.11 g/g for activated carbon in the same condition. The experimental results show that the adsorption capacity is controlled by concentration of oxygen-containing surface groups and total pore volumes of adsorbents.

## CHARACTERIZATION OF ALGERIAN SAHARA SAND DUNES

MAAZOUZI Abdelhak<sup>(a,b\*)</sup>. KETTAB Ahmed<sup>b</sup>. ZAHRAOUI Brahim<sup>c</sup>. KHELFOUI Rachid<sup>c</sup>.

(a)Dept. of Process Eng., Bechar Univ. 08000, Algeria.

(b)Water Science Research Laboratory (LRS-EAU) EL HARACHE Algiers 16000, Algeria.

(c)Dept. of Process Eng., (ENERGARID) Laboratory, Bechar Univ. 08000, Algeria.

a: Corresponding author: (maazdz@yahoo.fr)

For a possible study of Algerian Sahara sand dunes (Western Erg), a representative sand sample is collected and analyzed by several physicochemical methods; which implies the setting up of a multi technical methodology. The results obtained show that the quartz (98%) is the most represented mineral, the oxides of aluminum, potassium, iron, chromium and manganese, identified by the chemical analysis, the granular analysis permitted us to determine some parameters such as the uniformity coefficient (CU), equivalent diameter. On the other hand a comparison of the IR spectrum of the sand (washed and unwashed) was achieved. Observations to the Scanning Electron Microscopy (SEM) and the X-Ray analysis were also achieved.

## ENHANCED PHOTO- AND UNDER X-RAY LUMINESCENCE FROM XEROGELS EMBEDDED IN MESOPOROUS ANODIC ALUMINA

Nikolai Gaponenko<sup>1,a</sup>, Vsevolod Kortov<sup>2</sup>, Vladimir Pustovarov<sup>2</sup>, Liudmila Khoroshko<sup>1</sup>, Maria Rudenko<sup>1</sup>, Ahmed Asharif<sup>1</sup>, Igor Molchan<sup>3</sup>, George Thompson<sup>3</sup>, Artur Podhorodecki<sup>4</sup>, Jan Misiewicz<sup>4</sup>, Sergey Prislowski<sup>5</sup>

1. Belarusian State Univ. of Informatics and Radioelectronics, P.Browki St.6, 220013 Minsk, Belarus
2. Ural Federal Univ. named after the first President of Russia B. N. Yeltsin, Mira St. 19, 620002 Yekaterinburg, Russia
3. Corrosion and Protection Centre, School of Materials, The Univ. of Manchester, Manchester M13 9PL, United Kingdom
4. Inst. of Physics, Wroclaw Univ. of Technology, 50-370 Wroclaw, Poland
5. Stepanov Inst. of Physics, National Academy of Sciences of Belarus, 220072 Minsk, Belarus  
a. Corresponding Author ( nik@nano.bsuir.edu.by)

In our previous work we have shown that porous anodic alumina (PAA) films with pore and cell sizes ranging from 100 to 190 and 240 to 270 nm, respectively, have been generated on aluminum and monocrystalline silicon substrates followed by spin-on sol-gel derived coating with the subsequent thermal treatment producing microporous xerogel. The xerogel/PAA structures doped with lanthanides reveal strong luminescence of lanthanides under ultraviolet and X-ray excitation, with the strongest luminescence in the direction along the channels of the pores. In this paper Terbium-doped yttrium aluminum composite was synthesized onto porous anodic alumina by the co-precipitation method. The  $YAlO_3$  phase was revealed after the heat treatment at 1000 °C. The terbium luminescence excited by X-rays was observed along with the intense photoluminescence. The synthesis procedure is of interest for the development of radiation-resistant luminescent film.

## **MICROSTRUCTURAL REFINEMENT AND MECHANICAL PROPERTIES OF Al-15Si-2.5Cu-0.5Mg ALLOY THROUGH HIGH-PRESSURE TORSION**

Hakan Yilmazer<sup>a\*</sup>, Ceren Gode<sup>b</sup>, Ismail Ozdemir<sup>c</sup>, and Yoshikazu Todaka<sup>d</sup>

<sup>a</sup> Inst. for Materials Research, Tohoku Univ., Sendai 980–8577, Japan

<sup>b</sup> School of Denizli Vocational Techn., Program of Machine, Pamukkale Univ., 20100, Denizli, Turkey

<sup>c</sup> Dept. of Materials Sci. and Eng., Izmir Katip Celebi Univ., 35620, Izmir, Turkey

<sup>d</sup> Dept. of Production Systems Eng., Toyohashi Un. of Technology,  
Toyohashi 441–8580, Japan

Corresponding author: (hakan@imr.tohoku.ac.jp)

Aluminum (Al) - silicon (Si) alloys have attracted attention to automobile industry due to their high strength to weight ratio, high wear resistance, low density, and low coefficient of thermal expansion etc. It is important for the alloys to control the size and morphology of Si phases and intermetallic compounds as well as grain size of Al matrix. Therefore, significant improvements in strength, ductility, and great wear resistance of Al-Si alloys can be achieved by microstructural refinement. High-pressure torsion (HPT) is the most effective to produce ultrafine-grained (< 500 nm) or nanostructured (< 100 nm) bulk materials and high dislocation density. These materials are expected to exhibit relatively better mechanical properties than that of the materials having coarse grains. Therefore, microstructural refinement and its effects on the mechanical properties of commercial Al-15Si-2.5Cu-0.5Mg alloy (Alumix-231) alloy through HPT have been investigated in this study. The hot extruded coin-shaped specimens of powders of Alumix-231 were and subjected to HPT processing at rotation number of 1, 5 and 10 with an anvil rotation speed of 0.2 rpm under a pressure of 5 GPa. Afterwards, the microstructure and mechanical properties of specimens were systematically evaluated using XRD, SEM, EBSD, and TEM; hardness measurement and tensile tests.

## **MICROSTRUCTURE, DENSIFICATION AND PROPERTIES OF LIQUID PHASE SINTERED Cu-28Zn PREALLOYED POWDER**

Abbas Sabahi Namin, Maziyar Azadbeh, Ahad Mohammadzade

Corresponding author: (abbas.sabahi64@yahoo.com)

The present study investigates the effect of sintering temperature on densification behaviour and properties of liquid phase sintered Cu-28 Zn brass alloy. Microstructural evolution, DSC, XRD, chemical analysis and mechanical properties measurements have been studied in details. Obtained results allowed to accurately evaluate the Sintering Characteristics of this alloy. It is especially relevant in sintered samples that exhibits a pronounced variation of microstructure from top to down part of the specimens and graded densification which was due to gravitational effect.

## **THE EFFECT OF STRUCTURAL CHARACTERISTICS ON THE REFLECTIVITY OF POROUS SILICON**

Gulsen Kosoglu<sup>1</sup>, Dimitrios Chaliampalias<sup>2</sup>, Aikaterini Breza<sup>2</sup>, Ozhan Ozatay<sup>1</sup>, Nikolaos Frangis<sup>2</sup>, Christos Lioutas<sup>2</sup>, Yani Skarlatos<sup>1</sup>, Efstathios Polychroniadis<sup>2a</sup>

1. Bogazici Univ., Physics Dept., Istanbul, Turkey  
2. Aristotle Univ. of Thessaloniki, Physics Dept., Thessaloniki, Greece  
a. Corresponding author (polychr@auth.gr)

The reduction in reflectivity of porous silicon layers was investigated as part of an attempt to improve the efficiency of silicon photovoltaic solar cells. The effect of production parameters on the nature of porosity and hence reflectivity was examined with the aid of scanning and transmission electron microscopy. Porosity reduces the reflectivity of polished silicon wafers by a factor of 10 to 20, with larger pore sizes resulting in higher reduction factors. However, intensive etching of the silicon surface in order to increase pore size beyond about 150 nm in diameter, causes flaking on the top of the porous layer, with the remaining lower part displaying smaller pore diameters.

## **SUPERSOLIDUS LIQUID PHASE SINTERING EFFECT ON GRAIN GROWTH OF SINTERED BRASS PREALLOYED POWDER**

A. Mohammadzadeh<sup>1</sup>, M. Azadbeh<sup>1</sup>, A. Sabahi Namin<sup>1</sup>, B. Alipour<sup>1</sup>

1. Dept. of Materials Eng., Sahand Univ. of Technology, P.O. Box 51335-1996, Tabriz, Iran  
Corresponding author: (abbas.sabahi64@yahoo.com)

Present study is about modeling and experimentally investigation on grain growth and microstructure of supersolidus liquid phase sintered Cu28Zn brass prealloyed powder. An experimental investigation using response surface methodology (RSM) based on a central composite rotational design (CCRD) with two parameters was used to model and evaluate the supersolidus liquid phase sintering procedure of the brass alloyed powder. The effect of sintering variables such as sintering temperature and time has to be characterized. Mathematical model was developed to predict grain size at 95% confidence level. The developed mathematical model would help to predict the variation of grain size at the various mentioned sintering conditions. To better analyzing the microstructure and pore evaluation was carried out from the metallographic and fractographic examination of samples to evaluate sintering variables during supersolidus liquid phase sintering (SLPS).

## **STUDY OF MICROSTRUCTURAL EVOLUTION DURING LIQUID PHASE SINTERING OF PREALLOYED LEADED TIN BRONZE POWDERS**

Sheida Shadpoor, Maziyar Azadbeh, Abbas Sabahi Namin  
Corresponding author: ( abbas.sabahi64@yahoo.com)

The microstructural evolution during sintering of prealloyed leaded tin bronze powders was studied. As no systematic investigations into the sintering of such materials have as yet been carried out, it is of interest to study structure formation processes in the Cu-10Sn-10Pb system as function of sintering temperature. During sintering of prealloyed powders, liquid phase forms and spread to create an interparticle capillary bond that induces densification. Improvement in sintered density at optimum temperature is due to decreasing of pores percentage and reducing of their sizes as a consequence of persistent liquid phase sintering and supersolidus liquid phase sintering in copper-tin system.

## **MAGNETIC CORE-ZEOLITIC SHELL NANOSTRUCTURES AS PROMISED SORBENT TO REMOVAL OF WASTE WATER**

Mohsen Padervand, Mohammad Reza Gholami

Dept. of Chemistry, Sharif Univ. of Technology, Azadi Ave., Tehran, Iran  
Corresponding author: (gholami@sharif.edu)

Functionalized magnetic core-zeolitic shell nanocomposites were prepared via hydrothermal and precipitation methods. The products were characterized by VSM, X-ray powder diffraction (XRD), Fourier Transform Infrared spectra (FTIR), nitrogen adsorption-desorption isotherms (BET) and Transmission Electron Microscopy (TEM) analysis. The growth of mordenite nanocrystals on the outer surface of silica coated magnetic nanoparticles at the presence of organic templates was well approved. The removal performance and the selectivity of mixed metal ions ( $Pb^{2+}$  and  $Cd^{2+}$ ) in aqueous solution were investigated via the sorption process. The batch method was employed to study the sorption kinetic, sorption isotherms and pH effect. The removal mechanism of metal ions was done by chem-phys sorption and ion exchange processes through the zeolitic channels and pores. The experimental data were well fitted by the appropriate kinetic models. The sorption rate and sorption capacity of metal ions could be significantly improved by optimizing the parameter values.

## **POROUS POLYIMIDE FILMS BY USING LITHIUM CHLORIDE AS PORE-FORMING AGENT**

Ion Sava and Stefan Chisca

„Petru Poni” Inst. of Macromolecular Chemistry, Aleea Gr. Ghica Voda 41A,  
Iasi - 700487, Romania

Coresponding author: (isava@icmpp.ro)

The porous materials have attracted enormous scientific attention for used as a high-performance materials due to their diverse potential applications. Porous polymer films have been obtained from polyimide based on benzophenonetetracarboxylic dianhydride and 4,4'-diamino-3,3'-dimethyl-diphenylmethane by incorporating of lithium chloride (LiCl) in polyamidic acid precursor and after cyclization and subsequently leaching out the maximum possible LiCl by water Soxhlet extraction.

With increase the LiCl content, the free volume increases at the beginning (to 50%), but further, by increasing the LiCl content even more, the free volume decreases. The cross-section of porous polyimide films shows the formation of pores not only on the surface, but also inside the film.

The porous polyimide films showed high thermal stability with decomposition temperature being above 400°C and the density was slightly lower than that of the pristine polyimide film, with 9-12.5%. The dielectric constant values depended on the quantity of LiCl added in the precursor being in the range of 2.01-2.91 and were lower than that of pristine polyimide film (3.32).

## **EFFECT OF NANOPARTICLE TYPES ON OIL VISCOSITY REDUCTION EXPERIMENTALLY**

Sahar Afzal<sup>1</sup>, Mohammad Reza Ehsani<sup>1</sup>, Mohammad Nikookar<sup>2</sup>, Emad Roayaei<sup>2</sup>

1- Dept. of Chemical Eng. of Isfahan Univ. of Technology, P.O. Box 84156-83111, Isfahan, Iran.

2- IOR Research Inst., National Iranian Oil Company (NIOC), Tehran, Iran.

a. Corresponding author: (s.afzall@ce.iut.ac.ir)

The reduction of oil viscosity is the most important issue in enhanced oil recovery special the thermal processes. In this paper, the effect of different metal oxide types including iron oxide, nickel oxide, copper oxide, zinc oxide, alumina, titanium dioxide and tungsten trioxide at the range of temperature was investigated on heavy oil viscosity. Also, this study was done in different concentration of selected types of nanoparticle. The experimental tests showed that some of the mentioned types of nanoparticle in optimum concentration at different temperatures could decrease the heavy oil viscosity above 60%. These viscosity reductions in low concentration of effective types of nanoparticle were the effect of doing catalyzed reaction in oil sample by addition of some of nanoparticles.

## **EFFECT OF FOAMING AGENT ON THE PORE MORPHOLOGY OF NITI INTERMETALLIC FOAMS PRODUCED USING THE COMBUSTION SYNTHESIS PROCESS**

Mandana Adeli

Center of Excellence for High Strength Alloys Technology (CEHAT), School of Metallurgy and Materials Eng., Iran Univ. of Science and Technology (IUST), Narmak, Tehran 1684613114, Iran

a. Corresponding author: (adelim@iust.ac.ir)

In this study, the production of NiTi intermetallic foams via a combustion synthesis route was investigated. The morphology and distribution of pores in the product with and without using a foaming agent were compared. The effect of type and amount of various foaming agents such as CaCO<sub>3</sub> and CaH<sub>2</sub> on the quality of product was studied. It was found out that the presence of foaming agent could remarkably improve the foaming properties of the porous product. The optimum amount of foaming agent to form a desirable product in terms of pore size and distribution was proposed.

## **SINTERING BEHAVIOR OF TITANIUM MATRIX COMPOSITE REINFORCED WITH CARBON NANOTUBES**

Ismail TOPCU<sup>1</sup>, H.Özkan GÜLSOY<sup>2</sup>, Arif N.GÜLLÜOĞLU<sup>1</sup>

<sup>1</sup> Marmara Univ., Eng. Faculty, Metallurgy & Materials Eng. Dep., 34722, Göztepe, Istanbul-Turkey

<sup>2</sup> Marmara Univ., Technology Faculty, Metallurgy & Materials Eng. Dep., 34722, Göztepe, Istanbul-Turkey

a. Corresponding author: (itopcu@marmara.edu.tr)

The aim of the present study is to investigate the effect of Carbon Nanotube (CNT) additions on sintering behavior, microstructural evolutions and hardness of mechanical alloyed and sintered Ti6Al4V (Ti64) powder. Mechanical alloyed powders were uniaxially compacted at different pressure in an 80 T hydraulic press with floating die to produce samples. Green samples were sintered at 845 °C - 1300 °C for 60 min. in a high level vacuum (10<sup>-5</sup> mbar). After sintering, the performances of the sintered materials were characterized using density measurement, hardness testing, optical microcopy (OM) and scanning electron microscopy (SEM). Theoretical density and hardness of mechanical alloyed and sintered Ti64 powders changed with the additions of CNT.

## **PRODUCTION OF Mg-Fly Ash COMPOSITES BY POWDER METALLURGY**

Yekta YAVUZ, Erdem KARAKULAK, Kemal KORUCU, Rıdvan YAMANOĞLU, Muzaffer ZEREN  
a. Corresponding author: (yektayavuz@gmail.com)

In this study, magnesium powders with different ratios of ash particles obtained from Yatagan were prepared. The powder were mixed mechanically and consolidated by hot pressing under vacuum due to high oxygen affinity of magnesium. The sintering procedure was chosen as 550 °C for 5 minutes under 40 MPa. The density of obtained compacts were measured by Archimedes method. Hardness and wear properties of the sintered compacts were studied in detail. Microstructural characteristics were investigated by using optical microscopy and scanning electron microscope. Enhanced mechanical properties were obtained and discussed.

## **PRODUCTION OF ELECTROLESS Ni PLATED ABRASIVE –ASTALOYCr-M POWDERS**

Ayhan EROL<sup>1</sup>, Ahmet YONETKEN<sup>2a</sup>, Ömer GÖKOĞLAN<sup>3</sup>, Taner MERSİN<sup>3</sup>

<sup>1</sup>Afyon Kocatepe Univ., Faculty of Technology, ANS campus, 03200, Afyonkarahisar-Türkiye

<sup>2</sup>Afyon Kocatepe Univ., Faculty of Eng., ANS campus, 03200, Afyonkarahisar-Türkiye

<sup>3</sup>Isik Döküm Celik Sanayi Ltd.Şti. Rasathane Yolu üzeri 106/4 Sk. No:46 Işıkent - Izmir -Türkiye  
a. Corresponding author (yonetken@aku.edu.tr)

Nickel matrix reinforced with Abrasive powder has been fabricated by conventional furnace sintering at various temperatures. A uniform nickel layer on Abrasive powders was deposited prior to sintering using electroless plating technique, allowing close surface contact than can be achieved using conventional methods such as mechanical alloying. The reactivity between Abrasive powders to form compounds is controlled through Ni layer existing on the starting powders. A composite consisting of quaternary additions, ceramic phases, Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub> within a matrix of Ni, Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub> and etc., has been prepared at the temperature range 1200°C-1400°C under Ar shroud. XRD, SEM(Scanning Electron Microscope), compressive testing and hardness measurements were employed to characterize the properties of the specimens. Experimental results carried out for 1200°C suggest that the best properties as compressive strength  $\sigma_{max}$  and hardness (HB) were obtained at 1200°C

## **EFFICIENT SYNTHESIS OF IMIDAZO[1,2-A]PYRIDINES VIA A ONE-POT THREE-COMPONENT REACTION CATALYZED BY MCM-41 ANCHORED SULFONIC ACID AS A RECOVERABLE NANOCATALYST**

Shahrzad Javanshir, Maryam Naeim Abadi, Ali Maleki  
a. Corresponding author: (shjavan@iust.ac.ir)

A green and highly efficient method for the synthesis of imidazo[1,2-a]pyridines has been developed by a sequential one-pot three-component reaction between isocyanides, 2-aminopyridines and aldehydes in the presence of nano-ordered MCM-41-SO<sub>3</sub>H using grinding technique under solvent free conditions at room temperature. The present method shows fascinating properties such as short reaction times at room temperature, high yields, simple workup and purification, recyclability and non-toxicity of the catalyst.

## **MECHANICAL PROPERTIES OF A COMPOSITE PRODUCED BY USING ELECTROLESS Ni PLATED Fe-Co-Cr POWDERS**

Eyüp Donat<sup>1</sup>, Ayhan EROL<sup>1</sup>, Ahmet YONETKEN<sup>2,a</sup>,

<sup>1</sup> Faculty of Technology, Afyon Kocatepe Univ., 03200, Afyonkarahisar, Turkey  
aerol@aku.edu.tr, eyupdonat\_03\_88@hotmail.com

<sup>2</sup> Faculty of Eng., Afyon Kocatepe Univ., 03200, Afyonkarahisar, Turkey  
a. Corresponding Author (yonetken@aku.edu.tr)

The microstructure, mechanical properties and corrosion characteristics of Ni plated %30Fe -%30Co and %10Cr powders were investigated using specimens produced by tube furnace sintering at 800-1200°C temperature. A uniform nickel layer on Fe-Co and Cr powders was deposited prior to sintering using electroless plating technique. A composite consisting of quintet additions, a metallic phases, Fe, Cr and Co, within a matrix of Ni has been prepared under Ar shroud and then tube furnace sintered. XRD, SEM (Scanning Electron Microscope), corrosion behavior in acidic media were investigated to characterize the properties of the specimens. Experimental results carried out for composition (%30Fe-%30Co-%10Cr)30Ni at 1200°C suggest that the best properties as 186.54 HV were obtained at 1200°C

## **SILICA NANOTESTTUBES: A NOVEL PLATFORM FOR MULTIFUNCTIONAL DELIVERY**

Sevde Altuntas<sup>1</sup>, Hande Yegenoglu<sup>2</sup>, Belma Aslim<sup>2</sup>, Fatih Buyukserin<sup>3</sup>

1Micro and Nanotechnology Graduate Program, TOBB Univ. of Economics and Technology, Ankara  
06560, Turkey

2Dept. of Biology, Faculty of Science, Gazi Univ., Ankara 06500, Turkey

3Dept. of Biomedical Eng., TOBB Univ. of Economics and Technology, Ankara 06560, Turkey

a. Corresponding author: (fbuyukserin@etu.edu.tr)

Multifunctional nanoparticles of different shapes attract great interest from a variety of scientific fields including materials engineering and biomedical research<sup>1</sup>. Among these nanoparticles, silica nanotesttubes are novel 1D inorganic structures, exhibiting several desired characteristic for biomedical applications involving ease of synthesis (typically via template method), modification and geometrical manipulation, large hallow interior geometry, low toxicity, extensive dispersion etc<sup>2</sup>. Despite these advances, the literature about the use of silica nanotesttubes as nanocarrier platforms is quite limited and the main challenge facing these carriers is the low loading capacities obtained<sup>3</sup>. Much larger payload capacities could be obtained if one can completely fill the large inner volumes of these hollow nanostructures with a therapeutic agent or a media that consist these agents. This talk will describe the use of nanoporous AAO templates and surface sol-gel chemistry to fabricate monodisperse silica nano test tubes (Figür 1). In addition to the characterization data, functionalization of the fabricated tube surface with specific biomolecules, doping the interior with therapeutic agents and the control of drug release as a function of pH will be presented. Finally, the specificity of the multifunctional carriers to healthy and carcinoma breast cell lines will be described.

## **FREEZE DRYING OF INSTANT TEA AND DETERMINATION OF EFFECTIVE PARAMETERS**

Ebubekir Siddik AYDIN, Hasan SADIKOGLU

a. Corresponding author: (e.aydin@gyte.edu.tr)

In this work, a mathematical model that based on energy and mass equations was used for freeze dried instant tea production. The model equations were solved using the orthogonal collocation based on polynomial approximation methods. Matlab<sup>®</sup> program was used to solve non-linear equations resulted from the dynamic behavior of the process.

The amount of removed water from the sample was experimentally determined during the freeze-drying at each two hours and each experiment tripled. In order to determine transport properties of instant tea during freeze drying, Hougen Watson algorithm of Matlab<sup>®</sup> was used.

Fitting experimental data with dynamic multi-dimensional model of freeze drying of instant tea, effective diffusivity constant, Knudsen diffusivity constant and thermal conductivity of dried layer that are difficult to measure directly were determined. The constants can be used for the estimation of drying time for the similar foodstuff in the next studies.

## PROCESSING AND CHARACTERIZATION OF POROUS TiNi ALLOYS

G.Ipek Nakaş<sup>a</sup>, E. Erkan Aşık, Şakir Bor

Middle East Technical Univ., Dept. of Metallurgical and Materials Eng., Türkiye  
a. Corresponding author (ipeknakas@gmail.com)

In this study, porous TiNi alloys with a porosity content of 64 vol% were processed by sintering with magnesium space holder technique. Prealloyed TiNi powder was used to prevent the formation of brittle secondary intermetallics. Both the powder and porous TiNi alloys were examined by X-ray analyses and SEM studies. According to X-ray analyses, it was found that both powder and processed TiNi foams are fully austenitic (B2) while SEM examination revealed the homogeneously distributed, interconnected, spherical pore structure of TiNi foams. Furthermore, both monotonic and superelastic compression behavior were analyzed at room temperature. It was observed that monotonic compression behavior of TiNi foams was similar to that of cellular metals. On the other hand, TiNi foams were cyclically loaded up to  $0.75 \sigma_{\max}$  (75% of ultimate compressive strength) and unloaded to analyze the superelastic response. It was also observed that full recovery of 3% strain was achieved at the end of five cycles of training.

## THERMAL BEHAVIOR OF NANO $Al_2O_3$ /POLYESTER METALLIC BONDING POWDER COATINGS

B. Shirkavand Hadavand<sup>1</sup>, H. Fakharzadeh Bafghi<sup>1,2</sup>, M.Seddighian<sup>2</sup>

<sup>1</sup> Dept. of Resin and Additives, Inst. for Color Science and Technology, Tehran, Iran

<sup>2</sup> Research and Development of Peka Chemie Powder Coatings Co, Tehran, Iran

a. Corresponding author: (shirkavand@icrc.ac.ir)

Metallic powder coatings are using for decorative protective for metal. In metallic powder coatings a base powder are homogeneously blended with metal particulate which is physically bonded to the surface of the powder. In this study, the effects of nano  $Al_2O_3$  on mechanical properties and thermal behavior of metallic bonding powder coatings were studied. For achieving this polyester resin with triglycidyl isocyanurate hardener and epoxy-polyester resin as a base powder were prepared using blending method by twin screw extruder. Then two metallic bonding powder coatings were prepared by compounding base powder with difrent percentage of nano  $Al_2O_3$  (0.05, 0.1 and 1% w/w). Morphology and dispersion state of particles in samples were studied by SEM and results indicated the good dispersion of nano particles in polymeric matrix. Determination of flow properties showed changes from 150 to 170 grams. Some other properties such as thermal behavior of coatings were determined and discussed.

## UTILIZATION OF ACTIVATED GBFS AND PERLITE IN POROUS LIGHTWEIGHT COMPOSITE MATERIAL

Cenk Karakurt<sup>1,a</sup>, Abdullah Demir<sup>2</sup>, Mehmet Canbaz<sup>3</sup>, Mehmet Uğur Toprak<sup>2</sup>

1 Bilecik Şeyh Edebali Univ., Dept. of Civil Eng., 11210, Bilecik, Turkey

2 Dumlupınar Univ., Dept. of Civil Eng., 43100, Kütahya, Turkey

3 Eskişehir Osmangazi Univ., Dept. of Civil Eng., 26480, Eskişehir, Turkey

a. Corresponding author (cenk.karakurt@bilecik.edu.tr)

The perlite aggregate has been used widely in lightweight concrete production. The expanded and raw perlite can be used as lightweight insulation material due to its high porosity. The light weight concretes are utilized in structures in order to reduce the own weight of the structure thus reducing the earthquake force which affects on the structure. The ground granulated blast furnace slag (GBFS) can be activated by using such activators like alkalis, lime and calcium sulfate. Therefore, it becomes an alternative binder against cement. In this study, GBFS is used as binder by plaster activation and lime. In lightweight composite production, GBFS and expanded perlite with silica sand was used as binding phase and aggregate respectively. The produced specimens were cured in different regimes as air curing, and steam curing. The physical and mechanical properties of the specimens were determined by experimental studies at early and further ages. Also the insulation properties of the composite specimens were obtained by thermal conductivity tests. According to test results, the unit weights and the strength properties of the specimens were decreased.

## SYNTHESIS AND CHARACTERIZATION OF NANO CRYSTALLINE Ni-Co ALLOYS BY ELECTRODEPOSITION TECHNIQUE

M.Salehi, A.Saidi\*, M.Ahmadian, and K.Raeissi

Dept. of Materials Eng., Isfahan Univ. of Technology, Isfahan 84156-83111, Iran

a. Corresponding author: (a.saidi@cc.iut.ac.ir)

Nano crystalline Ni-Co alloys are electrodeposited in a Watt's type bath of nickel and cobalt sulfate, and boric acid. Deposition parameters including current density and pH of electrolyte were changed to obtain desired compositions when temperature and composition of bath were kept constant. X-ray diffraction was employed for phase analysis of deposits. The microstructure and deposited alloy composition were characterized by scanning electron microscope (SEM) that was equipped with energy dispersive X-ray (EDS). Magnetic properties were determined with alternating gradient force magnetometer (AGFM). The results show that when current density changes from 60 to 100 mA/cm<sup>2</sup>, deposited alloys composition of 30-50wt% Ni is obtained. When pH of electrolyte changes from 1.5- 4, the changes in deposited alloys isn't remarkable. Calculating the grain size of the alloy, using XRD results, indicates that a grain size in the range of 30-40 nm was obtained. The average of H<sub>c</sub> and M<sub>s</sub> obtained for the deposited alloys was about 30(oe) and 700(emu/cm<sup>3</sup>) respectively.

## **SOL-GEL AND FLAME SPRAY PYROLYSIS ASSISTED TiO<sub>2</sub> NANOPOWDERS: PRODUCTION, CHARACTERIZATION AND PHOTOCATALYTICAL KINETICS**

Mustafa Erol<sup>1,2,4,\*</sup>, Orkut Sancakoglu<sup>1,2</sup>, Metin Yurddaskal<sup>1,2,5</sup>, Serdar Yıldırım<sup>1,2</sup>, Erdal Çelik<sup>1,3</sup>

<sup>1</sup> Dokuz Eylul Univ., Dept. of Metallurgical and Materials Eng.,  
Buca, Izmir, 35160, Turkey

<sup>2</sup> Dokuz Eylul Univ., The Graduate School of Natural and Applied Sciences,  
Buca, Izmir, 35160, Turkey

<sup>3</sup> Dokuz Eylul Univ., Center for Production and Applications of Electronic Materials, Buca, Izmir,  
35160, Turkey

<sup>4</sup> Hitit Univ., Dept. of Metallurgical and Materials Eng.,  
Çorum, 19000, TURKEY

<sup>5</sup> Afyon Kocatepe Univ., Dept. of Metallurgical and Materials Eng., -Afyonkarahisar, 03200, Turkey  
\*Corresponding author: (m.erol@deu.edu.tr)

In this study, nano scale photocatalyst TiO<sub>2</sub> powders were synthesized via sol-gel (SG) and flame spray pyrolysis (FSP). Phase structures and ratios were analyzed by x-ray diffractometer (XRD). Size, specific surface area and morphologies were determined using particle size analyzer, Brunauer-Emmett-Teller (BET) theory and scanning electron microscope (SEM) respectively. Anatase phase with some rutile together was obtained in XRD analysis. The degradation rates of aqueous methylene blue (MB) by nano TiO<sub>2</sub> powders were calculated using UV-Vis spectrophotometer. It was found that MB decomposition was successfully achieved with significantly high efficiencies for both SG and FSP derived powders with small differences. Finally photocatalytic reaction rates were calculated using kinetic considerations.

## **EXPANDED GLASS GLOBE – ALUMINUM FOAM ALUMINUM FOAMS COMPARISON**

Nihal YUMAK, Metin BÜYÜKÇORAK, Halil AYKUL  
a. Corresponding author: (nihal\_yumak88@hotmail.com)

In recent years, increased interest in the issues of the production and characterization of light metal foams. When used in combination with other metals, aluminium foams suitable to the production of many parts of military and industrial applications. Metal foams; micro-porous heat changers, cooling of electronic equipment, industrial ovens, air cooled, chemical reactors, aircraft electronic equipment, filters, non-combustible interior coatings, heat and sound insulation for wall panels are used in large proportion. High energy absorption capacity and because of security and low density places the Prism for the automobile, railroad and aviation industry needed aluminium foams interest is increasing. Under low stress has more energy absorption of metal mass. These materials because of its good thermal properties and cellular voice capable of swallowing. The biggest problem in the price/performance of Metal foams having very low as a result of daily use is not appropriate. The Clipboard is not used except in private. Expanded glass globes stainless 5 cm x 5 cm x 15 cm, put in a closed container over the base of the 6xxx and 7xxx series aluminium melting and mixing of the materials together with the density difference of aluminium composite material production. Low density expanded by adding glass spheres between molten aluminium composite panels will be produced according to the investigation of the density of low intensity pulse of Aluminium foams comparison.

## **COMPARISON OF HEAVY METAL REMOVING CAPACITIES OF CALCIUM SILICATE PRODUCED FROM RICE HULL ASH WITH ORIGINAL RICE HULL ASH AND ACTIVATED CARBON**

Polat Tugrul YAZOGLU, Onur Yilmaz OZCAN\*, Ozgul TASPINAR

Istanbul Technical Univ., Chemical Eng. Dept., Maslak, Istanbul

\* Istanbul Technical Univ., Environmental Eng. Dept., Maslak, Istanbul

a. Corresponding author: (ozguloz@itu.edu.tr)

This study covers the adsorption of copper, lead and zinc ions from aqueous solutions by calcium silicate produced from Rice Hull Ash (RHA), original RHA and activated carbon. Besides these materials, re-burned rice hull ash, and a mixture of calcium silicate produced from rice hull ash and activated carbon were used as adsorbents.

For all three heavy metals, effects of initial concentration and adsorption time were examined, and their adsorption capacities were compared. The characteristic of the adsorption for especially copper ions has been determined by analyzing the FTIR spectra before and after the adsorption process.

## **ADSORPTION CHARACTERISTICS OF REACTIVE BLUE 19 FROM AQUEOUS SOLUTION ONTO SESAME AND SAFFLOWER SEED CAKES**

Şule ÜNAL and Belma ÖZBEK

Yıldız Technical Univ., Dept. of Chemical Eng., Davutpaşa Campus, 34210, Esenler/Istanbul, Turkey

a. Corresponding author: (suunal@yildiz.edu.tr)

The textile and dyeing industries discharge highly coloured and toxic wastewater to aquatic life. Discharging dyes into the hydrosphere causes environmental damage as the dyes give water undesirable color and reduce sunlight penetration, with some dyes also having subsequent health effects. The world market share of reactive dyes is between 20-30%.

In many industries especially in the recovery of chemical and biochemical pollutants, the adsorption process plays a significant role. For removing the toxic chemicals, adsorption process has an advantage in comparison to other processes such as electrochemical, biochemical, or photochemical degradation processes.

Activated carbon is commonly used as adsorbent for dye removal because of its extended surface area but it's hard to regenerate and it's also expensive, resulting in high costs. As an eco-friendly alternative, non-conventional biosorbents can be used in dye-removal. For this purpose, in this present study, sesame seed cake and safflower seed cake which are both agricultural residues were used to investigate their adsorption performance. The effects of pH, temperature, initial reactive dye concentration, and amount of biosorbent were examined. Besides, the most suitable adsorption kinetic models were examined according to the data obtained from experiments for each cake studied.

## **TRIBOLOGICAL AND THERMO-MECHANICAL PROPERTIES OF GLASS FIBER REINFORCED COMPOSITES CONTAINING TUNGSTEN BASED NANOFILLERS**

Kazım Karal<sup>1</sup>, Metin Tanoğlu<sup>2</sup>, Vefa Ezirmik<sup>3</sup>, M.Lütfi Öveçoğlu<sup>3</sup>, Mustafa Ürgen<sup>3</sup>

Izmir Inst. of Technology

<sup>1</sup> Material Science and Eng. Program

<sup>2</sup> Mechanical Eng. Dept.

Gülbahçe Campus, 35437 Urla, Izmir, Turkey

<sup>3</sup> Istanbul Technical Univ., Dept. of Metallurgical and Materials Eng.

34469, Maslak, Istanbul, Turkey

a. Corresponding author (metintanoglu@iyte.edu.tr)

In this study, quadriaxial non-crimp glass fiber reinforced epoxy composites were prepared with the addition of tungsten based nanostructured powders produced by mechanical alloying. The powders were incorporated into matrix resin to apply on one side of the laminates as a relatively thin surface layer. Laminates were manufactured with hand lay-up technique and cured under compression. The effects of the nanostructured additives on the tribological and thermo-mechanical properties of fiber reinforced epoxy composites were investigated. It was found that tungsten based powder loading has no significant effect on the flexural properties of laminates. The significant improvement on the wear resistance of the composites was observed with the addition of 3 wt. % W-SiC-C (mechanically alloyed for 24 h) powder onto composite surface. The worn surfaces were examined with scanning electron microscopy (SEM) and the results revealed that wear mechanisms are altered due to the presence of nanoparticles in the matrix. Incorporation of nanoparticles improved the thermo-mechanical properties of composite laminates.

## **TITANIUM-BASED COMPOSITE FOR BIOMEDICAL APPLICATIONS**

Jan Ryszard Dabrowski<sup>1,a</sup>, Piotr Deptula<sup>2</sup>, Marcin Klekotka<sup>3</sup>

1,2,3. Bialystok Univ. of Technology, Dept. of Materials and Biomedical Eng., Bialystok, Poland

a. Corresponding author (j.dabrowski@pb.edu.pl)

Titanium and its alloys (Ti-Al-V) comprise one of the most promising groups of biomaterials used in bone surgery, owing to the fact that they possess a great number of valuable bio-functional features. On the other hand, however, the alloys also have certain disadvantages as they contain toxic additives in the form of aluminum and vanadium, and show poor tribological properties. This paper presents the results of a research study on new titanium composite materials with a graphite filler (5-20%), obtained using the methods of powder metallurgy. Structural, mechanical, tribological and biological tests of the composites were performed in the course of the research. It was found out that composite materials with a 10% graphite content manifested the best bio-functional properties, especially with respect to their mechanical and tribological characteristics.

The produced sinters were used as a construction material of a frictional contact in a dynamic stabilizer of hip fractures, whose sensitive parts are particularly exposed to tribological wear. Operational tests of the modified/improved device showed a significant increase of its durability/resilience, as compared to the commercial product.

## SILICOTUNGSTIC ACID INCORPORATED SBA-15 CATALYSTS FOR DEHYDRATION OF ALCOHOLS

Arzu Arslan, Gökhan Çelik, Timur Dogu

Dept. of Chemical Eng., Middle East Technical Univ.  
Ankara Turkey

a. Corresponding author: (arzu0arslan@gmail.com)

Heteropolyacids (HPA's) draw attention in the catalysis world with their controllable acidic and redox properties. HPA's have been used in alkylation, esterification and dehydration reactions. Some properties of HPA's, such as having low surface areas and being soluble in polar solvents, limit the widespread use of these materials as catalysts. To overcome these limitations, HPA incorporated mesoporous silicate structured materials were synthesized in our earlier studies. In the present study, silicotungstic acid (STA) incorporated silicate structured SBA-15-like materials containing W/Si ratios of 0.4 and 1.0 were synthesized, for potential use in methanol dehydration to produce dimethyl ether. These materials were found to have mesopores in a narrow range of 5-10 nm. Surface area of the material containing W/Si ratio of 0.4 was 187 m<sup>2</sup>/g, while the surface area of pure SBA-15 was over 800 m<sup>2</sup>/g. XRD analysis also indicated formation of ordered mesopores in the STA incorporated SBA-15. Reaction test results proved high activity of these materials in methanol dehydration to produce DME.

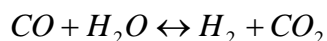
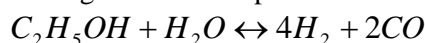
## EFFECT OF CO-MG INCORPORATION METHOD ON HYDROGEN PRODUCTION PERFORMANCE OF MESOPOROUS ALUMINA BASED CATALYSTS

Seval Gunduz, Timur Dogu

Dept. of Chemical Eng., Middle East Technical Univ., 06800 Ankara, Turkey

a. Corresponding author: (gseval@metu.edu.tr)

Steam reforming of ethanol is a promising route for the production of hydrogen rich synthesis gas.



Cobalt based catalysts have been considered to have good potential in reforming reactions. Mesoporous catalyst supports have significant advantages over conventional microporous materials, in terms of minimization of coke formation during reforming and elimination of transport limitations. In the present study, quite stable Co and Mg incorporated mesoporous alumina (MA) catalysts with narrow pore size distributions were synthesized following both direct synthesis (Co-Mg-MA) and impregnation procedures (Co-Mg@MA) using Pluronic P123 as the structure directing template. XRD and nitrogen adsorption/desorption analysis indicated formation of ordered mesoporous structures. Co-Mg-MA and Co-Mg@MA catalysts had surface area and average pore diameter values of about 380 m<sup>2</sup>/g 3.8 nm and 130 m<sup>2</sup>/g, 4.3 nm, respectively. These catalysts were tested in steam reforming of ethanol and complete conversion of ethanol was achieved with both of these catalysts. However, while Co-Mg@MA catalyst enhanced ethanol dehydration reaction and gave very high ethylene selectivity, Co-Mg-MA catalyst was very active for steam reforming of ethanol reaction with a quite high H<sub>2</sub> yield value of about 5.0 per mole of ethanol reacted.

## **MICROSTRUCTURE AND LUMINESCENCE PROPERTIES OF Er<sup>3+</sup> DOPED CdNb<sub>2</sub>O<sub>6</sub> COLUMBITE OXIDES SYNTHIZED BY MOLTEN SALT TECHNIQUE**

Sanaz Ghafouri, Murat Erdem, Mete Kaan Ekmekçi, Ayhan Mergen, Hasan Gökçe, Gönül Özen  
a. Corresponding author: (sanaz.ghafouri1@gmail.com)

Rare-earth ions also has a critical role in energy-efficient luminescent materials such as phosphors for fluorescent lamps, cathode ray tubes (CRT's) and plasma displays as both the active emitters as well as "sensitizing" agents that increase efficiency. The synthesis and luminescence properties of metal niobates have been intensively investigated during the past half century. CdNb<sub>2</sub>O<sub>6</sub> is one of those materials which is also interesting photoactive host material. The main purpose of this work is to explore the effect of the Er<sup>3+</sup> doped CdNb<sub>2</sub>O<sub>6</sub> columbite structure on the luminescence properties of CdNb<sub>2</sub>O<sub>6</sub>. In this study, CdNb<sub>2</sub>O<sub>6</sub> powders containing various concentrations of Er<sub>2</sub>O<sub>3</sub> were produced by molten salt synthetic route using Li<sub>2</sub>SO<sub>4</sub> -Na<sub>2</sub>SO<sub>4</sub> flux as a molten salt mixture. The orthorhombic CdNb<sub>2</sub>O<sub>6</sub> single crystalline phase was observed when the powders were heat-treated at 900°C. The luminescence properties of columbite compounds were investigated at low (200-800nm) and high (900-1100nm) wavelength regions depending on concentration of Er<sup>3+</sup> in CdNb<sub>2</sub>O<sub>6</sub>. The luminescence measurements show that the concentration quenching occurred in high concentration of Er<sup>3+</sup> doped CdNb<sub>2</sub>O<sub>6</sub>.

## **USING THEORETICAL CORRELATIONS FOR PREDICTING NOBLE GAS SEPARATION PERFORMANCES OF METAL ORGANIC FRAMEWORKS**

Yeliz Gürdal, Seda Keskin  
a. Corresponding author: (skeskin@ku.edu.tr)

Purification of noble gases is crucial due to the large variety of applications that noble gases are used. The conventional noble gas separation method is cryogenic distillation but this method requires significant energy use. In this study, we focused on using metal organic frameworks (MOFs) for adsorption-based and membrane-based separation of noble gas mixtures. We studied several different MOFs and predict the Xe/Kr and Xe/Ar separation performances of these MOFs using theoretical correlations. We used Ideal Solution Adsorbed Theory (IAST) and Krishna-Paschek correlation (KP) to estimate mixture adsorption and diffusion in MOFs, respectively. We then compared the predictions of these correlations with the results of direct adsorption simulations, Grand Canonical Monte Carlo, and diffusion simulations, equilibrium molecular dynamics. Our results showed that theoretical correlations can be used instead of the computationally demanding molecular simulations to make predictions about the selectivity of MOFs for noble gases. We will discuss the results of adsorption selectivity, working capacity, diffusion selectivity, permeation selectivity, and gas permeability of MOFs for noble gases.

## TENSILE PROPERTIES OF GROUND COLEMANITE FILLED POLYPROPYLENE HOMOPOLYMER

Şenol Şahin and Tülin Şahin<sup>a</sup>

Kocaeli Univ., Dept. of Mechanical Eng., Kocaeli, Turkey

a. Corresponding author (tulsah@kocaeli.edu.tr)

In this study the effect of the ground colemanite (GC) substance, to the tensile properties of the polypropylene homopolymer (PPH) material, was studied. The average particle size ( $d_{0.5}$ ) of the GC substance was 20.6  $\mu\text{m}$ . The PPH raw material was filled with GC at different percentage rates (5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5, 25, 27.5 and 30%) by weight with a twin-screw extrusion machine by constant extrusion parameters. Firstly, the melt flow rates (MFR) of the filled (PPH/GC composite) and unfilled (pure PPH) raw materials were determined. Secondly, the pure and the composite raw materials were pressed into standard tensile specimens with an injection-moulding machine by constant injection parameters. The test experiments were performed with samples at constant experiment conditions. The results were given according to the increasing amount of GC filler content in PPH base material. It was detected that, GC substance increases the MFR, Young's modulus and tensile strength at break, while it decreases the tensile strength at yield, the tensile strain at yield and at break of the material.

## SYNTHESIS, CRYSTAL STRUCTURE, AND NITROGEN-GAS-ADSORPTION PROPERTY OF CHAIN COMPLEX OF DINUCLEAR RHODIUM(II) BENZOATE AND ETHYLENEDIAMINE

Masahiro Mikuriya<sup>1,a</sup>, Kazuya Ouchi<sup>1</sup>, Yasutaka Nakanishi<sup>1</sup>, Daisuke Yoshioka<sup>1</sup>, Hidekazu Tanaka<sup>2</sup>, and Makoto Handa<sup>2</sup>

1. Kwansei Gakuin Univ., School of Science and Technology, Sanda 669-1337, Japan

2. Shimane Univ., Interdisciplinary Graduate School of Sci. and Eng., Matsue 690-8540, Japan

a. Corresponding author (junpei@kwansei.ac.jp)

The title compound, an adduct of rhodium(II) benzoate  $[\text{Rh}_2(\text{O}_2\text{CC}_6\text{H}_5)_4]$  ( $[\text{Rh}_2(\text{bz})_4]$ ) with ethylenediamine (en),  $[\text{Rh}_2(\text{bz})_4(\text{en})]_n \cdot 4n\text{CH}_3\text{CN}$ , was synthesized, and the crystal structure was determined by the single-crystal X-ray diffraction method at 90 K. It crystallizes in the triclinic space group  $P2_1/c$  with  $a = 10.149(3)$  Å,  $b = 20.250(5)$  Å,  $c = 19.180(5)$  Å,  $\beta = 103.602(5)^\circ$ ,  $V = 3831.3(17)$  Å<sup>3</sup>,  $D_x = 1.586$  g/cm<sup>3</sup>, and  $Z = 4$ . The  $R_1$  [ $I > 2\sigma(I)$ ] and  $wR_2$  (all data) values are 0.0704 and 0.1931, respectively, for all 7844 independent reflections. The crystal contains zig-zag chain molecules with an alternating arrangement of  $\text{Rh}_2(\text{bz})_4$  [Rh-Rh 2.4004(12) Å] and en, and acetonitrile molecules. The adsorption property was confirmed for  $\text{N}_2$  with a specific surface area of 7.5 m<sup>2</sup>/g.

## **MOLECULAR ENGINEERING ON CONFINED SPACE IN SOFT TEMPLATED OXIDES**

Belén Albela and Laurent Bonneviot

a. Corresponding author: (belen.albela@ens-lyon.fr)

The design of a heterogeneous catalyst with equivalent active sites and molecular control of the active species is a matter of concern. Indeed, better knowledge of the nature of the active sites can allow fine-tuning of the material to improve its reactivity properties and potential applications.

The Molecular Stencil Patterning technique, which has been developed for soft templated oxides such as MCM-41, offers the advantage of affording a homogeneous dispersion of one function at high loading with control of the vicinity of the metal site. It is based on the use of the cationic template as stencil masking the surface according to a regular pattern generated by electrostatic self-repulsion. Then a sequential introduction of two different functions is performed: the first function is usually a trimethylsilyl group, which acts as hydrophobic isolating function that is incorporated in the presence of some of the template molecules. Then, after removal of the remaining template, the second function (a ligand for a metal ion, for example) is introduced in the appropriate ratio to be totally surrounded by the first function, and therefore isolated. This technique has been used to design bio-inspired heterogeneous catalysts containing metal ions such as Mn, Ru, Cu and Fe.

## **PHYSICAL PROPERTIES OF POROUS CARBON SHEET FROM POLY(2-CYANO-P-PHENYLENE TEREPHTHALAMIDE) FIBERS**

Youngho Eom, Byoung Chul Kim\*

a. Corresponding author: (bckim@hanyang.ac.kr)

The production of electrospun fibers has attracted considerable attention owing to the advantages for the creation of fibers with nano scale diameters. These ultra-fine fibers have a very high surface to volume ratio which makes it suitable for filtration, medical and textile applications. Although numerous groups have reported studies on electrospinning various materials and making porous sheets or membranes, there is little research on electrospinning para-aramid. In particular, poly(p-phenylene terephthalamide) (PPTA) is an attractive material for electrospinning as it has high tensile strength, thermal stability and liquid crystal properties. However, PPTA has very limited solubility due to its strong hydrogen bonding and stacking of benzene rings. To resolve the solubility problem, a cyano group was introduced to PPTA which is soluble in N-methyl-2-pyrrolidone with metal salts. We have electrospun poly(2-cyano-p-phenylene terephthalamide) (CY-PPTA) and produced porous carbon sheets by heat treatment. Further, we will investigate its morphology along with its physical properties.

## **ELABORATION AND CHARACTERIZATION OF FOAM GLASS BASED WASTE**

Sititi Nacira, Ayadi Azzedine  
a. Corresponding author: (lastiti@yahoo.fr)

The porous glass “foam glass”, is counted among the new glass products meeting certain requirements sought comfort in the building industry in particular (thermal and acoustic insulation). The production of foam glass based waste glass plays a very important role in environmental protection, and also gains in energy. As part of our work, we seek to improve the properties of glass to obtain a building material lighter with excellent insulation properties. The properties of foam glass are very dependent on the porosity and morphology. It is in this context that our proposed work to analyze the microstructure of the glass produced by scanning electron microscopy (SEM) and optical microscopy (OM) to be more precise on the size and shape of pores constitute our material.

## **STRUCTURAL AND SPECTROSCOPIC PROPERTIES OF $\text{TeO}_2 - \text{GeO}_2$ DOPED WITH $\text{Er}^{3+}$ IONS**

Yasemin Pepe, Murat Erdem, Gönül Özen  
a. Corresponding author: (yasmin.pepe8@gmail.com)

Tellurite glasses, compared with silicate, borate and fluoride glasses, have more advantages as photonic materials due to their superior physical properties such as low melting temperature, high dielectric constant, high refractive index, large third order non- linear susceptibility and good infrared transmissivity.[1-2] In this study,  $(90-x) \text{TeO}_2-10\text{GeO}_2-x\text{Er}_2\text{O}_3$  (mol%) ( $x=0,5$  and  $1$  mol%). glass materials were synthesised by melt-quenching. Powders of  $\text{TeO}_2$ ,  $\text{GeO}_2$  and  $\text{Er}_2\text{O}_3$  were mixed and melted in platinum crucible at  $870$  oC in air for 2 hours and then quenched on preheated stainless steel blocks and annealed at  $60$  oC for 24 hours. The optical properties studied by measuring the absorption and luminescence spectra at room temperature.

## **FUNCTIONALISED SPHERICAL SILICA PARTICLES WITH TUNEABLE INTERNAL STRUCTURE PRODUCED BY MEMBRANE EMULSIFICATION**

M. M. Dragosavac<sup>\*</sup>, G. T. Vladislavljević, R. G. Holdich

Chemical Eng. Dept., Loughborough Univ., Loughborough, Leicestershire LE11 3TU, UK

a. Corresponding author: (m.dragosavac@lboro.ac.uk)

A membrane emulsification method for production of monodispersed spherical silica particles using a water-in-oil emulsion route is reported. A hydrophobic microsieve-type membrane with 15  $\mu\text{m}$  pore size and 200  $\mu\text{m}$  pore spacing was used to produce droplets, with a mean size between 65 and 240  $\mu\text{m}$  containing acidified sodium silicate solution (with 4 and 6% wt.  $\text{SiO}_2$ ) in kerosene. After drying, the final silica particles had a mean size in the range between 30 and 70  $\mu\text{m}$ . The most uniform particles had a mean diameter of 40  $\mu\text{m}$  and coefficient of variation of 17%. The internal pore structure of the particles was controllable, depending on the solvent used to 'age' the particles before drying and calcination. The siliceous precursor was inexpensive and environmentally friendly sodium silicate. After the production particles were successfully functionalised to sorb copper from the water solution. Scale up of the process is possible if oscillating or pulsating membrane emulsification is applied.

## **ELABORATION OF CELLULAR LIGHTWEIGHT FIREBRICKS FROM ALGERIAN KAOLIN**

Khaled Boumchedda, Bahia Ghernouti, Azzedine Ayadi

a. Corresponding author: (boumchedda\_k@yahoo.fr)

Cellular lightweight refractory materials were developed starting from foamed slurry of water, formed of an Algerian kaolin, foaming agent, and mineral binder. The consolidation is performed at room temperature, by adding refractory cement which allows the transformation of foamed slurry into a rigid and stiff body that can be machined in the green state after drying. Sintering of samples which are rectified in form of a regular geometry gives interconnected cellular materials with a good pore size distribution. Various porosities were obtained with this novel method of elaboration of porous materials from 50 % to 90 % of vacuum, and various sizes of cells, from 1/100 mm to 1 mm. This way of elaboration of porous materials makes possible to envisage the final density with an acceptable precision. Indeed it is easy to calculate the density by knowing volume of the mould of casting, the content of dry matter, and the loss on the ignition, and the voluminal withdrawal which the sample undergoes during the heating. The structure in form of foam of cellular refractories having voids filled of air confers an high heat insulation to this porous refractory material, and offers a large industrial applications, such thermal insulators, filters.

## **USING OF PHOTOLUMINESCENT TILE FOR EVACUATION OF THE BUILDINGS DURING ELECTRICAL FAILURE**

Neslihan TAMSÜ<sup>1</sup>, Ayse TUNALI<sup>1</sup>

<sup>1</sup>Eczacibasi Building Products Co. Vitra Innovation Center Bozuyuk/Bilecik-Turkey  
a. Corresponding author (neslihan.tamsu@eczacibasi.com.tr)

Photoluminescent pigments could be successfully applied on the wall tiles, floor tiles and porcelain tiles as well as glass substrates (glass mosaics, borders, and cutted glass with various designs). For this applications, these products can be used for different purposes. In this study, these pigments are applied on the ceramic tiles and glass mosaics/tiles with traditional ceramic production line. These products are intended to provide guidance in the event of a power failure. With this study also aimed to prevent potential accidents and injury during evacuation of building.

## **DETERMINATION OF LEAD (II) SORPTION CAPACITY OF HAZELNUT SHELL AND ACTIVATED CARBON OBTAINED FROM HAZELNUT SHELL ACTIVATED WITH ZnCl**

Aziz ŞENCAN, Mehmet Kılıç, Mustafa KARABOYACI

Süleyman Demirel Univ. Eng. Faculty Environmental Eng. Dept.  
a. Corresponding author: (azizenscan@sdu.edu.tr)

Water pollution is one of the most important environmental pollution that affects human health. The need for clean drinking water is increasing day by day in consequence of population growth and increasing number of industrial firms. One of the reasons which cause water pollution is heavy metal ions result from production process.

In this study in order to remove heavy metals from aqueous media, activated carbon adsorption is used. Activated carbon is a unique absorbent with high surface area and pore structure which has the capacity of high adsorption performance in gas and solution phase. Nowadays, production of activated carbon from lignocellulosic agricultural waste products which has high carbon content is one of the common areas of researches. In this study the possibility of recycling the hazelnut shells to the activated carbon which occurs at the end of the hazelnut processing is researched.

For this purpose, hazelnut shells are activated thermally by pyrolysis in 250 and 700 °C and activated carbon is obtained through treating them chemical activation by using ZnCl<sub>2</sub>. The effects of treatment is determined by measuring surface area. In order to determine the adsorption capacity of produced activated carbons, Pb(II) adsorption capacity from aqueous solution is researched.

## **SYNTHESIS AND CHARACTERIZATION OF Pr<sup>3+</sup> DOPED YTTRIUM ALUMINUM GARNET (YAG) NANOPHOSPHORS**

Ceren Yılmaz<sup>1</sup> and Uğur Ünal<sup>1,2,3,a</sup>

1. Graduate School of Materials Sci. and Eng., Koc Univ., Istanbul, Turkey

2. Dept. of Chemistry, Koc Univ., Istanbul, Turkey

3. Koc Univ. Surface Science and Technology Center (KUYTAM), Koc Univ., Istanbul, Turkey

a. Corresponding author (ugunal.ku.edu.tr)

We have synthesized Pr:YAG nanopowders via modified sol-gel processes. First technique is citrate-nitrate method which involves nitrate salts of the metals and citric acid as chelating agent. Second process is Pechini method that requires introduction of ethylene glycol different than citrate-nitrate system. The formation process and structure of the phosphor powders were investigated by means of MS coupled TG-DTA, XRD and SEM. Thermal analysis revealed that both precursors contain nitrates, carbonates and unburnt carbon that were released before crystallization. Both methods yielded phase-pure YAG crystallites upon calcination at temperatures between 850-1200°C directly from the amorphous structure without any phase-transformations. However, YAG nanocrystals were obtained at lower calcination temperatures and with lower crystallite sizes by using Pechini system. The average primary particle size calculated was 16 nm for Pr(1%):YAG calcined at 850°C for 3 hours. In addition, photoluminescence characteristics of Pr:YAG powders were characterized. Production of transparent ceramics from these powders is under process. Transparent, polycrystalline Pr:YAG materials will be tested for lasing activity.

## **SPECTROSCOPIC PROPERTIES OF Nd<sub>3+</sub> :CdNb<sub>2</sub>O<sub>6</sub> PHOSPHORS**

Murat Erdem, Mete Kaan Ekmekçi, Ayhan Mergen, Gönül Özen, Baldassare Di Bartolo

a. Corresponding author: (merdem@marmara.edu.tr)

Rare earth (RE<sup>3+</sup>) doped luminescence materials are particularly attractive in photonic applications due to their fluorescence arising from the 5d → 4f or 4f→4f transitions. High purity, compositionally uniform, single phase and uniform particle size powders are required for high resolution and high luminous efficiency in the photonic device developments. In view of the nanotechnology, moreover, it should be pointed out that the selection of host lattices and active centers for such an optical material is important. So the host lattice of CdNb<sub>2</sub>O<sub>6</sub> may be doped, because it shows thermal and, chemical stability. In this study, we present here the results of a detailed investigation of the spectroscopic properties of the neodymium (Nd<sup>3+</sup>) doped cadmium niobates which were successfully prepared by the molten salt technique. Luminescence spectra and lifetime measurements of the powders doped with Nd<sup>3+</sup> ion were conducted in the wavelength-range of 850-1500 nm at different temperatures. Figure 1 shows that the concentration quenching occurred in high Nd<sup>3+</sup> ions doped powder. The decay curves show that as the Nd<sup>3+</sup> concentration increases the lifetime decreases in Fig. 2. This decrease in the decay patterns of high concentrations of Nd<sup>3+</sup> is likely due to the energy transfers between Nd<sup>3+</sup> ions.

## PHOTOCATALYTIC ACTIVITIES OF ZnO AND Pd-ZnO DOPED BY BOROHYDRIDE REDUCTION METHOD

Nuray Güy<sup>1,a</sup>, Mahmut Özacar<sup>1</sup>

1. Dept. of Chemistry, Art and Science Faculty, Sakarya Univ., 54187, Sakarya, Turkey  
a. Corresponding author (nurayg@sakarya.edu.tr)

In the present study, ZnO was synthesized by a simple and fast microwave assisted method. The Pd-doped on ZnO nano photocatalyst was carried out by borohydride reduction method. The Pd-doped and undoped ZnO nano photocatalysts were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM) and energy dispersive spectroscopy (EDS). Afterwards, the photocatalytic activities of the produced ZnO and Pd-ZnO were investigated using Basic Blue 17 (Toluidine Blue) photodegradation with UV lamp irradiation.

## SYNTHESIS AND CHARACTERIZATION OF ZSM-5 ZEOLITE FROM WHEAT HULL ASH

Pınar Terzioğlu<sup>1,a</sup>, Sevil Yücel<sup>2</sup>, and Mehmet Öztürk<sup>1</sup>

1. Muğla Sıtkı Koçman Univ., Faculty of Sciences, Dept. of Chemistry, Muğla, Turkey
  2. Yıldız Technical Univ., Faculty of Chemistry and Metallurgy, Dept. of Bioengineering, Istanbul, Turkey
- a. Corresponding author (pinarterzioglu@mu.edu.tr)

Wheat hull is an abundantly available residue from wheat milling industry which has an important value due to its silica content. The husks are generally burned in open air, thus bring serious pollution problems. It is necessary then, to utilize the silica of this agrowaste. The extraction of silica from natural sources such as rice hull, sugarcane bagasse and wheat hull is very simple and rapid. The extracted silica can be evaluated in many fields for production of silica based materials. Silica is one of the main raw material for zeolite production. Zeolites are micro-porous crystals that can be used in many fields ranging from adsorption to construction.

## **HYDROTHERMAL SYNTHESIS OF MODIFIED PHOSPHATE MATERIALS APPLICATION TO WASTEWATER TREATMENT**

Roumila Yasmina, Abdmeziem Kaïssa

Université USTHB, Faculté de chimie, Laboratoire d'Electrochimie-corrosion, Métallurgie et Chimie  
Minérale, BP 32 El Alia, Alger, Algérie

a. Corresponding author: (abdmeziemk@gmail.com)

In search of new porous compounds, the synthetic approach of silica based mesoporous materials has been extended to the non-silica based materials; among them metal- phosphates. In the last few years, the transition metal phosphate chemistry was extensively investigated with the aim of synthesizing new materials with a wide range of applications.

In the present contribution, we report, first, on the hydrothermal synthesis of transition metal phosphate materials, by using a cationic surfactant as a structure directing agent. The physicochemical characteristics of the as-synthesized materials were investigated by: powder X-Ray diffraction, chemical and thermal analyses, FTIR, scanning electron microscopy with EDX analysis, N<sub>2</sub> adsorption-desorption isotherms and UV-Visible diffuse reflectance measurements.

The influence of synthesis parameters, such as pH of the reaction mixture and crystallization temperature and time was studied. The adsorption behavior of the prepared materials was compared in the removal of phenol and methyl violet dye from aqueous solutions.

The results highlighted that the synthesized materials presented good adsorption efficiency either for one or the other pollutant. The effects of adsorption temperature and pH were investigated. The kinetic and thermodynamic studies were performed and models were applied to test the experimental data obtained from the different adsorbent/ pollutant systems.

## **REMOVAL OF CADMIUM FROM AQUEOUS SOLUTION ONTO UNTREATED COFFEE GROUNDS: A FIXED-BED COLUMN STUDY**

N. Azouaou, Z. Sadaoui and H.Mokaddem

Laboratoire de génie de la réaction, Faculté de génie mécanique et de génie des procédés, Université des sciences et de la technologie Houari - Boumediene, USTHB, BP n°32 El Alia bab ezzouar 16111 Alger, Algérie.

a. Corresponding author: (azouaou20@yahoo.fr)

Continuous fixed-bed column studies were carried out by using Untreated Coffee Grounds as an adsorbent for the removal of Cd(II) from aqueous solution. The effect of parameters like bed depths (75, 55 and 36 mm), flow rate (2, 3 and 5 mL/min), was investigated. The exhaustion time increased with increase of bed depth. The Adams–Bohart, Thomas and BDST models were applied to the adsorption under varying experimental conditions to predict the breakthrough curves and to evaluate the model parameters of the fixed-bed column that are useful for process design. The Thomas and BDST models were in good agreement with the experimental data. The Untreated Coffee Grounds column study states the value of the excellent adsorption capacity for the removal of Cd (II) from aqueous solution.

## **PHOTOCATALYTIC REMOVAL OF PHARMACEUTICAL POLLUTANTS BY ZnO NANOPARTICLES AND UV LIGHT**

Fatiha BENTAHAR<sup>1</sup>, Djilali TASSALIT<sup>1,2</sup>

<sup>1</sup>Université des Sciences et de la Technologie Houari Boumediene (USTHB), Faculté de Génie Mécanique et de Génie des Procédés, Laboratoire des Phénomènes de Transfert, Bab-Ezzouar, 16111 Algiers, Algeria.

<sup>2</sup>Solar Equipment Development Unit, UDES, Route Nationale n°11, BP386, Bou Ismaïl, 42400, Tipaza, Algeria

a. Corresponding author: (fbentahar@usthb.dz)

With industrialization and social development, environmental pollution caused by organic pollutants becomes one of the most important problems faced by all worlds. Most pharmaceuticals pollutants are toxic, long-lived, and highly resistant against degradation. Photocatalysis has received intensive attention because of its potential ability for eliminating the pollution in water and air while without causing additive damage to our environment. Under light irradiation, contaminations could be decomposed into non-toxic substance on the surface of photocatalyst.

In this work, the photocatalytic degradation of tylosin was studied using helical glass reactor of 2 m linear length and a volume of 0.8 L with a flowrate of 3.787 mL.s<sup>-1</sup> and a variable amounts of ZnO particles as catalyst from 0.05 to 0.5g.L<sup>-1</sup> under UV light irradiation of 24 W/m<sup>2</sup>. The effect of process parameters such as pH, catalyst loading and initial concentration of tylosin on the degradation was investigated. The degradation of tylosin was found to be effective in the neutral pH range. The optimum catalyst loading was observed at 0.10 g/L. The process followed first order kinetics and the apparent rate constant decreased with increase in the initial concentration of tylosin. The mechanism for the degradation of tylosin could be explained on the basis of Langmuir-Hinshelwood mechanism. The complete mineralization of tylosin was observed in the presence of ZnO. Removal efficiencies greater than 96% were obtained in all cases.

## **REMOVAL OF PHARMACEUTICAL POLLUTANTS WITH RAW AND OXIDIZED FORMS OF ACTIVATED CARBON**

Orthodoxia Kiteri, George Kyzas, Nikolaos Lazaridis, Eleni Deliyanni

a. Corresponding author: lenadj@chem.auth.gr

The adsorption of a pharmaceutical pollutant onto (i) raw porous activated carbon, and (ii) the oxidized counterparts of the carbon was examined for different time of oxidation, in order to estimate the effect of oxygen functional groups on adsorption. Graphite oxide was also examined as pramipexole adsorbent. The initial materials, those after surface oxidation and those after adsorption were characterized using adsorption of nitrogen (BET analysis), FTIR and Boehm titration. Batch experiments were conducted in order to study the effect of initial concentration, pH and temperature on the removal of pramipexole, which selected as pollutant (pramipexole is a novel dopamine agonist indicated for treatment of the signs and symptoms of idiopathic Parkinson's disease). Adsorption was pH-dependent, and the increase of temperature resulted in increase of adsorption, indicating the endothermic nature of the process. Typical isotherm models were tested and fitted well to describe the data. Oxidation was found to increase the adsorption on pramipexole due to a complex adsorption mechanism.

## INFLUENCE OF ZEOLITE LTA MORPHOLOGY ON THEIR BULK PROPERTIES

Tomaž Fakin<sup>1,a</sup>, Alenka Ristić<sup>1</sup>, Venčeslav Kaučič<sup>1</sup>

1. National Inst. of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia  
a. Corresponding author (tomaz.fakin@ki.si)

Among the most important parameters of powdered zeolitic materials are also bulk and tapped densities. These properties of powders can be controlled by changing the morphology of the zeolite crystals. Crystal sizes, particle size distribution and the shape of the crystals play an important role as well as they control the density of materials, flowability, permeability, etc. In the present study we investigated the influence of synthesis parameters such as the molar ratio of reactants, the preparation of the reactants, the crystallization time and temperature, the addition of crystallization seeds, the mixing of reaction gel, the gel aging and heating rate of reaction gel on the morphology of the as-synthesized zeolite LTA and consequently on their bulk and tapped densities.

## EFFECTS OF MODIFIED ZnO NANO POWDER ON THE MECHANICAL AND ANTICORROSION PROPERTIES OF POLYESTER POWDER COATINGS

B. Shirkavand Hadavand<sup>1,a</sup>, M. Ataefard<sup>2</sup>, H. Fakharzadeh Bafghi<sup>1,3</sup>

<sup>1</sup>Inst. for Color Science and Technology, Dept. of Resin and Additives, Tehran, Iran

<sup>2</sup>Inst. for Color Science and Technology Dept. of Printing Science and Theology, Tehran, Iran

<sup>3</sup>Peka Chemie Industrial Company, Research and Development Center, Tehran, Iran

a. Corresponding author (shirkavand@icrc.ac.ir)

In this study, the effects of modified Nano ZnO on thermal and anticrossion properties of polyester powder coating were studied. For achieving this, by twin screw extruder, polyester powder coating were prepared using Zinc Oxide (1, 3 and 5% w/w) Nano particles which modified by vinyl trimetoxo silane (VTMS) and triethoxy methyl silane (TEMS). Functionalized Nano particles were characterized by FT-IR and TGA. Thermal properties of polyester/nano ZnO powder coating were characterized by DSC and Gel time. Mechanical properties of polyester/nano ZnO powder coating were characterized by pendulum hardness, Impact and mandrel tests. Anticrossion properties were evaluated by salt spray methods. Morphology and dispersion state of particles in samples were studied by field emission scanning electron microscopy (FE-SEM). The results shown that the surface of Nano ZnO was modified in a acceptable form with good dispersion of nano particles in polymeric matrix. The mechanical and anticrossion properties of polyester/nano ZnO powder coating increased whit additional nano particles up 3 % w/w.

## **EFFECTS OF $KClO_3$ ON THE PORE SIZE OF ACTIVATED CARBON WHICH OBTAINED FROM ROSE WASTES**

Mustafa KARABOYACI<sup>1</sup>, Bahadır TAMA<sup>2</sup>, Aziz ŞENCAN<sup>1</sup>, Mehmet Kılıç<sup>2</sup>

<sup>1</sup>Süleyman Demirel Univ. Eng. Faculty Chemical Eng. Dept.

<sup>2</sup>Süleyman Demirel Univ. Eng. Faculty Environmental Eng. Dept.

a. Corresponding author: (mustafakaraboyaci@sdu.edu.tr)

Nowadays environmental damage of heavy metals is increasing and that becomes a big problem for human and human health. Especially after the industrial revolution, increasing of production and consumption materials, adversely affect the environment. Among all the pollutions, heavy metal is an important part. Because they are toxic or poisonous even at low concentration Therefore, treatment of heavy metals from aqueous media have great importance of environment.. The most widely used process is activated carbon adsorption for heavy metal adsorption from waste water. . Activated carbon can be produce from carbon containin substances

Turkey is an important rose oil producer of the world and Isparta is the most important rose production region of Turkey. In this study, activated carbon was obtained from rose crops of rose oil factories.

There are some activation methods for increasing surface area of carbon. In this study  $KClO_3$  was used for increasing carbons surface area. The thermal decomposition of  $KClO_3$  (potassium chlorate) generates  $KCl$  and  $O_2$  gas. Effects of  $O_2$  gas outlet on the pore size of activated carbon was studied. The surface characterization was examined with BET analysis and  $Pb^{+2}$  adsorption capacity of obtaining activated carbon was studied.

## **PLASMA SPRAYED AND ANNEALED CALCIUM TITANATE DIELECTRICS**

Jiri Kotlan<sup>1,a</sup>, Pavel Ctibor<sup>2</sup> and Zdenek Pala<sup>2</sup>

1. Czech Technical Univ. in Prague, Faculty of Electrical Eng.. Dept. of Electrotechnology, Prague, Czech Republic

2. Academy of Sciences of the Czech Republic, Inst. of Plasma Physics, Materials Eng. Dept., Prague, Czech Republic

a. Corresponding author (kotlaji1@fel.cvut.cz)

This paper studies self-supported  $CaTiO_3$  layers prepared by plasma-spraying technology. Water stabilized plasma gun WSP as well as conventional widely used gas stabilized plasma gun GSP were employed. For both methods of plasma spraying  $CaTiO_3$  in the form of powder with size 63–125  $\mu m$  was used. Self-supporting layers were obtained by removing the coating from metallic substrates. These specimens were annealed in air atmosphere up to 1170<sup>0</sup>C. Work is focused on dielectric properties of these specimens. Relative permittivity and loss factor were observed in frequency range 30 Hz to 30 MHz. Microstructure was studied by light microscopy, microhardness and X-ray diffraction. The work deals with influence of annealing on dielectric properties, crystalline structure and porosity of plasma deposited calcium titanate.

## HIGH CAPACITY CO<sub>2</sub> CAPTURE BY POROUS POLYMERS DESIGNED FOR PRE- AND POST- COMBUSTION CONDITIONS

Mert Atilhan

a. Corresponding author: (mert.atilhan@qu.edu.qa)

Efficient CO<sub>2</sub> scrubbing without a significant energy penalty remains an outstanding challenge for fossil fuel-burning industry where aqueous amine solutions are still widely used. Porous materials have long been evaluated for next generation CO<sub>2</sub> adsorbents. Porous polymers, robust and inexpensive, show promise as feasible materials for the capture of CO<sub>2</sub> from warm exhaust fumes. We report the syntheses of porous covalent organic polymers (COPs) with CO<sub>2</sub> adsorption capacities of up to 5616 mg/g (a world record - measured at high pressures, i.e. 200 bar) and industrially relevant temperatures (as warm as 65 °C). COPs are stable in boiling water for at least one week and near infinite CO<sub>2</sub>/H<sub>2</sub> selectivity is observed. Theoretical calculations refer to an amorphous extended framework as density is likely the main reason for exceptional CO<sub>2</sub> capacities. COPs 1-2 feature basic nitrogen sites that show chemospecific affinity towards acidic gases such as CO<sub>2</sub>. COP-3 has reasonably high surface area (418 m<sup>2</sup>/g), effective for low pressure operations. tuning their architecture, we show that COPs reach to 3 mmol CO<sub>2</sub>/g sorbent at 6 bar and 45 °C. High and low pressure capacities make these porous polymer structures viable alternatives to amine scrubbers.

## STRUCTURAL FACTORS DETERMINING THE OPERATING CONDITIONS OF PHOSPHONIUM-TYPE IONIC LIQUID-COATED POROUS METAL-OXIDES IN CATALYSIS

Volkan Balci, Aslı Akçay, Alper Uzun\*

Dept. of Chemical and Biological Eng., Koç Univ., 34450 Sarıyer, Istanbul

\*Corresponding author: (auzun@ku.edu.tr)

With their tunable physical/chemical properties, ionic liquids (ILs) have received tremendous attention in recent years. As one of the emergent application areas, porous metal-oxide supported metal catalysts are coated with ILs to achieve significant performance enhancements in terms of both catalytic activity and selectivity. However, one essential factor that limits the applicability of these IL-coated catalysts is limited thermal stability of ILs on porous metal-oxides. Although pure ILs are thermally stable at elevated temperatures (>500 K), they become less stable when they are interacting with metal-oxides. Such effects are governed by structural factors including those of both ILs and porous support materials. Here, thermogravimetric analyses were complemented with IR spectroscopy to systematically elucidate structural factors determining short- and long-term thermal stability of phosphonium-type ILs on commonly used porous metal-oxide supports (i.e., SiO<sub>2</sub>, γ-Al<sub>2</sub>O<sub>3</sub>, and MgO). Results illustrate that phosphonium-type ILs are thermally more stable on metal-oxides than imidazolium-type counterparts on same supports. Their thermal stability is influenced significantly by their interactions with metal-oxide. For instance, stability limit of tetrabutylphosphonium p-toluenesulfonate decreases from 670±10 to 530±10 K as metal-oxide changes from SiO<sub>2</sub> to MgO. This trend is valid for all phosphonium-type ILs tested, for which thermal stability decreases as follows: SiO<sub>2</sub>>γ-Al<sub>2</sub>O<sub>3</sub>>MgO.

## **DEVELOPMENT OF NANO-POROUS MATERIALS FOR THE PRODUCTION OF VACUUM INSULATION PANELS (VIPS)**

Yusuf YUSUFOĞLU, Sel Didem AKKOYUNLU, Nurseli UYANIK

a. Corresponding author: (yusuf.yusufoglu@arcelik.com)

Vacuum insulation panels (VIPs) offer extremely high thermal resistances properties that can enhance the energy efficiency of the insulating systems and provide savings in energy consumption. They are generally made with porous core materials wrapped, under vacuum, in airtight films. In the construction of VIP, core materials play a crucial role in thermal performance and mechanical properties of the insulation system. Core materials with higher porosity and smaller pore size have greater ability to maintain lower thermal conductivity. The main objective of this work is to develop nano-porous core materials that can be used as core insulation filler in VIPs with thermal conductivity of less than 4 mW/m.K. The nanoporous inorganic materials are developed using triblock self-assembled polymers (Pluronic® F127) as structure directing compounds. Pluronic forms nano-size micelles and have polar OH end groups that when assembled as a surface can provide slightly negatively charged sites for nucleation of the inorganic phase. After coating of the nano-size polymeric micelles with the inorganic phase, a porous structure is obtained when the polymer is removed from the inorganic-polymer composite by calcination. The porous materials that are developed in this study are analyzed by XRD, TEM, FTIR, TGA, BET and thermal conductivity analyzer.

## **ADSORPTION CHARACTERISTICS OF REACTIVE BLUE 19 FROM AQUEOUS SOLUTION ONTO MODIFIED COMMERCIAL ACTIVATED CARBON**

Şule ÜNAL<sup>a</sup>, Sunullah ÖZBEK and Belma ÖZBEK

Yıldız Technical Univ., Dept. of Chemical Eng., Davutpaşa Campus, 34210, Esenler/Istanbul, Turkey

a. Corresponding author (suunal@yildiz.edu.tr)

The aqueous effluents of the textile industry is one of the main sources with severe pollution problems. In the global dye market, reactive dyes have a share between 20-30%. Activated carbon (AC) is commonly used as adsorbent for dye removal because of its extended surface area. Recently, studies on the adsorption performance of AC have showed that the adsorption process is related to the pore size, pore structure and pore distribution. Thus, the main focus of researchers has become to develop surface modified carbons using different techniques such as acid treatment and heat treatment. The method of activation affects surface functional groups and pore structure of the activated carbon.

In this study, firstly, to enhance surface properties of commercial AC powder, the samples were modified separately by heat and acid treatment. Then, BET surface area analyser was used to compare the total surface area and the mesoporous surface area of modified AC with unmodified AC samples. Secondly, the adsorption rates of RB19 onto unmodified and modified AC samples were compared with each other at different pH, temperature, and the amount of AC. The adsorption rates were used to determine the appropriate isotherm model for the process.

## STRUCTURAL FACTORS DETERMINING THERMAL STABILITY OF IMIDAZOLIUM-TYPE IONIC LIQUIDS ON POROUS METAL-OXIDES

Aslı Akçay, Volkan Balci, Alper Uzun\*

Chemical and Biological Eng., Koç Univ., 34450 Sarıyer, Istanbul

a. Corresponding author (auzun@ku.edu.tr)

Recently, considerable efforts have been devoted to ionic liquids (ILs) for a variety of applications. In catalysis, porous metal-oxide supported metal catalysts are coated with ILs to tune their catalytic performances. Applicability of IL-assisted catalysts is restricted. Because, ILs have limited thermal stabilities especially when they are interacting with supports.

Here, porous metal-oxides with varying zero-point-charges (i.e., SiO<sub>2</sub>,  $\gamma$ -Al<sub>2</sub>O<sub>3</sub>, MgO) were coated with more than 30 different imidazolium-type ILs. Thermogravimetric analyses complemented with IR spectroscopy were performed to elucidate structural factors determining thermal stability of ILs on metal-oxides. Results show that interactions of ILs with porous metal-oxides significantly influence the thermal stability limits of pure ILs. For instance, 1-ethyl-3-methylimidazolium hexafluorophosphate [EMIM][PF<sub>6</sub>] is reported to be stable up to 755 K, however its thermal stability decreases to 495±10 K when coated on SiO<sub>2</sub>. Moreover, acidity level of metal-oxides affects the thermal stability significantly such that acidic ILs are thermally more stable on neutral/basic supports than on basic metal-oxides. For example, thermal stability of ILs with BF<sub>4</sub> anion decreases from 625±10 to 450±10 K as support changes from acidic SiO<sub>2</sub> to basic MgO.

Results given here can guide the selection of ILs for IL-assisted supported metal catalysts according to the application conditions.

## EFFECT OF CEMENT KILN DUST ADDITION ON THE MECHANICAL AND TRANSPORT PROPERTIES OF CONCRETE

Okan Karahan<sup>a</sup>, Erdoğan Özbay<sup>b</sup>, Khandaker M.A. Hossain<sup>c</sup>, Mohamed Lachemi<sup>c</sup>, C.D. Atiş<sup>a</sup>

<sup>a</sup> Civil Eng Dept., Erciyes Univ., Kayseri, Turkey

<sup>b</sup> Civil Eng Dept., Mustafa Kemal Univ., Iskenderun, Hatay, Turkey

<sup>c</sup> Civil Eng Dept., Ryerson Univ., Toronto, Ontario, Canada

a. Corresponding author (okarahan@erciyes.edu.tr)

This study presents the mechanical and transport properties of concrete containing cement kiln dust (CKD). Water-binder ratio of 0.45 and total binder content of 400 kg/m<sup>3</sup> were used. CKD was used in three different replacement levels from 5% to 15% by volume of either cement or sand. Compressive, flexural and split tensile strengths, water absorption, water porosity and rapid chloride ion permeability properties of CKD concrete was studied. The compressive strength and splitting tensile strength of CKD include concretes were determined according to ASTM C39 and ASTM C496 by using 100×200 mm cylinders, respectively. Water absorption, voids in hardened concrete and chloride ion permeability values of CKD included concretes were determined according to ASTM C642, ASTM C1585 and ASTM C1202 standards.

Laboratory results showed that strength properties did not significantly alter with the use of CKD replacement up to 15%. Even though the water absorption and porosity values of concrete amended ambiguously with use of CKD as a cement replacement, mentioned properties improved prominently as a use of CKD sand replacement. Use of CKD as a cement replacement in concrete production increased the chloride ion penetration, while use as a sand replacement did not significantly change chloride ion penetration.

## HETEROGENEOUS CATALYTIC DITHIOSYSTEMS FOR POLYMERIZATION OF 1,3-BUTADIENE

Fuzuli Nasirov, Nazil Janibayov

a. Corresponding author (fnasirov@petkim.com.tr)

Heterogeneous catalytic dithiosystems for polymerization of 1,3-butadiene 1,2Fuzuli NASIROV, 1Sevda RAFIEVA, 1Gulnara HASANOVA, 1Seymur SALMANOV, 1Nazil JANIBAYOV 1Inst. of Petrochemical Processes Azerbaijan National Academy of Sciences, 30, Khodjaly av., AZ 1025, Baku, Azerbaijan, 2Petkim Petrokimya Holding A.Ş., P.K. 12, 35800, Aliaga, Izmir, Turkiye, e-mail: fnasirov@petkim.com.tr The problems appeared in the synthesis of dithiophosphates of HY and HLaY zeolites by the reaction of their surface hydroxyl groups with phosphorus pentasulfide and synthesis of Ni-, Co-, Fe-, and Cr-containing dithio compounds on their basis are considered. Synthesized nickel- and cobalt-containing zeolite dithiophosphates as the heterogenized components in combination with aluminum organic compound (diethyl aluminumchloride) are highly active and selective catalysts for preparing of high and low molecular weights 1,4-cis-polybutadienes. Their productivities reach to 120.0-250.0 kg polymer/g Me•hour for cobalt catalysts and to 70.0-85.0 kg polymer/g Me•hour for nickel catalysts, that are much more than that in homogeneous cobalt- or nickel -containing catalytic dithiosystems which is 27-40 kg polymer/g Me•hour. Synthesized polymers are characterized with intrinsic viscosity of 2.0-2.8 dL/g (for cobalt catalysts), 0.85-1.1 dL/g (for nickel catalysts), and 1,4-cis content of 92-96% (for cobalt catalysts), 86-91% (for nickel catalysts).

## ANALYSIS OF THE GROWTH OF ALPHA-LACTALBUMIN PROTEIN NANOTUBES FUNCTIONAL FOR FOOD APPLICATIONS

Özgür Tarhan<sup>1,a</sup> and Şebnem Harsa<sup>1</sup>

<sup>1</sup>Izmir Inst. of Technology, Food Eng. Dept., Urla, Izmir, Turkey

<sup>a</sup>ozgurtarhan@iyte.edu.tr

**ABSTRACT:** Alpha-lactalbumin ( $\alpha$ -La), the second major protein in whey, produces nano tubular structures in the presence of calcium ions by self-assembly process after partial hydrolysis with *Bacillus licheniformis* protease. They promise functionality in some food applications with their gelation, viscosifying and encapsulation capabilities, besides some non-food applications eg. using as scaffolds for tissue engineering. The constructed  $\alpha$ -La nanotubes ( $\alpha$ -LaNTs) were regular hollow strands with uniform dimensions of about 20 nm in width and 1 micron in length, according to microscopy. Both intensity and apparent hydrodynamic radius increased along with nanotube growth. Calcium to protein concentration ratio affects critically nanotube formation and stability. As the protein concentration decreased, UV absorbance change was also decreased. The increased calcium concentration also increases absorbance values due to aggregation and turbidity. Stability increased with increasing protein concentration. The  $\alpha$ -LaNTs enhanced the gel formation with increased stiffness and viscoelasticity. These gels can be used for the entrapment of some bioactive materials and coloring agents for various food applications.

## SYNTHESIS and CHARACTERIZATION OF POLY(N-METHYL PYRROLE)- POLY(STYRENE SULFONIC

Timuçin BALKAN, Zeliha GULER, D. Ezgi AYDIN, A. Sezai SARAÇ

a. Corresponding author (timucinbalkan@hotmail.com)

Recently, electro conducting polymers have been actively studied because of their wide application in electronics, biomaterials and other industrials. Until now, the well-known electro-conducting polymers include polyacetylene, polythiophene, polyparaphenylene, polypyrrole (PPy) and its derivatives such as poly(N-methyl pyrrole) (PNMPy), etc. However, like many other conductive polymers, PNMPy suffers from limited processability, due to insolubility in common solvents, probably because of some degree of cross-linking and their highly conjugated bacbones. In order to improve its processability, many methods have been explored. Currently preparing hollow conducting polymer (CP) capsules has been of particular interest, owing to the expected improvement their processability and unique potential properties in encapsulation and high conductivity. A typical method for the preparation of CP's capsules relies on a template, such as polystyrene (PS) latex spheres, resin spheres, and emulsion. On removing the template, hollow CP's micro-nano spheres can be obtained. In this study, PNMPy-PSSA (polystyrene sulfonic acid) core-shell structures were synthesized and characterized successfully. PNMPy coating which is nanometers order on PSSA template was confirmed by SEM measurement. In addition to these, solvent effect on formation of PNMPy shell was investigated. We found that stronger shell can be obtained by changing solvent medium during the synthesis.

## STUDY OF CERAMIC PIGMENTS BASED ON $CE_xPR_xSM_xMG_{1-3x}AL_2O_4$ SYSTEM USING COMBUSTION SYNTHESIS

Ayman Awad Ali <sup>1,2,3,a</sup>, Bekir Karasu<sup>2</sup>, Mahmud Allazov<sup>3</sup>, Teymur Ilyasli<sup>3</sup>

<sup>1</sup>Benha Univ., Faculty of Science, Chemistry Dept., Benha, Egypt

<sup>2</sup>Anadolu Univ., Eng. Faculty, Materials Sci. and Eng. Dept., Eskisehir, Turkey

<sup>3</sup>Baku State Univ., Faculty of Science, Inorganic department, Baku, Azerbaijan

a. Corresponding author (pigment23@gmail.com)

Nanosize magnesium aluminates doped with cerium, praseodymium, samarium powders of the  $Ce_xPr_xSm_xMg_{1-3x}Al_2O_4$  system where ( $x= 0, 0.05$  and  $0.10$ ) were prepared by the combustion synthesis method using malonic acid dihydrazide as fuel at  $300^\circ C$  for 30 min. Yellow-orange colored nano-pigment was produced after annealing ash powders at  $800, 1000$  and  $1200^\circ C$  for 2h. Then, they were characterized by means of different techniques such as thermal analysis, x-ray diffractions, transmission electron microscopy, infrared spectroscopy and UV-visible spectroscopy. The colors of inorganic pigments were determined by diffuse reflectance spectroscopy employing CIE-L\*a\*b\* parameters method. Produced powders with different calcinations times were, afterwards, applied into a ceramic glaze. The effect of acids and bases on both pigments themselves and the pigmented glaze were also studied. The morphology of  $Ce_{0.1}Pr_{0.1}Sm_{0.1}Mg_{0.7}Al_2O_4$  system pigment calcined at  $1000^\circ C$  for 2 h by the transmission electron microscopy indicate the spherical and sheets with nanosize.

## PRODUCTION OF Mg-Fly Ash COMPOSITES BY POWDER METALLURGY

Rıdvan Yamanoğlu, Yekta Yavuz, Erdem Karakulak, Kemal Korucu, Muzaffer Zeren

a. Corresponding author (ryamanoglu@kocaeli.edu.tr)

In this study, magnesium powders with different ratios of ash particles obtained from Yatagan were prepared. The powder were mixed mechanically and consolidated by hot pressing under vacuum due to high oxygen affinity of magnesium. The sintering procedure was chosen as 550 oC for 5 minutes under 40 MPa. The density of obtained compacts were measured by Archimedes method. Hardness and wear properties of the sintered compacts were studied in detail. Microstructural characteristics were investigated by using optical microscopy and scanning electron microscope. Enhanced mechanical properties were obtained and discussed.

## NOVEL SANDWICH TRIPLE-DECKER DINUCLEAR ND<sup>III</sup>-(BIS-N,N'-P-BROMO-SALICYLIDENEAMINE-1,2-DIAMINOBENZENE) COMPLEX

Laila Hamdan Abdel-Rahman<sup>a</sup>, Ahmed Mohammed Abu-Dief<sup>a</sup>, Raúl Díaz-Torres<sup>b</sup>, Eva Carolina Sañudo<sup>b, a</sup> and Núria Aliaga-Alcalde<sup>c</sup>

<sup>a</sup>Chemistry Dept., Faculty of Science, Sohag Univ., 82524 Sohag, Egypt. <sup>b</sup>Departament de Química Inorgànica, Universitat de Barcelona, Diagonal 645, 08028 Barcelona, Spain. <sup>c</sup>ICREA-Institut de Ciència de Materials de Barcelona (ICMAB-CSIC), Campus de la UAB, 08193 Bellaterra, Spain

a. Corresponding author (lailakenawy@hotmail.com)

In the search of new multifunctional molecular materials, the present paper introduces the work performed with the Salen-type Schiff base: bis-N,N'-p-bromo-salicylideneamine-1,2-diaminobenzene (H<sub>2</sub>bsph), to attain novel coordination complexes containing lanthanides centers (Ln<sup>III</sup>). So far, our studies have shown that the combination in acetone of the well-known H<sub>2</sub>bsph ligand, a base and Nd<sup>III</sup>(NO<sub>3</sub>)<sub>3</sub>·6H<sub>2</sub>O, results in a yellow solid which crystalline forms has been suitable for X-ray diffraction studies. As a result, a novel Nd<sup>III</sup> system has been achieved, with formula [Nd<sub>2</sub>(bsph)<sub>3</sub>(H<sub>2</sub>O)]·2CH<sub>3</sub>Cl (**1**). The architecture of **1** encloses two metal centers inserted among three Schiff bases (2Nd<sup>III</sup>:3(bsph<sup>2-</sup>)) resembling a sandwich-shape, is a rare example of triple-decker coordination species with only few similar systems described in the literature. The magnetic properties of **1** have been examined as well as the luminescence activity; the latest was compared with H<sub>2</sub>bsph for better interpretation.

## INVESTIGATION ON THE EFFECTS OF INITIAL STRESS STATE OF POWDER PACKING ON MACROSCOPIC POWDER FLOW PROPERTIES

Saeed Albaraki, S Joseph Antony

a. Corresponding author (pmsmaa@leeds.ac.uk)

To measure the distribution of maximum shear stress inside powders stored initially under confined flow geometries using advanced photo stress analysis tomography (PSAT), flow profiles of powders using colour coding technique [1,2] and finding correlations between them. Method: Novel stress-responsive birefringent (sensor) powder (300 $\mu$ m-1000 $\mu$ m) has been developed in our laboratory and used for this study to measure the shear stress ( $t_{max}$ ) distribution within particles fed in conical hoppers. The macroscopic powder flow profiles have been visualised by applying colour coding technique. Results and discussion: In general, the magnitude of maximum shear stress within hopper increases for decrease in internal angle of opening. When the internal angle of the hopper geometry becomes higher,  $t_{max}$  tends to become more dominant towards the wall and much less in the middle region powder packing. The direction of the major principal shear stress was mostly along the direction of gravity for the smallest internal angle of opening. The dynamic flow profiles results are in full agreement with the PSAT results in general, and show clearly the effect of initial stress state of powders on dynamic flow properties. Conclusions: The study provides valuable links between microscopic stress fields to potentially macroscopic flow characterisation of particulate processes.

## LIGHT-EMISSION IN POROUS SiO<sub>2</sub>:C NANO-COMPOSITES

A.V. Vasin<sup>1</sup>, A. V. Rusavsky<sup>1</sup>, V.A.Tyortyh<sup>2</sup>, I.N. A.N. Nazarov<sup>1</sup>, V.S. Lysenko<sup>1</sup>

<sup>1</sup>Inst. of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine

<sup>2</sup>Inst. of Surface Chemistry, NAS of Ukraine, Kyiv, Ukraine

a. Corresponding author (andriyvasin@gmail.com)

White light emitting nano-composite material (SiO<sub>2</sub>:C) is one of new promising materials for artificial lighting and/or light indication devices as phosphor converting ultraviolet radiation into white light. The most advantages of this material are those: (1) spectral properties of the photoluminescence (PL) of por-SiO<sub>2</sub>:C can be tuned almost ideally to that of natural day light and (2) material does not contain heavy metal dopants. In present report the light-emitting carbon incorporated porous silicon oxide layers (por-SiO<sub>2</sub>:C) were fabricated by successive procedure of thermal treatment of porous silicon in flow of acetylene (in temperature range of 1100-1300 K) followed by oxidation in flow of wet argon in temperature range of 900-1000 K. The other type of nanostructured SiO<sub>2</sub>:C composites in form of powder were fabricated by successive chemical modification of fumed silica (specific surface area of 300 m<sup>2</sup>/g) with toluene solution of phenyltrimethoxysilane followed by calcinations at temperature up to 700 C in nitrogen flow. Correlations of fabrication conditions, local bonding structure and light emission properties were studied. It is demonstrated that white light emission is, most likely, associated with carbon nano-clusters incorporated in silica matrix.

## **STUDY OF METHYLENE BLUE REMOVAL FROM AQUEOUS SOLUTION BY THE NATURAL, PLENTIFUL AND LOW-COST BIOSORBENT DATES' PEDICELS**

Nardjes Guendouz, Hynda Yazid<sup>\*</sup>, Zahra Sadaoui

Laboratory of Reaction Eng., Faculty of Mechanical and Processes Eng. ,  
Univ. of Science and Technology Houari Boumediene,  
BP 32 El Alia Bab Ezzouar 16111, Algiers, Algeria.  
a. Corresponding author (yazhyn1@yahoo.fr)

The feasibility of dates' pedicels as a waste biomaterial for removing basic dye, (methylene blue) from aqueous solutions was investigated in this work using batch biosorption technique. studies were carried out as a function of average biosorbent particle size, pH, biosorbent dosage, contact time, initial dye concentration and temperature. The percentage of biosorption increases with an increase in the biosorbent dosage and the decrease of particle size. The equilibrium metal uptake was increased with an increase in the initial concentration. The maximum biosorption (97.6%) occurred at pH 4.5. The kinetic data obtained at different particle size, initial dye concentrations and different temperatures were analyzed using pseudo-second-order and intra-particle diffusion models. Biosorption kinetic data were properly fitted with the pseudo-second-order kinetic model. Equilibrium data were well interpreted by Langmuir model with maximum biosorption capacity of 54.05 mg g<sup>-1</sup>. Thus, this research highlights the potential of dates' pedicels as an effective biosorbent for the basic dye (methylene blue) removal of from aqueous media.

## **FRESH PROPERTIES OF SELF COMPACTING CONCRETE MADE WITH ARTIFICIAL COARSE FLY ASH AGGREGATE**

Hatice Öznur Öz, Mehmet Gesoğlu, Erhan Güneyisi

a. Corresponding author (oznuroz@gantep.edu.tr)

This study addresses an experimental program carried out to investigate the properties of self-compacting concretes (SCCs) in which natural coarse aggregates had been replaced by artificial fly ash coarse aggregates (AFCA). For this, a powder mixture of 90% fly ash and 10% portland cement by weight were pelletized in a tilted revolving pan through cold-bonded agglomeration at ambient temperature. A total of six concrete mixes including various AFCA replacement levels (0%, 20%, 40%, 60%, and 100%) were designed with a water-to-binder (w/b) ratio of 0.32. The concretes were tested for slump flow time, V-funnel flow time, L-box height ratio to determine the fresh properties such as filling ability, passing ability and segregation resistance of SCC. Compressive strength of hardened SCCs was also determined at 28 days of curing. It was observed that increasing the replacement level of AFCA resulted in decrease in the amount of superplasticizer to achieve a constant slump flow diameter. Although compressive strength of SCCs was decreased, passing ability and viscosity of SCCs enhanced with increasing the amount of AFCA in the concrete mix.

## **INVESTIGATION ON MANUFACTURABILITY, REPEATABILITY, AND MECHANICAL PROPERTIES OF LIGHTWEIGHT POLYLACTIC ACID BCC-Z CELLULAR LATTICE STRUCTURES FABRICATED BY FUSED DEPOSITION MODELING**

M.R Karamooz Ravari<sup>1,a</sup>, R. Rezaei<sup>1</sup>, M. Kadkhodaei<sup>1</sup> and M. Badrossamay<sup>1</sup>

1. Dept. of Mechanical Eng., Isfahan Univ. of Technology, Isfahan, Iran  
a. Corresponding author (m.karamoozravari@me.iut.ac.ir)

Cellular lattice structures are of high interest, due to their high strength in combination with low weight, and can be used in various industries such as aerospace and automotive. Besides, if a biocompatible material is utilized, these cellular structures can be employed for load bearing applications in tissue engineering. Accordingly, assessing their manufacturability, repeatability and mechanical properties are very important. In this paper, these issues are investigated for Polylactic Acid as a biocompatible and biodegradable material. A cellular lattice structure with more than 90% porosity is fabricated by fused deposition modeling (FDM) process. To do so, some benchmarks are designed and fabricated to find suitable manufacturing processing parameters as well as the structure dimensions. A number of fabricated cellular lattices are then tested in compression to obtain the force-displacement curves. These curves are very similar to each other with a good resolution indicating the repeatability of the mechanical properties of the manufactured structures. The elastic modulus of the built structure and its load-carrying capacity are found to be about 43 MPa and 150 kg respectively whereas its weight is about 5.2 gr. Accordingly, this paper suggests a method to fabricate strong and lightweight cellular lattice structures with a laboratory low cost FDM machine.

## **USAGE OF FLAME RETARDANT NANOPOWDER IN PAINTS**

Serdar YILDIRIM, Erdal ÇELİK, Emre Burak ERTUŞ

a. Corresponding author (serdaryildirim34@gmail.com)

Paints used in many areas of daily life are used with the aim of creating in surface protection and decorative designs of materials. These paints contain material susceptible to fire such as polymeric binders, organic solvents, and thus paints easily burn. In this study, flame retardant properties of huntite/hydromagnesite reinforced composite paints were investigated and developed using nanoscale powders. In this context, prior to the coating process, flame retardant powders were ground using nanogrinder system and their sizes were classified by particle size distribution machine. The composite coatings were obtained by adding different amounts of environmentally friendly (hologen-free) and nanosized flame retardant powders into paint material. These composite materials were characterized by XRD, XPS, DTA-TG, SEM, FTIR, scratch test and surface roughness. Candle flame test standards were also performed to examine flame retardant properties of these composite materials. The obtained results will be discussed.

## **SIMULATION OF FLOW THROUGH OPEN CELL COPPER FOAMS USING MICRO TOMOGRAPHY STRUCTURE**

MohamadZafari, MasoudPanjepour<sup>a</sup>, Mahmoud Meratian

Isfahan university of technology, Dept. of materials engineering, Isfahan, Iran  
a. Corresponding author (panjepour @cc.iut.ac.ir)

Due to the increasing metallic foams roll in industries, the need of simulating the fluid flow in metallic foams to understand the effect of parameters like porosity on the flow is increasing nowadays. Flow in porous media could be investigated from two approaches. In the first view the semi-empirical equations were used to obtain the mean value of variables. However, in the second one the equations were studied in macroscopic scale and the local value of the variables such as velocity and pressure were obtained. In this study, foams were simulated with 92 percent porosity. The geometry of these foams was obtained by using X-ray Computed Tomography (XCT). Impacting the fluid flow to the walls of media caused velocity to increase which had higher rate of increasing at the higher velocities. Finally the results were compared to the experimental data using Reynolds number. In this comparing there was high agreement (>99%) between the numerical calculations and experimental results. The equations showed that for Reynolds less than 1 the flow remains laminar.

## **PHOTOCATALYTIC ACTIVITY OF FILM STRUCTURES COMPRISING TITANIA XEROGEL IN POROUS ANODIC ALUMINA**

Oksana Linnik<sup>1</sup>, Makxym Zhukovskiy<sup>1</sup>, Nataliia Smirnova<sup>1</sup>, Eugeny Krutko<sup>2</sup>, Anatoly Kulak<sup>2</sup>, Nikolai Gaponenko<sup>3,a</sup>, Ahmed Asharif<sup>3</sup>, Liudmila Khoroshko<sup>3</sup>, Marina Meledina<sup>3</sup>, Taisia Orekhovskaya<sup>3</sup>, Viktor Borisenko<sup>3</sup>

1. O. Chuiko Inst. of Surface Chemistry National Academy of Sciences of Ukraine, General Naumov St. 17, 03164 Kyiv, Ukraine
2. Inst. of General and Inorganic Chemistry, Surganova 9/1, 220072 Minsk, Belarus
3. Belarusian State Univ. of Informatics and Radioelectronics, P. Browka 6, 220013 Minsk, Belarus  
a. Corresponding author (nik@nano.bsuir.edu.by)

A honey-comb structure of porous anodic alumina with a tailor-made size of meso- or macropores is considered as a template for photocatalytic coating. Sol-gel derived titania in porous anodic alumina film has been demonstrated as an efficient photocatalytic coating. Its photocatalytic performance in an aqueous solution after calcination at 400 °C correlates with the size of the pores and the thickness of the porous alumina film. Strong photocatalytic activity for the porous alumina films of 1.5 μm thickness with a size of the pores of 60-70 nm after deposition of the titania xerogel is reported.

## FABRICATION OF SCAFFOLD FOR CARTILAGE WITH SUBCHONDRAL BONE REGENERATION BY LAMINATION OF HYDROXYAPATITE/COLLAGEN NANOCOMPOSITE AND COLLAGEN

S.Oshima<sup>1,2</sup>, K.Ozeki<sup>2</sup> and M.Kikuchi<sup>1,a</sup>

1. Biomaterials Unit, Nano-Life Field, International Center for Materials Nanoarchitectonics, National Inst. for Materials Science, Japan
2. Dept. of Mechanical Eng., Ibaraki Univ., Japan
- a. Corresponding author (KIKUCHI.Masanori@nims.go.jp)

**ABSTRACT:** A laminated scaffold with chondral and subchondral parts was fabricated with type-I collagen sponge and hydroxyapatite/collagen bone-like nanocomposite (HAp/Col) sponge. The HAp/Col sponge was prepared by gelation, freezing and lyophilization of the HAp/Col sol, a mixture of the HAp/Col fibers, phosphate buffered saline and collagen sol. A laminated scaffold was prepared by placing the HAp/Col sponge (sponge-sol method) or the HAp/Col sol (sol-sol method) on collagen sol followed by the same procedure for preparing the HAp/Col sponge. The scaffold was then dehydrothermally cross-linked. The microstructures of scaffolds were observed with a scanning electron microscope (SEM). Mean pore diameter of the scaffold was measured by the line-intercept method using SEM photos. The ultimate tensile strength (UTS) of the scaffold in PBS-wet condition was measured with a texture analyzer. The bonding part of the scaffolds seemed to be well unified. Mean pore diameters of the HAp/Col and collagen parts were  $75\pm 3$  and  $85\pm 4$   $\mu\text{m}$  for the sponge-sol method, and  $114\pm 10$  and  $76\pm 9$   $\mu\text{m}$  for the sol-sol method. The UTS of the scaffolds were  $8.3\pm 1.5$  kPa for the sponge-sol method and  $6.6\pm 2.2$  kPa for the sol-sol method. These results suggested that the laminated scaffold materials are expected to be good osteochondral regeneration scaffold.

## NICKEL REMOVAL BY USING IMMOBILIZED MACRO FUNGUS: BATCH BIOSORPTION STUDIES

Tamer Akar<sup>1</sup>, Sema Celik<sup>2</sup>, Asli Gorgulu Ari<sup>3</sup>, Sibel Tunali Akar<sup>1</sup>

<sup>1</sup>Dept. of Chemistry, Faculty of Arts and Science, Eskisehir Osmangazi Univ., 26480 Eskisehir, Turkey

<sup>2</sup>Dept. of Chemistry, Graduate School of Natural and Applied Sciences, Eskisehir Osmangazi Univ., 26480 Eskisehir, Turkey

<sup>3</sup>Dept. of Elementary Education, Faculty of Education, Yildiz Technical Univ., 34210 Istanbul, Turkey  
a. Corresponding author (sema.celik.87@hotmail.com)

**ABSTRACT** Heavy metal contaminated waters serious damage in the environment and living organisms. In recent years, biosorption is a considerable alternative process for the treatment of the heavy metal bearing effluents. Biosorption can be defined as the removal of different pollutants from aqueous media by biological materials. It is an attractive technology with the advantages of low cost, high yield and easily available of biomasses. In the present study, macro fungi *Lactarius salmonicolor* was immobilized in the silica gel matrix and successfully used for the removal of nickel ions from aqueous media. Operating conditions were optimized as functions of initial pH, agitation time, sorbent amount. Biosorption performance of the biomass continuously increased in the pH range 2.0–8.0. The coverage of the biosorbent surface by silica gel resulted in a significant increase in biosorption yield of nickel ions. The highest nickel loading capacity was obtained as  $114.44$   $\text{mg g}^{-1}$  using a relatively small amount of immobilized biosorbent. Biosorption equilibrium time was recorded as 5 min. As a result, Silica gel immobilized biomass of *L. salmonicolor* is suggested as a low cost and potential biosorbent with high biosorption capacity for the removal of nickel ions from contaminated solutions.

## **MORPHOLOGY OF MICELLES AND MICELLAR AGGREGATES AS A FUNCTION OF ELECTROLYTE VALENCE AND CONCENTRATION**

Aybike Nil Olcay<sup>1</sup>, Mehmet Polat<sup>2</sup> and Hurriyet Polat<sup>3,a</sup>

1. Izmir Inst. of Technology, Dept. of Environmental Eng., Izmir, Turkey
  2. Izmir Inst. of Technology, Dept. of Chemical Eng., Izmir, Turkey
  3. Izmir Inst. of Technology, Dept. of Chemistry, Izmir, Turkey
- a. Corresponding author (hurriyetpolat@iyte.edu.tr)

Micellar structures are becoming increasingly important in numerous applications from drug delivery to waste treatment. Morphology of these structures are extremely important in the applicability and the outcome of these applications. Despite this, the literature is still not very clear on how the micelle formation takes place and the aggregation behavior of the formed micelles with changing solution conditions. In this study, micelle development and micellar interactions in the presence of electrolytes of varying valence and at a wide electrolyte strength spectrum for model cationic, anionic and non-ionic surface active agents were studied. The surface tension, micelle size distribution and electrokinetic potentials were the main parameters studied. It was shown that the association behavior of surfactant molecules, size and charge of the micelles or the micellar aggregates is strongly affected by the valence and the strength of the electrolyte in solution for ionic surfactants.

## **INTEGRATED USE OF STEEL MAKING SLAG IN THE PRODUCTION OF CLINKER AND CEMENT**

Mastura Iskandarova<sup>a</sup>, Zariybay Pulatov  
a. Corresponding author (ionxanruz@mail.ru)

We studied the composition and properties of recycled steel slag - as components of cement raw mixes and active mineral additives to the cement in order to conserve natural resources, raw materials, waste management, improvement of industrial ecology, reducing the cost of the wedge and cement. Established the possibility of using recycled steel slag as a component of cement raw mix of two- and three-component cement raw meal. It was revealed that during the firing of new raw mix and mastering process decarbonization lime is intensive with a full binding of clinker minerals. The process ends with clinker at 1350-1420°C. The structure of the clinkers equigranular, alite and whitens as plate, oval, prismatic, round and irregular shapes of grains, have a clear crystallization. Active hydraulic cements synthesized clinkers (41,8-42,6 MPa) provides brand "400". Replacing 15-20% of the clinker component recycled steel slag does not reduce the type of cement.

## PRODUCTION OF COPPER FOAM BY CARBAMIDE SPACE HOLDER

Mohammad HoseinShahzeydi<sup>1</sup>, MasoudPanjepour<sup>1,a</sup>

1. Isfahan university of technology, Dept. of materials, Isfahan, Iran  
a. Corresponding author (panjepour@cc.iut.ac.ir)

Today metallic foams have known as one of the most widely used materials in the aerospace industries. Characteristics such as high thermal conductivity, low density and good specific strength caused that manufacturing methods of foams expand which one of these methods is powder metallurgy. In this study the production and characterization of copper foam by method of powder metallurgy using carbamide space holder were investigated. However for production of copper foam with different porosity of 50, 60 and 70 vol. %, the powder mixture of copper- carbamide(with different value of carbamide) were compressed under 300 MPa. Then the prepared samples were sintered at 800 °C for 2 hrs. After removing of carbamide from samples during sintering process the pore structure in the copper foam studied by optical microscopy. Finally the result of quantity evaluations were shown that the volume percent, distribution and size of pores in the copper foam strongly were depended to value and size of carbamide in initial powder mixture.

## USE OF METAL DOPED ZSM-5 ZEOLITE CATALYSTS IN METHYLATION OF 2-METHYLNAPHTHALENE

ÜmitSerdar Erol<sup>1</sup>, Mustafa Güllü<sup>2</sup>and Ali Karaduman<sup>1,a</sup>

1. Ankara Univ., Faculty of Eng., Chemical Eng., Ankara, Turkey
2. Ankara Univ., Faculty of Science, Chemistry, Ankara, Turkey  
a. Corresponding author (karaduman@ankara.edu.tr )

2,6-Dimethylnaphthalene (2,6-DMN) is produced with methylation of 2-methylnaphthalene (2-MN). 2,6-Dimethylnaphthalene (2,6-DMN) is a significant compound for polyethylene naphthalate (PEN) which is new polyester. When compared with polyethylene terephthalate (PET), PEN has better qualities. For production of 2,6-Dimethylnaphthalene various medium and large-pore zeolite catalysts can be used in the fixed-bed flow reactors. The main question of 2,6-DMN production is to develop a catalyst with high selectivity to 2,6-DMN at acceptable conversion of 2-MN. One of these zeolites which is commonly used as catalyst catalysts is ZSM-5. In this work, the methylation of 2-MN over Ni, Fe and Pd doped ZSM-5 zeolite catalysts were investigated. 2-MN, methanol and 1,3,5-trimethylbenzene mixture (1:5:5 molar ratio) were fed into a fixed-bed flow reactor in all experiments. Effects of temperature and weight hourly space velocity (WHSV) on 2-MN conversion were examined. The experiments were carried out at a temperature ranging from 200 to 450 °C and WHSV ranging from 1 to 3 h<sup>-1</sup>. The liquid products were analyzed using the GC-MS in MSD (Mass Selective Detector) with Rxt-5 MS Column.

## **DIRECT EFFECT OF NANOCRYSTALLINE IRON AND NICKEL OXIDES ON STRUCTURAL, TEXTURAL AND CATALYTIC PROPERTIES OF MESOPOROUS ZrO<sub>2</sub>**

Mohamed Mokhtar Mohamed Mostafa, Tarek T. Ali, Narasimharao Katabathini, Tamer Said, Sulaiman Basahel, Shaeel Al-Thabaiti  
a. Corresponding author (mmokhtar2000@yahoo.com)

Nano crystalline iron and nickel supported mesoporous ZrO<sub>2</sub> catalysts were prepared and thermally treated at 500 °C. The physicochemical properties of materials were determined using XRD, TEM, Raman, N<sub>2</sub> physisorption, TPR and TPD techniques. The efficacy of the supported catalysts for catalyzing the benzoylation of benzene using benzyl chloride has been studied. The reaction proceeded to afford diphenylmethane in high yields. The ZrO<sub>2</sub> alone in the absence of iron and nickel oxides showed little catalytic activity. Comparing the activities of ZrO<sub>2</sub> supported iron oxide (10 wt.% and 20 wt.%) and nickel oxide (10 wt.% and 20 wt.%) catalysts, the iron oxide supported ZrO<sub>2</sub> catalysts offered higher yields. The characterization results showed that ZrO<sub>2</sub> sample is mesoporous with a mixture of monoclinic and tetragonal phases. The loading of the iron and nickel oxides led to phase transformation of ZrO<sub>2</sub> into cubic phase. X-ray diffraction peaks due to iron oxides were not observed in iron oxide supported samples; in contrast, presence of segregated NiO phase was observed in case of nickel oxide supported ZrO<sub>2</sub> samples. Higher activity of iron supported ZrO<sub>2</sub> catalyst is attributed to presence of greater degree of dispersion of iron oxide over ZrO<sub>2</sub>, redox potential and higher surface acidity.

## **HYDRAULIC CONDUCTIVITY AND SUCTION CHARACTERIZATION OF GÖRDES ZEOLITE BLOCKS**

Seda Durukan<sup>1,a</sup>, Arif Ş. Kayalar<sup>2</sup> and Ender Başarı<sup>3</sup>

1. Celal Bayar Univ. MOSB MYO, Construction Technology, Manisa, Turkey
2. Dokuz Eylül Univ. Eng. Faculty, Civil Eng., Izmir, Turkey
3. Celal Bayar Univ. Eng. Faculty, Civil Eng., Manisa, Turkey  
a. Corresponding author (seda.durukan@cbu.edu.tr)

Zeolite is a favorable micro-porous material in many industrial applications as commercial adsorbents, e.g., agriculture, radioactive cleanup, water, air, gas and wastewater treatment, mining and landfilling applications, etc. Zeolites are usually defined by their porosities, pore size distributions and adsorption capacities. However, depending on the developing studies regarding zeolites, more characterization knowledge is needed. In instance, lately, zeolite bentonite mixtures are offered for use of liner materials. In this study, the hydraulic conductivity and suction characteristics of block zeolite (Clinoptilolite) samples from Gördes, Manisa, Türkiye is identified. When studying with a porous material, it's very critical to know the hydraulic conductivity and the suction characteristics of the porous grain itself. In this regard, block samples of 5 cm in diameter with varying heights were subjected to falling head type hydraulic conductivity tests after CO<sub>2</sub> permeation through the blocks in order to prevent trapped air formation. The suction characteristics were also determined on compacted zeolite samples of 4 cm in diameter for varying grain sizes in addition to zeolite blocks by using filter paper method with Whatman No.42 filter papers. The results are drawn and discussion is presented.

## CEMENT-BASED COMPOSITES MODIFIED LOW BASIC CLINKERS

Gulrukh Begjanova<sup>1</sup>, Atabek Begjanov<sup>1</sup>, Sayibjan Negmatov<sup>1</sup>, Nigmat Ruziev<sup>1</sup>

1. State Unitary Enterprise "Fan va Taraqqiyot", Tashkent State Technical Univ., Uzbekistan  
a. Corresponding author: (polycomft2005@rambler.ru)

In work are presented results of the studies on revealing the regularities physico-chemical conversions in raw materials mixture under their heat processing, the sequence of the process of the formation clinker mineral on comparatively lowtemperature to stage. To account of the high reactionary ability raw materials mixtures process is terminated at the 1350<sup>0</sup> that on 100<sup>0</sup>C lower, the temperature burning traditional raw materials charge. Clinker are a product dominating of the composition, on their shaping in determined degree affects the condition of the cooling: water cooling promotes the stabilizations of the structure high temperature forms 2s. Due to more high contents C<sub>3</sub>A and S<sub>4</sub>AF cements create the optimum structure, providing strong artificial conglomerate. The Installed dependency "composition-structure-toughness".

Is it For the first time designed efficient compositions binding composition, on toughness not yielding traditional portland cement, by introductions to composition at grind additives from. The Revealed regularities corroletsion dependencies "composition - a structure - a characteristic" when repeating over and over again designed composition.

## STRUCTURAL AND PHOTOLUMINESCENT PROPERTIES OF CeO<sub>2</sub> AND Eu<sup>3+</sup>/Sm<sup>3+</sup> DOPED CeO<sub>2</sub> NANO POWDERS PREPARED BY SOL-GEL METHOD

<sup>1,2,\*</sup>Serdar Yildirim, <sup>2,3</sup>Tuncay Dikici, <sup>2,4</sup>Ozlem Oter, <sup>2,4</sup>Kadriye Ertekin, <sup>1,2</sup>Erdal Celik

<sup>1</sup>Dokuz Eylul Univ., Metallurgical and Materials Eng., 35160 Izmir, Turkey

<sup>2</sup>Dokuz Eylul Univ., Center for Fabrication and Application of Electronic Materials (EMUM), 35160 Izmir, Turkey

<sup>3</sup>Izmir Katip Celebi Univ., Materials Sci. and Eng., 35620 Izmir, Turkey

<sup>4</sup>Dokuz Eylul Univ., Faculty of Sciences, Dept. of Chemistry, 35160 Izmir, Turkey

a. Corresponding author (serdaryildirim34@gmail.com)

CeO<sub>2</sub> is a well known functional material for electronic and electrochemical functional devices, ion conducting and ion storage layers and luminescence based applications [1, 2]. In this study, CeO<sub>2</sub> and Eu<sup>3+</sup>/Sm<sup>3+</sup> doped CeO<sub>2</sub> nanostructures were prepared by sol-gel process. The produced particles were grinded to nanoscale and particle size distribution was controlled by Zetasizer (ZS-90). The phase analysis and elemental analysis were performed by X-Ray Diffraction (XRD) and X-Ray Photoelectron Spectroscopy (XPS) instruments, respectively. The surface morphology and area were identified exploiting scanning electron microscopy (SEM) and BET Surface Area Analyzer. Thermal behavior of the produced nano particles was investigated by Differential Thermal Analysis (DTA) and Thermo Gravimetric Analysis (TGA) approaches. The structural analysis was supported by Fourier Transform Infrared Spectroscopy (FTIR) measurements. Luminescent properties of the produced nanoparticles were investigated by steady state and time resolved fluorescence spectra. Our preliminary test results show that CeO<sub>2</sub> is a good host material for rare earth ions doping and sol-gel process is a useful method to derive high quality pure and doped CeO<sub>2</sub>.

## **THE DISTRIBUTION ANALYSIS OF ALUMINUM AND TiH<sub>2</sub> POWDERS IN THE POWDER METALLURGY FOAMING PROCESS**

Alpay Tamer ERTÜRK<sup>1,a</sup>, Tülin Şahin<sup>2</sup>

<sup>1,2</sup>Kocaeli Univ., Mechanical Eng. Dept., Umuttepe Campus, 41380 Izmit, Turkey  
a. Corresponding author (tamererturk@gmail.com)

Titanium hydride takes place the source of pure hydrogen for foaming aluminum in powder metallurgy route. The regular mixture of aluminum powder and TiH<sub>2</sub> particles is regarded as a parameter that directly effect on the final aluminum foam product. This research was aimed at determining the mixing parameters that give optimal powder homogeneity. In order to analyze the conditions of the best distributions as a function of mixing time and speed, the titanium hydride powder was mixed with specified amounts of aluminum powders to reach the targeted composition. After the mixing processes optical microscope images were taken with 100 and 200 magnifications. The distributions of average particle size, the aspect ratio and the distribution ratio of titanium hydride particles were analyzed and graphically illustrated by the Clamex-Captiva image capturing and measuring software on the images. After conducting the distribution analysis, we concluded that the mixing process should be carried out with 90 rev/min stirring rate and 90 or 120 min periods to obtain the best particle distribution.

## **THE DETERIORATIONS ON BUILDING STONES USED IN HISTORICAL SULTANHANI CARAVANSARY (AKSARAY, TURKEY) DUE TO FREEZING AND SALINIZATION RELATED TO CAPILLARITY AND MOISTENING EFFECTS**

Mustafa Yıldız<sup>1</sup>, Ali Sinan Soğancı<sup>1</sup>, Emine Yıldız Kuyrukçu<sup>1</sup>

1. Selcuk Univ., Eng. and Architecture Faculty, Campus, Konya-TURKEY  
a. Corresponding author (musyildiz@selcuk.edu.tr)

Salt and ice crystallization due to capillarity and moistening cause the natural stone buildings to have significant physical damages whose effect can be observed inside the building stone during the crystallization period. The building materials of marlstone and andesitic tuff have been used in constructing the historical tall buildings of Seljuks and Ottoman Periods due to their easy workability characteristics. However, these materials deteriorate rapidly under external atmospheric conditions. In this study, the deteriorations observed on the building materials of Sultanhanı Caravansary (constructed in 1225 in Seljuks period) due to freezing and salinity effects by the aid of capillarity and moistening were investigated. First of all, the density, bulk density, capillary water absorption tests were performed on the building materials to determine their physical characteristics such as capillary water absorption coefficient, porosity, capillary porosity and water content under capillary saturation, etc. There were performed tests to determine the resistance of the specimens saturated with capillary water against natural freezing effects. Additionally, the deteriorations encountered on the building stones due to salinity were also investigated.

## **SOL–GEL SYNTHESIS AND CHARACTERIZATION OF BARIUM HEXAFERRITE (BAFe<sub>12</sub>O<sub>19</sub>) AS A RADAR ABSORBING MATERIAL**

E. B. Ertuş<sup>1,2,a</sup>, S. Yildirim<sup>1,2</sup> and E. Çelik<sup>1,2</sup>

1. Dokuz Eylül Univ., Metallurgy and Material Eng., Buca, Izmir, 35160, Turkey

2. Dokuz Eylül Univ., EMUM Electronic Materials Production and Application Centre, Buca, Izmir, 35160 Turkey

a. Corresponding author (burakertus@gmail.com)

Novel studies were carried out about electromagnetic absorber materials, because electromagnetic absorber materials can be used various special areas such as electromagnetic interference shielding and reduction of radar cross section in military applications. Barium hexaferrite powders have been investigated as a material for permanent magnets, microwave absorber devices, recording media. Barium hexaferrite is widely used due to its high stability, excellent high frequency response, narrow switching field distribution and the temperature coefficient of the coercivity in various applications.

In this study, pure and La and Ti doped BaFe<sub>12-x</sub>(La,Ti)<sub>x</sub>O<sub>19</sub> powders were prepared by sol-gel processing for radar absorbing applications. In the first step of the processing to evaporate water from the solution, it was heated to 80 °C for 5 hours in air. In order to obtain dried gel, it was heated 200 °C for 1 hours. The produced powders were subsequently calcined at 500 °C and 850 °C for 1 hour and sintered at 1200 °C for 1.5 hours to obtain the required phases. The produced powders were characterized through DTA-TG, XRD, XPS and SEM. After BaFe<sub>12</sub>O<sub>19</sub> powders were produced they were mixed with paint to obtain radar absorbing nanocomposite materials. The produced nanocomposites were characterized through vibrating sample magnetometer (VSM), and microwave vector network analyzer to investigate the magnetic properties and complex electromagnetic parameters. The obtained results were discussed in detail.

## **SOL–GEL SYNTHESIS AND CHARACTERIZATION OF Sr<sub>4</sub>Al<sub>14</sub>O<sub>25</sub>:Eu<sup>2+</sup> Dy<sup>3+</sup> POWDER FOR AFTERGLOW PAINTING APPLICATIONS**

E. B. Ertuş<sup>1,2</sup> and E. Çelik<sup>1,2</sup>

<sup>1)</sup> Dokuz Eylül Univ., Metallurgy and Material Eng., Buca, Izmir, 35160, Turkey

<sup>2)</sup> Dokuz Eylül Univ., EMUM Electronic Materials Production and Application Centre, Buca, Izmir, 35160 Turkey

a. Corresponding author (burakertus@gmail.com)

Long persistent phosphors are phosphors that have very long afterglow emission or phosphorescence, in some cases even longer than a whole day. Afterglow is caused by trapped electrons or holes produced during the excitation. Long persistent phosphors are also called long lasting or long afterglow phosphors. Long lasting phosphors are a type of energy storage material, which can absorb both ultraviolet (UV) and visible light from the sunlight and gradually release the energy in the darkness at a certain wavelength. Recently, increasing attention has been paid to strontium aluminates doped with rare-earth metal ions, due to their excellent properties such as high quantum efficiency, long persistence of phosphorescence and stability, as well as the fact that they are environmentally friendly. In this study, rare earth elements doped Sr<sub>4</sub>Al<sub>14</sub>O<sub>25</sub>:Eu<sup>2+</sup> Dy<sup>3+</sup> powders were prepared by sol-gel processing for afterglow painting applications. In order to obtain powder, sol-gel method processes carried out step by step. Started from a colloidal solution which obtained from suitable precursors as the source of metal ions and heat treatment processes applied. The produced powders were finally calcined with atmosphere controlled furnace to obtain the required phases. The produced powders were characterized through DTA-TG, XRD, XPS and SEM. Fluorescence spectrophotometer were used to investigate the luminescent properties of the Sr<sub>4</sub>Al<sub>14</sub>O<sub>25</sub>:Eu<sup>2+</sup> Dy<sup>3+</sup>. The obtained results were discussed in detail.

## **PREPARATION AND CHARACTERIZATION OF NANOSIZED NiCo/Al<sub>2</sub>O<sub>3</sub> CATALYSTS PREPARED BY POLYOL METHOD FOR PARTIAL OXIDATION OF METHANE**

Tuğçe Çınar<sup>1</sup>, Tuba Gürkaynak Altınçekiç<sup>1,a</sup>, M.Ali Faruk Öksüzömer<sup>1</sup>

1. Dept. of Chemical Eng., Istanbul Univ., 34320, Istanbul, Turkey  
a. Corresponding author (tubag@istanbul.edu.tr)

Methane is referred to be the most significant source of hydrocarbon as it is the major component of natural gas and natural gas exists on earth profusely. Even though noble metals are relatively stable and active in catalytic partial oxidation process[1], high cost and limited access to those metals made Ni and Co based catalysts as best alternative in catalytic partial oxidation of methane. In order to improve these problems, in contradistinction to traditional catalyst preparing methods Ni-Co bimetallic catalysts were successfully prepared by polyol method on alumina support in the presence of protecting agent. CoNi alloy particles as a ferromagnetic metal-based materials were synthesized via polyol process [2] but the reduction of Ni(Ac)<sub>2</sub> and Co(Ac)<sub>2</sub> in ethylene glycol for the preparation of spherical bimetallic nickel-cobalt nanoparticles supported on  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> as a catalyst has not been studied. The crystal structure was determined by X-Ray diffractogram. The results indicate that the NiCo (fcc) phases are dominant. Also in terms of characterization studies of those catalysts TG-DTA, HRTEM, BET, TPD and AAS analysis will be performed. The activity, selectivity and stability tests of catalysts for partial oxidation of methane will be made on GC-Micro-reactor System existing in our laboratories.

## **EVALUATION OF MAGNESIUM-ALUMINUM METASILICATE AND SILICA CARRIERS FOR IMPROVING ORAL BIOAVAILABILITY OF POORLY SOLUBLE DRUG**

Branko Vukosavljević, Marko Krstić, Jelena Đuriš, Zorica Đurić, Svetlana Ibrić<sup>a</sup>

Dept. of Pharmaceutical Technology, Faculty of Pharmacy,  
Vojvode Stepe 450, 11221, Belgrade, Serbia  
a. Corresponding author (svetlana.ibric@pharmacy.bg.ac.rs)

Novel porous powder materials which are characterised by large adsorption capacity and high specific surface area could be potentially used as carriers for improving dissolution characteristics and oral bioavailability of poorly water soluble drugs. The aim was examination of solid dispersions with porous carriers, as potential solubility and dissolution rate enhancing delivery systems of low soluble model substance, Carbamazepine (CBZ). Four different porous adsorbents were used: Neusilin® UFL2 and FL2-both magnesium-aluminum metasilicate, Sylysia® 320(SYL)-synthetic porous silica and Diatomite(DIAT)-natural porous silica, in three drug/carrier weight ratios, using ethanol as a drug solvent. DSC, TGA, HSM, PXRD and FTIR analyses were performed in order to characterize physical state of CBZ and to identify potential interaction between CBZ and adsorbent. Drug release testing of dispersions was performed. DSC and PXRD curves have shown increasing of amorphous form of CBZ with increasing the ratio of the porous powder carrier. FTIR analyses have shown significant drug/carrier interaction. Dissolution rate of CBZ increased by enlarging the ratio of the carrier using NFL, SYL and NUFL, respectively. While using different ratios of DIAT, drug dissolution rate stays almost constant. Formulation of drug/carrier solid dispersions can be an effective method for improving drug dissolution rate and oral bioavailability.

## **SURFACE CHARACTERISTICS OF TITANIUM TREATED BY SANDBLASTING AND ACID ETCHING FOR DENTAL IMPLANT**

B.Balli<sup>1,3,4</sup>, T.Dikici<sup>2,3,4</sup>, M.Toparlı<sup>3,4</sup>

1. Çanakkale Onsekiz Mart Üniversitesi, Dept. of Materials Sci. and Eng., 17100, Çanakkale, Turkey
2. Izmir Katip Celebi Univ., Dept. of Materials Sci. and Eng., 35620, Izmir, Turkey
3. Dokuz Eylül Univ., Dept. of Metallurgical and Materials Eng., Buca 35160 Izmir, Turkey.
4. Dokuz Eylül Univ., Center for Fabrication and Appl. of Electronic Materials (EMUM), Buca 35160 Izmir, Turkey.  
a. Corresponding author (busraballi16@gmail.com)

Titanium (Ti) and its alloys have been used extensively over the past 25 years as biomedical materials in orthopedic and dental applications because of their good mechanical properties, corrosion resistance and biocompatibility. It is known that the rate and quality of osseointegration in titanium implants are widely related to their surface properties and surface treatments like sand blasting and acid etching improved bioactivity of implants and enhance bone growth. The purpose of this investigation was to evaluate the effect of sandblasting and acid etching on surface morphology, roughness, wettability and chemical composition of Ti. The surface properties were characterized by scanning electron microscopy (SEM), atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), and contact angle and roughness measurements. The results show that surface morphology, roughness, wettability and chemical composition were changed by the treatments.

## **THE MATHEMATICAL MODEL FOR CURRENT MIXED-MODE OSCILLATIONS OCCURRING IN THE PROCESS OF ELECTROREDUCTION OF PERSULFATE ON THE GOLDEN ROTATING DISC ELECTRODE**

Volodymyr Tkach<sup>a</sup>, Vitaliy Mishchenchuk, Natalia Khovanets', Mykhailo Tkachuk, Valentyna Yuz'kova, Lyudmyla Kostyuk, Volodymyr Tkach  
a. Corresponding author (vvn777@mail.ru)

The model for the anions' electroreduction, that described well the Frumkin-type oscillations, was developed in [1,2]. The model was approved on the example of the electrochemical system with the electroreduction of persulfate-ion on copper RDE and it has shown the satisfactory concordance with experimental data. Other experimental investigations have shown the more complex type of MMO during the electroreduction of S<sub>2</sub>O<sub>8</sub><sup>2-</sup> over gold and platinum [3]; the kinetic mechanisms were suggested and the possible causes of this type of behavior have been discussed [4-6]. The goal of our work is to investigate theoretically the mechanism for the oscillatory reduction of sulfate peroxide on gold and platinum, basing on the mathematical model, capable to describe adequately this process, and its analysis. We resolve this problem modifying the models [1-2] by quantitative account of the factors, causing the complicated non-equilibrium behavior, such as the kinetics of the electroreduction on gold, that is realized by two parallel mechanisms with and without formation of specially adsorbed products:

## **STUDIES ON PREDICTION OF ACTIVATED CARBON PROPERTIES VIA INTELLIGENT SYSTEMS**

Mansooreh Soleimani<sup>1,a</sup>, Farzad Naghibzadeh<sup>1</sup>, Maryam Sadi<sup>2</sup>

1. Dept. of Chemical Eng., Amirkabir Univ. of Technology, No.424, Hafez Ave., PO Box 15875-4413, Tehran, Iran, Tel. & Fax: +98(21) 66405847, \*E-mail: Soleimanim@aut.ac.ir

2. Research Inst. of Petroleum Industry (RIPI), West Blvd., Near Azadi Sports Complex, Zip Code: 1485733111, Tehran, Iran.

a. Corresponding author(soleimanim@aut.ac.ir)

Due to highly developed porosity, activated carbons are known as very effective adsorbents in different industries throughout the world. These adsorbents can be prepared from any carbonaceous material with two different processes: physical and chemical. Because of complex relationships between the activated carbon properties and operating parameters in production process, it is very useful and important to predict its properties. In this work, three models based on intelligent systems including hybrid back-propagation artificial neural network and genetic algorithm (BP-GA), radial basis function neural network (RBF) and adaptive neuro-fuzzy inference system (ANFIS) were applied to predict characterization parameters of activated carbon prepared by physical activation method. Fixed carbon and ash content of raw materials, time and temperature of carbonization step, time and temperature of activation step and flow of activation gas were studied as input variables for these systems. Specific surface area and micropores volume were predicted as output of models. Based on obtained results, maximum average error in all models was less than 8 percentage. Results of three models indicated that the ANFIS prediction (with error below 4%) was the best model for prediction of activated carbon properties.

## **EFFECT OF FINENESS AND CALCINATION TEMPERATURE ON THE POZZOLANIC BEHAVIOUR OF IMPURE KAOLIN**

Kasım Mermerdaş<sup>1,a</sup>, Erhan Güneyisi<sup>1</sup>, Mehmet Gesoğlu<sup>1</sup>

1. Gaziantep Univ., Civil Eng. Dept., Gaziantep Turkey

a. Corresponding author (mermerdas@gantep.edu.tr)

Utilization of supplementary cementitious powder materials (SCM) has been one of the most common practices for improving fresh and hardened properties of cement based construction materials. The effectiveness of SCMs is highly depended on the chemical composition as well as physical properties such as particle shape, particle size, and fineness. Being one of the most popular SCMs, metakaolin or calcined kaolin is obtained by thermally treatment of kaolinitic clay at convenient temperature to obtain pozzolanic reactivity. In this study, the effect of fineness on the calcination property of the untreated local crude kaolin was investigated. For this, kaolin in powder form was subjected to further grinding to obtain various fineness and particle distribution. The microstructural properties of the ground material was determined through particle size analysis with laser diffractometer, BET specific surface area measurements, image analysis with scanning electron microscopy (SEM). Then, the ground material was exposed to thermal treatment, based on the results obtained from differential and thermal gravimetric analyses (DTA-TG). After calcination process, the pozzolanic activity index test according to ASTM C311 was applied to examine the relation with fineness and calcination temperature. So that, engineering property of calcined kaolin, namely pozzolanic activity, was determined and discussed comparatively.

## **ELECTRICALLY ANISOTROPIC CNTS/GEL-COAT SYSTEMS WITH DIFFERENT CNT RATIOS**

Atike Ince Yardimci<sup>1</sup>, Metin Tanoğlu<sup>2</sup>, and Yusuf Selamet<sup>1</sup>

1. Dept. of Physics, Izmir Inst. of Technology, Urla Izmir 35430, Turkey

2. Dept. of Mechanical Eng., Izmir Inst. of Technology, Urla Izmir 35430, Turkey

a. Corresponding author (atikeince@iyte.edu.tr)

Carbon nanotubes (CNTs) are appropriate reinforcing constituents for polymer composites because of their excellent properties such as high aspect ratio, high strength and they also improve electrical and thermal conductivity of composite materials. However, as-grown CNTs are often found in a tangled form, therefore, the critical challenge is how to enhance dispersion and alignment of CNTs in the polymer matrix.

In this study, CNTs were synthesized by chemical vapor deposition (CVD) method on Co-Mo/MgO catalyst and methane was used as a carbon source for growth experiments. CNTs were characterized with scanning electron microscopy (SEM), thermo-gravimetric analysis (TGA) and Raman spectroscopy. CNTs were dispersed in the gel-coat resin by 3-roll milling technique. This technique provides high shear mixing and enhances CNTs dispersion within thermoset resins. To align the CNTs within the polymer matrix, a sinusoidal AC electric field of 400 V/cm was exposed to CNT/gel-coat suspension during curing process and then I-V measurements of composites were made by two point technique.

The electrical conductivity of a gel-coat system containing 0.05 and 0.025 wt.% CNT was investigated for both SWNTs and MWNTs and the aim is to obtain electrically conductive and anisotropic CNT/gel coat polymer systems.

## **THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND GEOTECHNICAL PROPERTIES OF SILTY SOILS**

Nazile URAL

a. Corresponding author (nazile.ural@bilecik.edu.tr)

The pore size distribution (PSD) is one of the important and fundamental parameters directed by the geotechnical behavior of a soil. Especially, these parameter could lead to a better understanding of the engineering properties of a compacted soil. This geotechnical applications is road construction, dams, slurry walls and waste landfills etc. The main objective of in this study is to investigate the pore size distributions of after compaction of the silts mixed with two clays have different mineralogy. To geotechnical properties of soils are conducted particle size distribution, consistency limits, specific gravity and standard compaction tests. The pore size distributions of the soils are investigated using mercury intrusion porosimetry in order to investigate the role of fabric on engineering properties of soils. Addition, effect of microstructure on geotechnical behavior of soils are investigated using scanning electron microscopy (SEM). In conclusion, the relationship between geotechnical properties with PSD and microstructure was investigated.

## THE EFFECT OF THERMAL CYCLES ON FRACTURE BEHAVIOUR OF FILLED CALCIUM CARBONATE POLYPROPYLENE RANDOM COPOLYMER

Tülin Şahin<sup>1,a</sup>, Zümeer Köksal Altıntaş<sup>2</sup>, Şenol Şahin<sup>1</sup>

1. Kocaeli Univ., Machine Eng. Dept., Izmit, Turkey

2. Kocaeli Univ., Machine Eng. Dept., Izmit, Turkey

a. Corresponding author (tulsah@kocaeli.com.tr)

Thermal fatigue might be damaging in structures internally constrained, which cannot expand or contract freely as in composite materials. During thermal cycling, both matrix and fiber expand or contract according to their coefficients of thermal expansion. This, in turn, influences the structural integrity of the composite and can limit the life of a composite material. In this article, in deference to environment conditions and working temperatures, thermal cycling applications on Polypropylene containing CaCO<sub>3</sub> at the different temperatures were realized. In this artical, in deference to environment conditions and working temperatures thermal cycling applications of PPrC (Polypropylene random copolymer) containing CaCO<sub>3</sub> at the different temperatures were realized. For different (25, 50, 100, 200) thermal cycling, according to ISO180 standard, charpy impact test was done. Properties of physical and mechanical features are explained as for that filling material and thermal cycle outputs. In this study, the crack propagation characteristic of the material exposed to thermal cycling and the absorbed energy amount during the crack initiation and propagation were analyzed.

## SILICA-ALUMINA FOR HYDROCARBON BULK REMOVAL FROM CONTAMINATED WATER.

Moreno Maretto<sup>+</sup>, Roberto Bagatin<sup>§</sup>, Alessandra De Folly D'Auris<sup>§</sup>, Angela Carati<sup>\*</sup>, Massimiliano Baric<sup>+</sup>, Rita Iazzoni<sup>+</sup>, Rodolfo Vignola<sup>+</sup>, Marco Petrangeli Papini<sup>+</sup>

§) eni S.p.A., Research Center for Unconventional Energies, v. G. Fauser 4, 28100, Novara, ITALY.

\*) eni S.p.A., Refining & Marketing Division, v. F. Maritano 26, 20097, San Donato M.se, ITALY.

+) La Sapienza Università di Roma, Chemistry Dept., p. A. Moro 5, 00185, Roma, ITALY.

a. Corresponding author (moreno.m@uniroma1.it)

Water management is expected to be a major issue in decades to come, due to increasing water scarcity. Aromatic hydrocarbons are frequently present as contaminants in water coming from sites devoted to petroleum extraction or processing. Their removal to acceptable levels is requested in order to avoid adverse effects on environment and health. Especially in case of massive contamination, bulk removal operations have to be coupled with polishing.

Within this framework, Eni S.p.A. has developed a proprietary sorbent based on Meso-porous Silica Alumina (MSA), suitable for bulk removal of hydrocarbons dissolved or dispersed in water. In collaboration with the Dept. of Chemistry of the Sapienza Univ. this material has been characterized under different point of view. Its adsorption properties has been studied to test its applicability in an industrial process for hydrocarbons removal from water. Different bulk conditions have been tested such as increasing ionic strength and heavy metal co-contamination to understand the influence of these variables to the adsorption process. To the other side a structural characterization was carried out by XRD and SEM analysis to observe the structural modification after the adsorption and which kind of mechanism acts between the porous material, pollutants and aqueous medium. We also studied the thermal regeneration by using TGA analysis after adsorption-desorption cycles, to understand its effective employability in a full industrial process. Results from laboratory batch tests have pointed to more than 85 % adsorption of toluene (assumed as aromatic organic representative) starting from an initial concentration of 350 mg/L, with kinetics of few hours. Regeneration of exhausted sorbent has been performed by heating at 823 K. Interestingly, similar results have been obtained using both as-synthesized and shaped samples.

## **THE SYNTHESIS AND CHARACTERIZATION OF Ni/SiO<sub>2</sub> CATALYSTS BY SOL-GEL METHOD: EFFECT OF METAL LOADING**

A. Ş. Yargıç<sup>1,a</sup>, R. Z. Yarbay Şahin<sup>1</sup>, N. Özbay<sup>1</sup> and E. Önal<sup>1</sup>

1. Chemical and Process Eng. Dept., Bilecik Seyh Edebali Univ., TURKEY.

a. Corresponding author (seyda.guler@bilecik.edu.tr)

Ni-based catalysts supported over acidic, amphoteric or basic oxides have been tested for many reactions like water–gas shift reaction, methanol/ethanol steam reforming, hydrogenation of olefins and aromatics, tar reforming due to their high activity and economics. Precipitation, incipient wetness impregnation, ion-exchange, coprecipitation and sol-gel techniques have been studied. Sol–gel methods allow the preparation of a broad variety of supported metals, metal oxides, coatings and composite materials with tailored properties . Supported metal catalysts with higher thermal stability, higher resistance to deactivation while allowing a better flexibility in controlling particle size, surface area and pore size distribution can be prepared .

This work reports the investigation of the characteristics of Ni/SiO<sub>2</sub> catalysts with metal loading 5 and 10 wt.% prepared by the sol-gel technique. The suspensions were transferred to an oven preheated at 50 °C and temperature was increased gradually until 120 °C to allow for the evaporation of ammonia and the deposition of nickel species on silica. The catalyst precursors were calcined in static air at 550 °C for 5 h with a heating rate of 5 °C/min. Finally, the calcined catalysts were characterized by using BET, FTIR, XRD, TG-DTA and SEM techniques.

## **PRODUCTION, CHARACTERIZATION AND PHOTOCATALYTICAL KINETICS OF SOL-GEL DERIVED K<sub>2</sub>La<sub>2</sub>Ti<sub>3</sub>O<sub>10</sub> POWDERS**

Nihal Altuğ Kahraman, Fatma Bakal, Mustafa Erol, Güneş Kurşun, Ayşegül Pala, Erdal Çelik

a. Corresponding author (Nihaltug@hotmail.com)

In this study, photocatalyst K<sub>2</sub>La<sub>2</sub>Ti<sub>3</sub>O<sub>10</sub> powders were synthesized via sol-gel. Phase structures and ratios were analyzed by x-ray diffractometer (XRD). Size and morphologies were determined using particle size analyzer, scanning electron microscope (SEM) respectively. Potassium lanthanum titanium oxide phase was obtained in XRD analysis. The degradation rates of aqueous methylene blue (MB) by K<sub>2</sub>La<sub>2</sub>Ti<sub>3</sub>O<sub>10</sub> powders were calculated using UV-Vis spectrophotometer. It was found that MB decomposition was successfully achieved with significantly high efficiencies for sol gel derived powders. Finally photocatalytical reaction rates were calculated by using kinetic considerations.

## **FABRICATION OF SMART PEGMA BIOPOLYMER NANOPARTICLES FOR DRUG RELEASE**

Mustafa Selman Yavuz, Mehmet Ulasan, Emine Yavuz, Yunus Cengeloglu  
a. Corresponding author (selmanyavuz@selcuk.edu.tr)

Smart materials have been attracting much attention because of their stimuli sensitive nature. We have synthesized biocompatible thermoresponsive poly ethylene glycol methyl ether methacrylate nanoparticles (PEGMA NPs) with disulfide based crosslinker by surfactant free emulsion polymerization (SFEP) method. PEGMA NPs are thermo-responsive and have lowest critical solution temperature (LCST) around 37 oC. As a delivery system, rhodamine B, a model of small drug molecule (dye with  $\lambda_{max}$ = 554 nm), and PEG-alizarin yellow (dye with  $\lambda_{max}$ = 372 nm), a model of large drug molecule, were loaded into PEGMA NPs. Below LCST, there was no dye released from PEGMA NPs. Most of rhodamine content was released at 39 oC, just above LCST which is close to body temperature. Below or above LCST there was no PEG-Alizarin yellow dye released from the PEGMA NPs. Furthermore, the PEGMA NPs were treated with dithiothreitol (DTT) which reduces disulfide bonds of PEGMA NPs. Due to reduction of disulfide bonds to thiols, PEGMA NPs were decomposed and then all remaining PEG-alizarin yellow content inside the PEGMA NPs were released. As a result, we showed that the disulfide crosslinked PEGMA nanoparticles can be used as a controlled drug carrier system.

## **INVESTIGATION ON UTILIZATION OF BIOPLASTICS IN TURKEY**

Ezgi Bezirhan<sup>1</sup>, H. Duygu Ozsoy<sup>2,a</sup>

1. Environmental Eng., Mersin Univ., Mersin, Turkey

2. Environmental Eng., Mersin Univ., Mersin, Turkey

a. Corresponding author ( ozsoyhd@gmail.com)

In the last decades there has been a significant increase in the amount of plastic wastes all over the world. Increasing environmental concerns/legislative pressure for petroleum-based plastics waste and rapid increases in the cost of petroleum have enabled to the development of bioplastics. “Bioplastics” are polymers made from renewable resources such as corn, sugars, potatoes, etc., and this materials have a wide range of applications in packaging, consumer goods, electronics, transportation, construction, medical and many other fields. The global bioplastics market is thought to be growing at a rate of as much as 20% per year. Total consumption of bioplastics worldwide at an average annual growth rate of 13% from 2009 to 2014. Bioplastics are currently considered the way to go and may be the only alternative in the future as fossil resources become exhausted. Whereas the bioplastics has yet known in recently and bioplastics technology development is in adequate in Turkey. Firms in the plastic industry should to be act in partnership for developing bioplastic technology in Turkey.

## **PORE-SCALE STUDY OF TWO-PHASE FLOW AND COLLOID TRANSPORT IN POROUS MEDIA**

S. Majid Hassanizadeh Hassanizadeh, Nikolaos K. Karadimitriou, Qiulan Zhang  
a. Corresponding author (s.m.Hassanizadeh@uu.nl)

Micro-models have been proven to be a valuable tool in the field of porous media by allowing the observation of flow and transport on the micro-scale. Studies have included chemical, biological, and physical applications. They have helped to increase our insight of flow and transport phenomena on both micro- and macro-scales. A micro-model is an artificial representation of a porous medium, made of a transparent material. We have used Poly-Di-Methyl-Siloxane (PDMS), which is a viscoelastic, silicon-based organic polymer. It is optically transparent, inert, non-toxic, and non-flammable. Given its mechanical and chemical properties, PDMS is a material suitable for manufacturing micro-models that can be used to study two-phase flow. We have performed two-phase flow and colloid transport experiments in these micro-models. We have established that the inclusion of fluid-fluid interfacial area lifts the ambiguity of the hysteretic relationship between capillary pressure and saturation in porous media. In colloid transport experiments, we directly observe colloids movement, their retention at interfaces, and mobilization with the moving interface and contact lines.

## **WEAR BEHAVIOUR OF POWDER INJECTION MOLDED Ti-6Al-4V ALLOY**

Hamit Özkan Gülsoy<sup>1</sup>, Zeynep Taşlıçukur<sup>2</sup>  
Gözde Sultan Altug<sup>2,a</sup>, Tuba Karahan<sup>2</sup>, Sunullah Özbek<sup>2</sup>

1. Marmara Univ., Technology Faculty, Metallurgical and Materials Eng., Istanbul, Turkey.
2. Gedik Univ., Dept. of Metallurgical and Materials Eng., Istanbul, Turkey.  
a. Corresponding author (gozde.altug@gedik.edu.tr)

Titanium and its alloys which are widely used in aerospace, biomedical and chemical applications, producing very good combination of properties, including high specific strength, low density, good corrosion resistance and exceptional biocompatibility. Nowadays, it is possible to fabricate Ti alloy components by powder injection molding (PIM) technique for unique mechanical properties. However, the use of titanium alloys in sliding applications is restricted because of their poor tribocharacteristics. In this study, the wear behavior of Ti6Al4V (Ti64) alloy was investigated under dry sliding condition against 100Cr6 steel. In the first stage of the study, Ti64 powders spherical in shape was injection molded with wax based binder. After molding and debinding stage, all samples sintered at 1150 °C, 1200 °C and 1250 °C for 1h under high vacuum level. The microstructures of sintered samples were determined with optical microscope. In the second stage, wear tests were carried out using “ball-on-disc” type tribometer. In the wear test, the load, total distance and sliding velocity were selected as 20 N, 500 m and 1 m/s, respectively. All worn surfaces were examined by scanning electron microscope and wear characteristics were evaluated as a function of sintering temperatures.

## INVESTIGATION OF HYDROXYAPATITE (HA) COATINGS WEAR BEHAVIOUR CREATED ON THE SURFACE OF Ti6AL4V MATERIALS AFTER DIFFERENT ACTIVATION PROCEDURES

Ibrahim AYDIN<sup>1,a</sup>, Hakan ÇETINEL<sup>2</sup> and Ahmet PASINLI<sup>3</sup>

1. Celal Bayar Univ. MOSB MYO, Machine, Manisa, Turkey
  2. Celal Bayar Univ. Eng. Faculty, Mechanical Eng., Manisa, Turkey
  3. Ege Univ. EGE MYO, Machine, Izmir, Turkey
- a. Corresponding author (Ibrahim.aydin@cbu.edu.tr)

In biomaterials technology, in order to increase the biocompatibility of the implant materials surfaces the surface is coated by hydroxyapatite (HA) which is a compound of calcium phosphate (CaP). Implant materials are generally made up of stainless steel, cobalt-chrome and titanium alloys. In this study the implant material was a titanium alloy: Ti6Al4V. The scope of the study is to investigate the HA coatings wear behavior adhered on the surface of Ti6Al4V materials by applying varying activation procedures. During the processes, NaOH and NaOH + H<sub>2</sub>O<sub>2</sub> activation procedures were conducted. The HA coating processes were applied based on biomimetic methods. Wear tests were performed by applying 5N and 10N loads on the coated surfaces. Finally, it's found that, NaOH + H<sub>2</sub>O<sub>2</sub> activation procedure applied on HA coatings had less amount in wear on HA coatings when compared that of NaOH activation procedure.

## EFFECT OF SALT MODIFICATION AND ACID ACTIVATION ON ETHYLENE ADSORPTION PROPERTIES OF SEPIOLITE

Meryem Sakızci<sup>1</sup>

- <sup>1</sup>Dept. of Physics, Science Faculty, Anadolu Univ., 26470, Eskişehir, Turkey,  
a. Corresponding author (msakizci@anadolu.edu.tr)

In this study, The adsorption of ethylene (C<sub>2</sub>H<sub>4</sub>) on sepiolite from Eskişehir, Turkey and on forms salt modified (NaS, KS, CaS and MgS) and treated with 1, 3 and 5 M HCl solutions (SH, S3H and S5H) was investigated. The sepiolite samples were characterized using x-ray diffraction (XRD), x-ray fluorescence (XRF), thermogravimetry (TG-DTG), differential thermal analysis (DTA) and N<sub>2</sub> adsorption methods. The ethylene adsorption isotherms of all clay samples were obtained at 293 K up to 37 kPa. The uptake of C<sub>2</sub>H<sub>4</sub> decreased as HS > CaS > NaS > S > MgS > KS > H3S > H5S for sepiolite samples. Capacity of sepiolites for C<sub>2</sub>H<sub>4</sub> ranged from 0.478 mmol/g to 0.622 mmol/g.

Sepiolite Si<sub>12</sub>O<sub>30</sub>Mg<sub>8</sub>(OH)<sub>4</sub>(H<sub>2</sub>O)<sub>4</sub>.8H<sub>2</sub>O, is a hydrated magnesium-silicate of fibrous morphology, with fine microporous channels of dimensions 3.7 Å × 10.6 Å running parallel to the fibre axis [1]. The presence of microporous and channels in sepiolite are responsible for its absorption and adsorption properties. Ethylene gas (C<sub>2</sub>H<sub>4</sub>) is an important plant hormone that is naturally produced in confined fruit or vegetable storage. Controlling ethylene accumulation in the storage will extend the shelf life of fruit and vegetables and maintain their freshness for a much longer period of time [2, 3]. Therefore, excessive amounts of ethylene should be removed from the storage room.

## CHARACTERIZATION AND METHANE ADSORPTION OF NATURAL AND MODIFIED MORDENITE

Meryem Sakızcı<sup>1</sup>, Leyla Özgül Kılınç<sup>1</sup>

1. Dept. of Physics, Science Faculty, Anadolu Univ., 26470, Eskisehir, Turkey,  
a. Corresponding author (msakizci@anadolu.edu.tr)

In this study, the adsorption of methane (CH<sub>4</sub>) capacities onto mordenite obtained from Izmir region and its cationic forms (Cu-, Ag-, Fe- and H-MOR samples) were investigated at the temperatures of 273 K and 298 K up to 100 kPa. Cationic forms were prepared by using 1 M Fe(NO<sub>3</sub>)<sub>3</sub>.9H<sub>2</sub>O, 1 M AgNO<sub>3</sub>, 1 M Cu(NO<sub>3</sub>)<sub>2</sub>.3H<sub>2</sub>O ve 1 M HCl solutions. Natural and modified samples were characterized by x-ray diffraction (XRD), x-ray fluorescence (XRF), thermogravimetry (TG-DTG), differential thermal analysis (DTA) and N<sub>2</sub> adsorption methods.

Zeolites are crystalline hydrated aluminosilicates of the alkali and alkaline earths. They consist of three-dimensional networks of SiO<sub>4</sub> and AlO<sub>4</sub> tetrahedra interconnected by sharing common oxygen atoms. In the zeolite structure, some of the Si<sup>4+</sup> is replaced by Al<sup>3+</sup>, giving rise to a negative charge which is balanced by the presence of exchangeable cations such as Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, etc., in the framework. These cations play a crucial role in the adsorption and gas-separation properties of the zeolites. Methane is the main component of natural gas and natural gas can be stored at room temperature in porous materials.

## A NUMERICAL STUDY ON THE EFFECT OF A POROUS LAYER ATTACHED AT A WALL OF A PARALLEL PLATE CHANNEL ON FORCED CONVECTION HEAT TRANSFER

ErenUcar<sup>1</sup>, Moghtada Mobedi<sup>1</sup>

1. Mechanical Eng. Dept., Izmir Inst. of Technology, Urla 35430, Izmir, Turkey  
a. Corresponding author (erenucar@iyte.edu.tr)

This paper presents a numerical study on heat and fluid flow of a forced convection in a parallel-plate channel partially filled with a porous medium layer. The layer of a porous medium is attached to one wall of the channel. A uniform heat flux is imposed to both walls of the channel, equally. The flow is assumed to be hydrodynamically and thermally fully developed. The flow in porous medium layer is modeled by using Brinkman extended Darcy's law while the momentum equation is solved to find velocity distribution in the clear part of the channel. The continuous shear stress and heat flux models are applied for determination of velocity and temperature at the interface of porous medium/clear fluid. The dimensional governing equations are solved numerically. An overall Nusselt number for partially filled channels are defined based on the temperature difference between the average surface temperatures of two walls and mean fluid temperature. The variations of the overall Nusselt number are examined and plotted for different values of the permeability, porous layer thickness and the conductivity ratio between porous medium layer and fluid. The changes of heat transfer rate and surface temperatures with these parameters are investigated and discussed.

## **SYNTHESIS OF SOL-GEL DERIVED TiO<sub>2</sub> XEROGEL SUPPORTED METAL BORIDE CATALYSTS FOR HYDROGEN GENERATION BY HYDROLYSIS OF ALKALI SODIUM BOROHYDRIDE**

Zümray V. Yiğit<sup>1</sup>, Ferhat Baydaroğlu<sup>2</sup>, Ercan Özdemir<sup>1,a</sup>, Ali Ata<sup>1</sup>

1. Gebze Institute of Technology, Clean Energy & Nanotechnology Research Center  
41400, Kocaeli, Turkey
2. Gebze Institute of Technology, Dept. of Chemistry, 41400, Kocaeli, Turkey  
a. Corresponding author (e.ozdemir@gyte.edu.tr)

Co-B and Ni-Co-B nanoparticles supported on sol-gel derived mesoporous anatase and rutile TiO<sub>2</sub> xerogel were synthesized as the catalyst of sodium borohydride hydrolysis for portable fuel cell applications. The effects of process parameters namely NaOH and NaBH<sub>4</sub> concentrations, reaction temperature and catalyst loadings on hydrogen production rate were investigated. The catalytic activity results showed that TiO<sub>2</sub> supported Co-B and Ni-Co-B catalysts exhibited higher activity than unsupported boride catalysts. Different calcination temperatures and calcination methods were also performed to observe the heat treatment effects on structural and morphological property of catalysts. All catalysts were characterized by XRD, TEM and SEM techniques.

## **MODELING POLYPHENOL EXTRACTION OF AVOCADO PIT THROUGH THE MASS TRANSFER COEFFICIENT**

Segovia, F<sup>1</sup>; Corral, JJ<sup>1</sup>; Almajano, MP<sup>1,a</sup>

Chemical Eng. Dept., Technical Univ. of Catalonia  
a. Corresponding author (m.pilar.almajano@upc.edu)

Increasingly, the polyphenols are the focus of many food and cosmetic industries due to their high antioxidant capacity. Furthermore, it has been shown that polyphenols intake through fruit and vegetables helps to prevent several diseases.

The avocado seed contains a large amount of extractable polyphenols. Therefore, the objective of this study is to optimize their extraction by the response surface method and to calculate their effective diffusion coefficient.

These coefficients are calculated using kinetics polyphenols extraction curves contained inside the pit of an avocado. The extractions are carried out in diverse temperature and concentration of methanol conditions, in continuous and in batch. Once the conditions that optimize the extraction of polyphenols are found, one proceeds to calculate the mass transfer coefficient from the effective diffusivity. Finally, the extraction of polyphenols which are contained in an avocado pit is modeled in order to convert its extraction from the laboratory scale to the industry.

It is a high contribution to science, since plant polyphenols would be obtained from an industrial waste such as the avocado pit.

## **SODIUM BOROHYDRIDE HYDROLYSIS FOR HYDROGEN PRODUCTION OVER A HIGHLY EFFICIENT Co–B/PANI CATALYST**

Ferhat Baydaroğlu<sup>1</sup>, Aydin Hasimoğlu<sup>1</sup>, Ercan Özdemir<sup>2,a</sup>

1. Gebze Institute of Technology, Dept. of Chemistry, 41400, Kocaeli, Turkey
  2. Gebze Institute of Technology, Clean Energy & Nanotechnology Research Center  
41400, Kocaeli, Turkey
- a. Corresponding author (e.ozdemir@gyte.edu.tr)

The objective of the present study was to develop an efficient catalyst for hydrolysis of NaBH<sub>4</sub>. In this research, unsupported and polyaniline supported cobalt boride catalysts were synthesized using reduction-precipitation method for hydrogen generation from sodium borohydride stabilized in 10% (w/w) of NaOH solution. According to experimental results, polyaniline supported cobalt boride catalyst showed better performance than that of unsupported one. The influences of NaOH concentration (1-20 wt%), NaBH<sub>4</sub> concentration (1-20 wt%) and reaction temperature (20-50 °C) on the performance of the catalysts were examined. Structural and morphological properties of the catalysts were investigated. The results show that PANI supported cobalt catalysts can be used in a hydrogen generator for mobile applications due to their high catalytic activity.

## **ELECTROCHEMICAL PREPARATION OF A NEW POROUS POLY(3,3'-DIAMINOBENZIDINE) – POLYANILINE (PDAB/PANI) FILM**

Muammer Kavanoz<sup>1,a</sup>, Emine Ülker<sup>1</sup>, Ufuk Bük<sup>1</sup>

1. Recep Tayyip Erdogan University, Faculty of Sciences & Arts, Dept. of Chemistry, Rize, 53100, Turkey
- a. Corresponding author (muammer.kavanoz@erdogan.edu.tr)

Modified electrode based on Poly(3,3'-diaminobenzidine) – Polyaniline (PDAB/PANI) copolymer film was synthesized electrochemically on Pt electrode in acetonitrile (ACN) and methylene chloride solution (MeCl<sub>2</sub>) for the first time. Six different copolymer films were obtained. Firstly, for PDAB / PANI copolymer film, PDAB film was deposited potentiostatically (0.50 V) on Pt electrode and PANI film was synthesized potentiodynamically (-0.40 V- 1.80 V) on this film in ACN. Secondly, for PANI / PDAB copolymer film, PANI film was prepared on Pt electrode and PDAB film was synthesized potentiodynamically on this film in ACN. Thirdly, for PDAB / PANI copolymer film, PDAB film was deposited potentiostatically on Pt electrode in ACN and PANI film was synthesized potentiodynamically on this film in MeCl<sub>2</sub>. Fourth, for PANI / PDAB copolymer film, PANI film was deposited potentiodynamically on Pt electrode in MeCl<sub>2</sub> and PDAB film was synthesized potentiodynamically on this film in ACN. Fifth, PDAB / PANI was prepared on the contrary of the fourth film. The final film was synthesized using both DAB and aniline monomers in MeCl<sub>2</sub>. SEM, FT-IR and UV-vis spectroscopic methods were used for characterization of those films. The fourth film was determined the most electroactive copolymer film in all the films obtained.

## **A NEW MODIFIED ELECTRODE SYNTHESIS BASED ON POLY (3,3'-DIAMINOBENZIDINE) – POLY (3-METHYLTHIOPHENE) (PDAB-P3MT)**

Muammer Kavanoz<sup>1,a</sup>, Emine Ülker<sup>1</sup>, Ufuk Bük<sup>1</sup>

1. Recep Tayyip Erdogan Universty, Faculty of Sciences & Arts, Dept. of Chemistry, Rize, 53100, Turkey

a. Corresponding author (muammer.kavanoz@erdogan.edu.tr)

In this study, Poly 3-methylthiophene (P3MT) film was synthesized electrochemically on Pt electrode in methylene chloride (MeCl<sub>2</sub>) and Poly (3,3'diaminobenzidine) (PDAB) film was deposited electrochemically on P3MT film in acetonitrile (ACN) for the first time. pH behaviour of PDAB/P3MT film has studied using different pH solution in NaHSO<sub>4</sub>/Na<sub>2</sub>SO<sub>4</sub> (2.0-6.50). SEM, EDS, FT-IR and UV-vis spectroscopic methods were used for characterization of this film. Cyclic voltametry was used to determine the electrochemical behavior of the modified electrode. It was aimed that using this modified electrode for electroanalysis and electrocatalysis.

## **ELECTROCHEMICAL SYNTHESIS AND CHARACTERIZATION OF POLY (3,3'-DIAMINOBENZIDINE) (PDAB) MODIFIED ELECTRODE IN NON-AQUEOUS MEDIA**

Muammer Kavanoz\*, Emine Ülker, Ufuk Bük

Recep Tayyip Erdogan Universty, Faculty of Sciences & Arts, Dept. of Chemistry, Rize, 53100, Turkey

a. Corresponding author (muammer.kavanoz@erdogan.edu.tr)

Poly (3,3'- diaminobenzidine) (PDAB) film was synthesized on Pt electrode potentiostatically and potentiodynamically in acetonitrile. For potentiostatic polymerization, 0.30 V – 0.80 V was used the range of potential and 0.50 V was selected the best potential. For the potentiodynamic polymerization, with 1.80 V to -0.40 V, -0.20 V, 0.0V and 0.20 V potentials were used and the best potential was selected with 1.80 V to -0.40 V. SEM, FT-IR, UV-vis and Raman spectroscopic methods were used for characterization of those films. Cyclic voltametry was used to determine the electrochemical behavior of the modified electrode.

## **SOLAR RADIATION EFFICIENCY FOR REMOVING MICROPOLLUTANTS IN PRESENCE OF A TiO<sub>2</sub> CATALYST SUSPENSION**

Laoufi N. A<sup>a</sup>., Mokhnache A., Bentahar F.

Université des Sciences et de la Technologie Houari Boumediene. Faculté de Génie Mécanique et de Génie des Procédés. Département de Génie Chimique et de Cryogénie. Laboratoire des Phénomènes de Transfert. Bp 32, El Alia, 16111 Bab Ezzouar, Algiers. Algeria  
a. Corresponding author (nadiaaoufi@yahoo.fr)

The study focused on the evaluation of solar radiations performances on the degradation of an aqueous solution of tylosin in a lab-scale tubular reactor. The reactor is positioned facing south in order to ensure maximum energy exchange between the solar source energy and the reaction mixture. Results showed that a low flowrate (120 mL/min) through the reactor, a catalyst dose of 0.3 g /L and a low concentration of tylosin were found to be optimum. The highest efficiency of the photocatalytic process was observed for an inclination angle of 50°, where tylosin was completely oxidized after 1 hour of solar exposure. A study on the influence of solar radiation power showed that, after 1 hour of photocatalysis process, 84% of tylosine were oxidized during the cloudy day and 100% during the sunny day.

The study of interactions between tylosin and diazinon, an organophosphorus insecticide generally used as soils spray, at different molar ratios [tylosin] / [diazinon] showed that for all molar ratios, tylosin was removed better when alone. When both pollutants were sets tylosin started to be oxidized, except for [tylosin] / [diazinon] = 1/2. Diazinon degraded more slowly when the molar ratio decreased from 2 to 1/4.

## **APPLICATION OF AN ADVANCED OXIDATION TECHNOLOGY FOR ENHANCING THE REMOVAL OF PESTICIDES AND PHARMACEUTICALS IN PRESENCE OF AN IMMOBILIZED TITANIUM DIOXIDE CATALYST**

Laoufi N. A., Bentahar F.

Laboratoire des Phénomènes de Transfert. Département de Génie Chimique et de Cryogénie. U.S.T.H.B. Faculté de Génie Mécanique et de Génie des Procédés Bp 32, El Alia, 16111 Bab Ezzouar. Algiers. Algeria  
a. Corresponding author (nadiaaoufi@yahoo.fr)

The study of photodegradation of different micropollutants such as chlortoluron, linuron (herbicides) and tylosin (antibiotic) has been done in a photoreactor containing immobilized layers of TiO<sub>2</sub> catalyst. Various types of catalysts based on titanium dioxide were used (P25, P105, PC500, DT51 and EL10). Photodegradation of tylosin in presence of chlortoluron with different ratios has been studied with P25, P105 and PC500 catalysts.

The photocatalytic elimination efficiencies of tylosin, linuron and chlortoluron were obtained with P25 catalyst, where respectively, abatements of 73%, 51% and 50% were observed after an irradiation time of 6 hours. Oxidation of linuron and chlortoluron gave the same abatement in presence of different catalysts except for DT51 where chlortoluron was less degraded than linuron (18% and 39%). The kinetics was described by the Langmuir-Hinshelwood (L-H) kinetic model. Photodegradation of tylosin in presence of chlortoluron for different ratios and different catalysts showed that on P25 catalyst, tylosine was not impeded for ratios studied. On PC105 catalyst, photodegradation of tylosin was strongly favored in presence of chlortoluron, thus, 93% of tylosin were oxidized (47% in the absence of chlortoluron) for ratio of 1/2. On PC500, for ratios 1/2 and 3/2; tylosin oxidation was strongly favored (abatement reached 99%).

## REMOVAL OF A PERSISTENT PHARMACEUTICAL MICROPOLLUTANT BY UV/TiO<sub>2</sub> PROCESS

Laoufi N.A<sup>a</sup>, Bentahar F.,

Laboratoire des Phénomènes de Transfert. Département de Génie Chimique et de Cryogénie.  
U.S.T.H.B. Faculté de Génie Mécanique et de Génie des Procédés Bp 32, El Alia, 16111 Bab  
Ezzouar. Algiers. Algeria

a. Corresponding author (nadiaoufi@yahoo.fr)

The study focused on the performance evaluation of the photocatalytic process UV/TiO<sub>2</sub> in presence of titanium dioxide on the degradation of an aqueous solution of a pharmaceutical compound: spiramycin in a double helical reactor spiral wherein the catalyst is present as a suspension. Degradation of spiramycin showed that the UV/TiO<sub>2</sub> process was the most efficient with an abatement of 84% after 140 minutes of exposure to UV radiation. The results showed that during photocatalysis, an optimum flow rate was found equal to 440.4 mL/min and spiramycin elimination reached 96% after 160 minutes of exposure to UV radiations. Similarly, an optimal concentration of catalyst 0.1 g/L led to a spiramycin abatement of 99.8% obtained after 80 minutes of exposure to UV radiation, it should be noted that 0.05 g/L of catalyst oxidized 96% of spiramycin. After 90 minutes of irradiation, the abatement of spiramycin reached 99% for concentrations between 8 and 15 mg/L, under optimal conditions. The spiramycin elimination exceeded 99% after 20 minutes of exposure to UV radiations at pH 3.5 and pH 7 adjusted, and 5 and 9 unadjusted in presence of HCl. The photodegradation kinetics of spiramycin was described successfully by the Langmuir-Hinshelwood (L-H) kinetic model.

## SYNTHESIS OF MESOPOROUS SILICA NANOCATALYSTS AND FUNCTIONALIZING THEM FOR OLIGOMERIZATION OF GLYCERIN AS BIODIESEL BYPRODUCT

Ashkan Heydari<sup>1,a</sup>, Mahmood Kazemzad<sup>1</sup>

1. Dept. of Energy, Materials and energy research center, P.O. Box 14155-477, Tehran-Iran  
a. Corresponding author (ashkan1031@gmail.com)

With the predicted disappearance of petroleum oil reserves, research is currently intensively focused on renewable resources. Glycerol can be derived as by-product of the vegetable oil industry through transesterification. Due to the growing biodiesel production, the price of glycerol significantly dropped, making it one of the most promising platform chemicals of the near future. Among the various reaction pathways for catalytic conversion of glycerol, oligomerization to polyglycerols (PGs) is one of the viable and demanding processes due to the wide field of applications of PGs in cosmetics, polymers, food additives, antifogging film industry, pharmaceuticals, biomedical and drug delivery systems. In this study MSU type mesoporous silicas synthesized using TEOS as silica source and various surfactants in a controlled condition, after that the surface of mesoporous material functionalized by “trimethoxysilyl propanethiol” following by oxidation of SH functionalized surface with H<sub>2</sub>O<sub>2</sub> to SO<sub>3</sub>H groups. The obtained materials were applied as acid catalysts to the etherification reaction of glycerol. All of the mesoporous catalysts were characterized by FT-IR and BET-BJH as well as small angle XRD methods. In addition, the progress of catalytic reaction was followed by GC-MS spectrometry method.

## **EFFECT OF IMMOBILIZATION SUPPORT ON ENANTIOSELECTIVITY OF CANDIDA RUGOSA LIPASE IN THE RESOLUTION OF d,l-(±)-MENTHOL**

Fatiha Benamia, Abdelrahmane Belafreikh, Lazhar Boughani, Zeneddine Djeghaba  
a. Corresponding author (fatiha.benamia@univ-annaba.org)

*Candida rugosa* lipase is an enzyme widely used in many reactions of hydrolysis and synthesis [1]. In industry, it is used in particular for the preparation of pharmaceutical compounds [2]. However, for economic necessity, the integration of biocatalysts in industrial processes of production requires their immobilization on solid supports [3]. This work describes the immobilization of CRL on solid supports (celite, bentonite, cationic and anionic resin) and their influence on the enzyme enantioselectivity. The model reaction used for this purpose is the acylation of d,l-(±)-menthol with vinyl acetate. The results of this study showed that among these supports, the celite which gives the best values of  $E > 100$  with a greatest conversion. The thermal stability of lipase was also studied. The higher  $E$  values are obtained at 30°C.

## **THERMODYNAMICS OF REMOVAL OF DYES FROM TEXTILE WATER BY ADSORPTION ON AN ALTERNATIVE SOURCE OF ADSORBENT: POSIDONIA OCEANICA**

F. Kaouah<sup>a</sup>, T. Berrama, L. Brahmi, S Boumaza, Z. Bendjama

Laboratoire des sciences de génie des procédés industriels - Faculté de Génie Mécanique et de Génie des Procédés - USTHB - BP 32, El-Alia, 16111, Bab-Ezzouar, Alger (Algérie)  
a. Corresponding author (faridakaouah@yahoo.fr)

Equilibrium and thermodynamic studies of the removal of basic Yellow 87 by adsorption on *Posidonia Oceanica*, have been investigated. The results of effect of temperature and thermodynamic parameters confirm the process of removal to be exothermic in nature. The removal decreased from 89.4% to 68.6% by increasing the temperature from 25 to 65°C at 100 mg.L<sup>-1</sup> initial concentration of basic Yellow 87, pH 9, 200µm particle size and 300 rpm. Values of Langmuir's constants, 'Q<sub>0</sub>' and 'b' were also determined. Thermodynamic parameters namely enthalpy of adsorption, change in standard free energy,  $\Delta G^\circ$ , standard enthalpy,  $\Delta H^\circ$ , and standard entropy,  $\Delta S^\circ$  were determined. The relatively low cost and high capabilities of *Posidonia Oceanica* make it potentially attractive adsorbent for the removal of dyes from aqueous solution.

## **INTRODUCING HIGH PRESSURE DOUBLE TORSION PROCESS AS A NEW EFFICIENT METHOD FOR CONSOLIDATION OF METALLIC BASED COMPOSITE POWDER WITH HIGH VOLUME FRACTION OF REINFORCEMENTS**

Mohammad Jahedi, Mohammad Hossein Paydar  
a. Corresponding author (mjahedi@shirazu.ac.ir)

Consolidation process of a metallic based powder mixture including high volume fraction of reinforcements by using high pressure double torsion process (HPDT), has been investigated. Al-50 vol. % SiC powder mixtures have been produced using conventional ball milling process. The powder mixtures were then cold compacted at 200 MPa pressure and then were conducted to the final consolidation process; high pressure double torsion (HPDT). To investigate the effect of double torsion mechanisms on consolidation of the powders, the initial powders were also consolidated by well-known conventional high pressure torsion (HPT) process. Both HPT and HPDT processes were performed by applying 1.5 GPa pressure during 2 turns, at room temperature. Measuring the densities of the samples showed that 95% of the theoretical density has been obtained and the hardness and compression tests were shown high values for hardness and strength with respect to HPT process. The microstructures of the produced composites were evaluated by scanning electron microscope (SEM).

## **INVESTIGATION ON THE EFFECT OF HIGH PRESSURE TORSION AS A CONSOLIDATION PROCESS ON THE REINFORCEMENT'S DISTRIBUTION OF METALLIC BASED COMPOSITE INCLUDING HIGH VOLUME FRACTION OF REINFORCEMENT**

Mohammad Jahedi, Mohammad Hossein Paydar  
a. Corresponding author (mjahedi@shirazu.ac.ir)

Reinforcement's distribution has been examined after performing high pressure torsion process on a mixture of Al and SiC particulate powders. High pressure torsion process has been conducted at constant angular velocity (0.2 rpm) but in different number of turns. The Al-SiC composite powders were cold compacted at 200 MPa pressure at room temperature. To investigate the effect of torsion straining in high pressure torsion, the pressure remains constant (1.5 GPa) and the number of turns varied from 1 to 4. Microstructural investigations on the produced samples were performed by scanning electron microscope (SEM). Some statistical studies were performed by image processing tools of MATLAB to examine different trends of distribution after increasing the number of passes. The microstructure analysis showed that the reinforcements' distribution has been changed efficiently after one turn of high pressure torsion with respect to the initial compact. By increasing the number of turns, a random distribution obtained, which is the result of circumferential shear strain during the high pressure torsion. In other words, the initial agglomerations have been broken up into many smaller clusters. The statistical analysis led to this fact that larger distances between particles were obtained when the number of turns increase.

## MICROWAVE ABSORBING PROPERTIES OF POLYPYRROLE/BAFE<sub>12</sub>O<sub>19</sub>-TiO<sub>2</sub> NANOCOMPOSITES

Özlem Akman<sup>1,a</sup>, Hüseyin Kavas<sup>1</sup>, Zehra Durmuş<sup>2</sup>, Hüseyin Sözeri<sup>3</sup>, Abdulhadi Baykal<sup>2</sup>, and Bekir Aktaş<sup>1</sup>

1. Dept. of Physics, Gebze Inst. of Technology, 41400 Gebze, Kocaeli, Turkey
  2. Dept. of Chemistry, Fatih Univ., B.Çekmece, 34500 Istanbul, Turkey
  3. TUBITAK-UME, National Metrology Inst., P.O. Box 54, Gebze-Kocaeli 41470, Turkey
- a. Corresponding author (ozlm\_akman@hotmail.com)

Microwave absorbers have been in use, both in civil and military applications, due to their ability to reduce electromagnetic interference (EMI) and to reduce radar signatures for a long time. EMI can be prevented either by reflecting the EM radiation or by absorbing it. For this reason, magnetic fillers such as spinel and/or hexaferrites together with additional dielectric materials are generally needed. Polypyrrole appear to be good candidate which is used as an EMI shielding material due to the higher electrical conductivity. In this study conductive polypyrrole coated BaFe<sub>12</sub>O<sub>19</sub>-TiO<sub>2</sub> nanocomposites were synthesized via citrate sol-gel method route. It was mixed with commercial TiO<sub>2</sub> nanoparticles with 2:1, 1:1, and 1:2 ratios. Also all these composites were coated with polypyrrole. The structural, magnetic, and microwave absorption properties of Polypyrrole/BaFe<sub>12</sub>O<sub>19</sub>-TiO<sub>2</sub> composites were analyzed by XRD, TEM, FT-IR, VSM, and VNA techniques. It was concluded that the polypyrrole coating was so effective on Microwave absorption because of acting as a matching layer between different parts of composites. The composites mixed with the sample having a higher amount of magnetic filler were the best candidate for high reflection loss material at about -45 dB. The polypyrrole coating also was important contribution on decreasing reflection loss.

## INFLUENCE OF HCl TREATMENT ON STRUCTURAL AND GAS (SO<sub>2</sub> and C<sub>2</sub>H<sub>4</sub>) ADSORPTION PROPERTIES OF CLINOPTILOLITE-RICH NATURAL ZEOLITE

Burcu Erdoğan Alver<sup>1</sup>

1. Dept. of Physics, Faculty of Science, Anadolu Univ., 26470, Eskisehir, Turkey
- a. Corresponding author (burcuerdogan@anadolu.edu.tr)

Clinoptilolite is a high-silica member of the heulandite group. The basic structure of the clinoptilolite crystal contains three types of channels with the following approximate dimensions: channel A (7.2 Å-4.4 Å), channel B (4.0 Å-5.5 Å) and channel C (4.1 Å-4.0 Å). These channels are predominantly occupied by exchangeable cations and water molecules.

In this work, clinoptilolite-rich mineral (C) from Gördes, Turkey was used. Acid modified forms of clinoptilolite samples were prepared by batch method using 100 ml of HCl solutions (0.1, 0.5, 1 and 2 M) at 70 °C for 3 h. Clinoptilolite-rich mineral (C) and that of acid modified forms were characterized by using XRD, XRF and N<sub>2</sub> adsorption techniques. N<sub>2</sub>, C<sub>2</sub>H<sub>4</sub> and SO<sub>2</sub> adsorption isotherms of clinoptilolites obtained using a volumetric-type apparatus (Autosorb 1C). Acid treatment caused significant structural changes in samples, as shown by a significant removal of cations from the material, the decrease in the intensities of the clinoptilolite reflections and increase in the specific surface areas. It was found that SO<sub>2</sub> adsorption capacities (2.356-2.739 mmol/g) of the clinoptilolite samples were superior to those of the C<sub>2</sub>H<sub>4</sub> (0.619-1.219 mmol/g) adsorptions.

## **ELEMENTAL RELEASE COMPARISON OF SELECTIVE LASER SINTERING METHOD AND CONVENTIONAL DENTAL CASTING ALLOYS USING ICP-MS**

Ayça Açıkalın<sup>1</sup>, Yurdanur Uçar<sup>1,a</sup>, Aytaç Dönerci<sup>2</sup>, Nur Deniz Kıcıır<sup>3</sup>, Tunç Tüken<sup>3</sup>

<sup>1</sup>: Cukurova Univ., School of Dentistry, Dept. of Prosthetic Dentistry, Adana-Turkey

<sup>2</sup>: Republic of Turkey, Ministry of Health, Adana HıfzıSıhhaInstitute, Adana-Turkey

<sup>3</sup>: Cukurova Univ., Science and Art Faculty, Chemistry Dept., Adana-Turkey

a. Corresponding author (ysanli@cu.edu.tr)

Selective Laser Sintering Method (SLS) is a rapid production technique used for dental restorations. The aim of this study was to measure the ion release from dental alloys into artificial saliva. Disks (n=6/group) with 11mm diameter and 3mm thickness were prepared for cast NiCr and CoCr and laser sintered CoCr groups. The thermostat was set on 37±0.1 °C open atmosphere, and then the specimens were electrolyzed with 0.7 mV potential. The percent concentration and total amount of ions passing into the solution were assessed with ICP-MS in ppm. Two-way ANOVA followed by Tukey test was used to analyze differences between 3 groups and different elements (Cr, Fe, Ni, Co, Mo, Cs, V, Nb). V and Nb were not detectable by ICP-MS. The release of Fe, Co, Mo and Cs was not statistically significantly different. Release of nickel in cast CoCr (0.0027 ppm) alloy was higher than laser sintered (0.0008 ppm) alloy. Cast CoCr (0.369 ppm) has higher elemental release for cobalt than laser sintered CoCr (0.312 ppm). SLS procedure decreases the elemental release from CoCr alloy. Total ion release is statistically significantly lower for SLS compared to the other two groups. SLS procedure seems promising for dental framework construction.

## **INVESTIGATION OF WELDABILITY of PRODUCED BY POWDER METALLURGY METHOD OF NI-TI COMPOSITE WITH STAINLESS STEEL COUPLE**

Mehmet ÇAKMAKKAYA<sup>1</sup>, Fatih ÇOLAK<sup>2,a</sup>, Ersan MERTGENÇ<sup>3</sup>, Rıza KARA<sup>2</sup>

1. Afyon Kocatepe Univ., Faculty of Technology, Automotive Eng., Afyonkarahisar, Turkey

2. Uşak Univ., Vocational School of Uşak, Welding Technology Programme, Uşak, Turkey

3. Afyon Kocatepe Univ., Graduate School of Natural and Applied Science, Afyonkarahisar, Turkey

a. Corresponding author (fatih.colak@usak.edu.tr)

In this study, a pair of austenitic stainless steel with Ni-Ti composite material combined with TIG welding method. Ni-Ti composite produced by the powder metallurgy (P / M) method. Ni-Ti composite material, 45 µm grain size of 99% purity powders by weight was prepared by mixing the composition of 51% Ni and 49% Ti. This study pairs of materials joining TIG welding method is preferred. Welding process, the Ni-Ti composite material of two stainless steel plate was used. Welding process was carried out with the forehead and blunt 40A. Search for post-merger changes in microstructure that occur on the surface of the source examined by SEM-EDX analysis. In this study has been observed a pair of stainless steel and Ni-Ti composite successful due to the TIG welding method.

## **IN SILICO PREDICTION AND NANO-SCALE VERIFICATION OF BINDING POCKET OF ALLATOSTATIN RECEPTOR (AlstR) IN CARAUSIUS MOROSUS**

Burcin Duan Sahbaz<sup>a</sup>, Necla Birgul Iyison, Osman Uğur Sezerman  
a. Corresponding author (burcInduan@yahoo.com)

Mammalian somatostatin receptors are G-protein coupled receptors (GPCR) that have anti-proliferative effects in human tissues, and this made them valuable targets for cancer treatment. Recently, allatostatin receptors (AlstR) of insects were found to be ancient homologs of the somatostatin family. In this study an AlstR has been identified from stick insect, *Carausius morosus*. It was supposed to be activated by allatostatin C peptide (AST-C). In order to predict the binding pocket of this receptor-ligand system and to propose an antagonism or mutation resulting in disruption of the system, homology modeling, ligand docking and molecular dynamics simulations were performed. Binding pocket was found to consist of N-terminus, second and third extracellular loops (ECL). ECL3 region was strongly conserved within AlstRs. Binding with AST-C was verified via Atomic Force Microscopy (AFM) in nano-scale. Surprisingly, CamAlstR-C could form a significant interaction also with AST type A (AST-A) in AFM. When these two ligands were compared according to binding strengths, AST-C showed higher dissociation constant. The same in silico procedures were performed also for AST-A. Binding pockets were similar for both ligands. Therefore we conclude that the receptor-ligand interactions obtained from in silico predictions would be a reliable target region for pharmaceutical studies.

## **PREPARATION AND CHARACTERIZATION OF MACROPOROUS BIOACTIVE GLASS BY NOVEL POROGEN METHOD FOR BONE TISSUE ENGINEERING**

Samaneh Izadi<sup>a</sup>, Saeed Hesaraki, Masoud Hafezi  
a. Corresponding author (samaneizadi@yahoo.com)

One of the important applications of porous materials is fabrication of bone scaffolds. In this paper, highly porous, bioactive and biodegradable scaffolds have been prepared by the novel porogen method using combination of bioactive glass powder and different citric acid percentage. In this method, prepared powders were pressed at 100 (MPa) pressure. Differential thermal analysis (DTA) was used to evaluate the sintering condition. Under an appropriate sintering condition (1250°C/4 h) which conferred the scaffolds the highest possible compressive for this porous structure. The scaffolds were characterized using different methods such as scanning electron microscope (SEM), Pycnometry (ASTM-D5550) and compressive strength analyses. The obtained experimental results ascertained that the apparent porosities and the pore size diameters of the scaffold decreased as the weight percent of porogen increased and the distribution of pores were differentiated at various percentage of porogen.

## REVERSE MONTE CARLO MODELING OF METAKAOLIN-BASED GEOPOLYMERS

Sezen Soyer-Uzun<sup>1,a</sup>

1. Dept. of Chemical Eng., Boğaziçi Univ., Bebek 34342, Istanbul, Turkey  
a. Corresponding author (sezen.soyer@boun.edu.tr)

Production of Portland Cement is responsible for about 7% of all human-generated CO<sub>2</sub> emissions in the world. As the existing reinforced concrete infrastructure is fading at a fast rate, significant amount of research effort in the world started to focus on the development of 'geopolymer cement'. These future green-alternatives of Portland Cement are categorized as 'inorganic polymers' formed by the polymerization of a solid aluminosilicate (such as metakaolin, fly ash etc..) with a highly concentrated aqueous alkali-hydroxide or silicate solution. Structural studies regarding geopolymers indicate that their structure can be interpreted as amorphous versions of zeolites, therefore they are highly porous in nature.

In this study, structure of metakaolin-based geopolymers are modeled using reverse Monte Carlo modeling based on the available experimental high-energy diffraction data to develop a detailed atomic understanding of the structure. Short-range order information from Nuclear Magnetic Resonance Spectroscopy is provided as input to the simulation environment and atomic configuration is iteratively modified until the simulated diffraction patterns agree with experimental ones. Three dimensional atomic structures obtained revealed interatomic correlations that are responsible for the features in diffraction pattern. These results provide unambiguous interpretation of the experimental data for metakaolin-based geopolymers that has not been achieved before.

## FABRICATION OF POROUS HYDROXYAPATITE BY ELECTROPHORETIC DEPOSITION

CemBülent ÜSTÜNDAĞ<sup>1</sup>, Ali Can ZAMAN<sup>2,3</sup>, Figen KAYA<sup>2</sup>, Cengiz KAYA<sup>2</sup>

1. Vocational School, Yildiz Technical Univ., Istanbul, Turkey
2. Dept. of Metallurgical and Materials Eng., Yildiz Technical Univ., Istanbul, Turkey
3. Dept. of Metallurgical and Materials Eng., Kocaeli Univ., Kocaeli, Turkey  
a. Corresponding author (ustundagcem@yahoo.com)

Hydroxyapatite (HA) bioceramic have been widely using as a substitute material for repairing bone and teeth due to biological and chemical properties. The formations of porous bioactive hydroxyapatite ceramics containing multi-walled carbon nanotubes (MWCNTs) by electrophoretic deposition (EPD) were studied. For the synthesis of stoichiometric HA, calcium acetate was dissolved in distilled water and then the drop wise addition of phosphoric acid was performed at ambient temperature under magnetic stirring and then MWCNTs were added to the mixture. The mixture was subjected to hydrothermal treatment at 200°C for 2 h. The porous HA coatings were deposited onto carbon rod and plate by EPD using n-butanol suspensions mixture of nano HA and MWCNTs. The aim of using MWCNTs is to prevent cracking and production porous structure of HA ceramic. The deposited materials were sintered at 1200 °C for 60 min to burnout of carbon rod and MWCNTs. Microstructural and phase analysis of the HA-MWCNTs powders, and coating layers were characterized by some characterization techniques including FT-IR, XRD, TG-DTA, SEM, TEM, and BET. The effects of EPD processing factors on coating behavior were also discussed.

## USE OF ZEOLITE A IN REMOVAL OF Cd<sup>2+</sup> IONS

Djamel Nibou<sup>a</sup>, Samira Amokrane, E Hadj Mekatel, Soumia Bensafi  
a. Corresponding author (dnibou@yahoo.fr)

Zeolites have been proven ion exchange materials as Na<sup>+</sup> cations are not tightly fixed to the hydrated aluminosilicate structure and can be easily exchanged with other cations in solutions. These ion exchange properties are used to remove cations from chemical effluents. Many toxic heavy metals have been discharged into the environment as industrial wastes, causing serious soil damage and water pollution. This research paper describes the investigation of Cd<sup>2+</sup> ions adsorption on the zeolite A. The adsorbent was characterized by several techniques as X-ray powder diffraction, Infrared spectroscopy, Scanning electronic microscopy, and Differential thermal and gravimetric analysis and Nitrogen adsorption. The effects of the initial cadmium concentration, pH solution, solid-liquid ratio and temperature were studied. The adsorption equilibrium isotherms of cadmium ions were tested using the Dubinin-Radushkevich (D-R), the Freundlich and the Langmuir models. The thermodynamic parameters namely the enthalpy  $\Delta H^\circ$ , entropy  $\Delta S^\circ$  and free energy  $\Delta G^\circ$  of adsorption of Cd<sup>2+</sup> ions on A zeolite were determined.

## REMOVAL OF COPPER IONS ONTO ALGERIAN CLAY. CHARACTERIZATION, EQUILIBRIUM AND KINETIC STUDIES

Djamel Nibou<sup>a</sup>, Samira Amokrane, E Hadj Mekatel  
a. Corresponding author (dnibou@yahoo.fr)

The removal of copper ions from aqueous solutions onto Algerian clay was investigated in batch. The clay samples were characterized by X-ray powder diffraction, Infrared spectroscopy, Scanning electronic microscopy, Differential thermal and gravimetric analysis and Nitrogen adsorption technique for specific area surface and porous volume. The effects of parameters as initial concentration, pH, solid-liquid ratio (S/L) and temperature were studied. The Freundlich and the Langmuir models have been applied and the adsorption equilibrium has been found to follow the Langmuir model. Kinetic studies showed that the second-order sorption model was the most prevalent for the adsorption of copper ions. The rate constant of the exchanged ions appears to be controlled by chemical sorption process. The thermodynamic parameters namely the enthalpy  $\Delta H^\circ$ , entropy  $\Delta S^\circ$  and free energy  $\Delta G^\circ$  of adsorption of Cd<sup>2+</sup> ions on Algerian clay were determined.

## KINETICS AND THERMODYNAMICS STUDIES OF COPPER IONS ADSORPTION ONTO ZEOLITE A FROM AQUEOUS SOLUTIONS

Djamel Nibou<sup>a</sup>, Samira Amokrane, E Hadj Mekatel, Soumia Bensafi  
a. Corresponding author (dnibou@yahoo.fr)

The removal of copper ions from aqueous solutions by zeolite A was investigated. The characteristics of zeolite were determined by XRD, SEM, EDS, FTIR, DTA and TG techniques. The effects of solution pH, initial copper concentration C, solid/liquid ratio R and temperature T were studied in batch experiments. The Freundlich and the Langmuir models have been applied and the adsorption kinetics followed both adsorption isotherms. A comparison of kinetic models applied to the adsorption of copper ions on the zeolite was evaluated for the pseudo first-order and the pseudo second-order kinetic models. It seems that these models were found to correlate the experimental data. Intra particle diffusion model was also used. The thermodynamic parameters namely the enthalpy  $\Delta H^\circ$ , entropy  $\Delta S^\circ$  and free energy  $\Delta G^\circ$  of adsorption of Cu<sup>2+</sup> ions on A zeolite were determined.

## INFLUENCE OF THE NANOPOROUS ZEOLITE MATERIAL ON THE BREAKDOWN OF DC GLOW MICRODISCHARGES

K. Koseoglu<sup>1</sup>, S. Ozturk<sup>1</sup> and B.G. Salamov<sup>1,2</sup>

1. Physics Dept., Faculty of Sciences, Gazi Univ., Ankara, Turkey

2. National Academy of Science, Inst. of Physics, AZ-1143 Baku, Azerbaijan

a. Corresponding author (bala@gazi.edu.tr)

The stabilization of glow discharges in a dc plasma is studied in air functions of pressure (4–760 Torr), discharge gap d (50–250  $\mu\text{m}$ ) and diameter D (5–25 mm) of the cathode areas in the gas discharge electronic devices (GDED) with nanoporous zeolite cathode (NZC) for the first time. Comparison of current and discharge light emission (DLE) from GDED are used for the determination of the stabilization under low- and atmospheric pressure (AP) glow microdischarges conditions. It is found that the gas in zeolite pores ionizes and, accordingly, the number of electrons in the pores grows. It is established that the effect of various D on the clinoptilolite cathode area to the discharge are provided stable DLE, homogeneous, nonthermal and controllable operation up to the AP as well. It is shown that breakdown voltage is reduced significantly at AP when the D of NZC is increased. The cell optimization is also realized by constructing the Paschen curves for each cell parameters.

## FACTORIAL DESIGN MODELING OF ADSORPTION OF COPPER ON A ZEOLITE A

Samira Amokrane<sup>1</sup>, Khalifa Rahmoun<sup>1</sup>, Soumia Bensafi<sup>1</sup>, El Hadj Mekatel<sup>1</sup> and Djamel Nibou<sup>1,a</sup>

1. Laboratory Materials Technology / Faculty of Mechanical and Process Eng. / Univ. of Science and Technology Houari Boumediene

a. Corresponding author (snibou@yahoo.fr)

The zeolites are microporous adsorbents resulting from the assembly of SiO<sub>4</sub> tetrahedra and AlO<sub>4</sub> joined by oxygen atoms they share. Zeolites have a network of pores of uniform size, and a possibility of compensating cation exchange which enables them to be used in ion exchange processes, which summarizes the objective of our work is planning, modeling and optimization of the adsorption process of various environmentally harmful metals such as copper using a zeolite A. the latter was characterized by various analytical techniques. In order to optimize the number of trials in the adsorption process, a full factorial design at two levels noted nk was used where n = number of levels and k = number of factors studied. The polynomial written in condensed form where Y is the response variable:  $Y = a_0 + \sum X_j a_{1j} X_i \sum a_{2ij} X_i X_j + \dots + \sum a_{ijk} X_i X_j X_k$

X1, X2, X3 and X4 are dimension less coded factors corresponding to the contribution of pH, initial concentration of the cation, the solid-liquid ratio and temperature. The 16 unknown coefficients of the model were determined by the software JMP8. The validity of the model was performed by two Student test and Fisher-Snedecor.

## DISINTEGRATION&STABILIZATION OF MECHANICALLY DEWATERED INDUSTRIAL SLUDGE THROUGH SEMICONDUCTOR BASED HETEROGENEOUS & THIN FILM METHODS

Can Burak Özkal<sup>1,a</sup>, Yayla Sezgin<sup>2</sup>, Tolga Tunçal<sup>1</sup> and Orhan Uslu<sup>3</sup>

1. Namik Kemal University, Environmental Engineering Dept., Tekirdağ, Turkey
2. Namik Kemal University, Institute of Natural and Applied Sciences, Tekirdağ, Turkey
3. Yeditepe University, Engineering Faculty, Civil Engineering Dept., Istanbul, Turkey

a. Corresponding author (cbozkal@nku.edu.tr)

Photocatalytic sludge disposal experiments carried out with constant individual photon flux values of varying UV irradiation spectrums (UV-A, UV-B, UV-C, UV-VIs) through thin film and heterogenous photocatalysis methods (TFPC and HPC respectively). Thin film coated quartz substrates (tfcqs) prepared with sol-gel derived dip coating method using titanium (iv) n-butoxide precursor. Photocatalysis applied through exposure of mechanically dewatered industrial treatment sludge samples (mdits) to uv irradiation between two tfcqs. Photocatalytic effects on disintegration and stabilization efficiencies of the sludge samples were determined based on variations of sludge drying rate, unit power requirement (upr) and reduction of the volatile suspended solids (vss). Structure, size, band gap, film thickness and phase content by xrd, afm, tem and spectrophotometric analysis. obtained results reveal that, simultaneous sludge drying and stabilization could be achieved through photocatalysis by disintegration of mdits via nano-particles thus upr is reduced consequently. Our initial results proposed that photocatalysis may become a promising and novel technology for sludge treatment sector.

## **INTERNATIONAL ROUND ROBIN TEST FOR INTERNATIONAL STANDARDIZATION OF CELL MIGRATION ABILITY TEST FOR BIO-CERAMICS**

M. Kikuchi<sup>1</sup>, Y. Kobayashi<sup>2</sup>, M. Hirose<sup>3</sup>, M. Yokoi<sup>4</sup>, T. Ushida<sup>4</sup>, Y.-B. Kang<sup>5</sup>, Y. Arai<sup>5</sup>, A. Johansson<sup>6</sup>, P. Thomsen<sup>6</sup>, R.J. Friederichs<sup>7</sup>, R. Brooks<sup>7</sup>, S.M. Best<sup>7</sup> and S. Tsutsumi<sup>5</sup>

1. National Inst. for Materials Science, Japan,
  2. Waseda Univ., Japan,
  3. National Inst. of Advanced Industrial Science and Technology, Japan,
  4. Univ. of Tokyo, Japan,
  5. Nihon Univ., Japan,
  6. Univ. of Gothenburg, Sweden,
  7. Univ. of Cambridge, UK.
- a. Corresponding author (KIKUCHI.Masanori@nims.go.jp)

Regenerative medicine offers potential for the repair of a wide range of tissues which are either diseased or damaged through injury. Although the ability of cells to infiltrate a scaffold is a key factor for both in vivo and in vitro tissue regeneration, no rigorous and quantifiable test method currently exists to characterize cell behavior in the scaffold. Recently, a test method to measure cell migration distance was proposed (Kikuchi, Key Eng. Mat., 2012). In this paper, the reproducibility and usefulness of the method were tested internationally.

Test specimens were provided from 4 private companies and 2 academic institutes. The specimens were deaerated to remove air in the scaffold pores and were then placed carefully on a confluent cell layer. After 3 days culture, the specimen was harvested, fixed with 2% glutaraldehyde and stained with Giemsa. The specimen was sectioned longitudinally such that the maximum extent of staining was clearly visible. The longest linear migration distance from the bottom of the specimen was measured using a stereoscopic micrograph. As a result, the trend in cell migration distance for each specimen was similar among the institutes. The method is a good candidate for standard of measuring cell migration distance.

## **FABRICATION AND ABSORPTION PROPERTIES OF ORDERED SI NANOWIRE ARRAYS USING POROUS ALUMINUM MASK**

Tomohiro Shimizu<sup>a</sup>, Takuya Yamaguchi, Shintaro Otsuka, Chong Wang, Yasuhiro Morosawa, Koichi Takase, Shoso Shingubara  
a. Corresponding author (shimi@kansai-u.ac.jp)

Highly ordered Si nanowire arrays on Si substrate were prepared using a combination of metal-assisted wet chemical etching and porous alumina masks with periodic hole-pattern. The porous alumina hole pattern was transferred to the metal catalyst for Si etching. The diameter of Si nanowire was 50 nm and it is almost same as diameter of porous alumina nanohole. The nanowire arrays were dried two different conditions, in particular supercritical drying and nature drying. We observed clear distinction of surface color of the samples. The supercritical dried sample shows yellowish surface due to the absorption of Si nanowires. The nanowires were aligned perpendicular to the Si substrate, independently. In contrast, the nature dried sample shows blackish surface. The nanowires were agglomerated randomly on Si surface during drying owing to surface tension of water, and the size variation of agglomerated wires contributed absorption of broad wavelength of light.

## **SYNTHESIS AND CHARACTERIZATION OF RHO-ZMOF AND ITS POTENTIAL USE AS FILLER IN MIXED-MATRIX MEMBRANES FOR CO<sub>2</sub> SEPARATION**

Gözde Işıl Öztürk<sup>1</sup>, Çiğdem Atalay-Oral<sup>1</sup>, Ahmet Sirkecioğlu<sup>1</sup>, M. Göktuğ Ahunbay<sup>1</sup>, Ş. Birgül Tantekin-Ersolmaz<sup>1,a</sup>

1. Istanbul Technical Univ., Dept. of Chemical Eng., Istanbul, Turkey,  
a. Corresponding author (ersolmaz@itu.edu.tr)

Metal-organic frameworks (MOFs) are hybrid materials consisting of metal clusters bridged by organic linkers. Zeolite-like metal-organic frameworks (ZMOFs) are a subclass of MOFs and has anionic framework unlike other MOFs which have neutral framework. The charge-compensating extra-framework cations in the pores of ZMOF structures can be ion-exchanged with alkali metals similar to zeolites, increasing their CO<sub>2</sub> affinity. Compared with other MOFs and nanoporous materials reported to date, rho-ZMOF exhibits exceptionally high selective adsorption for CO<sub>2</sub> especially from CO<sub>2</sub>/CH<sub>4</sub> mixture. In this study, rho-ZMOF crystals were synthesized and characterized for possible use in the development of polyimide based mixed-matrix membranes (MMMs) for CO<sub>2</sub> separation. The rho-ZMOF crystals were synthesized using the solvo-thermal method and characterized by XRD, SEM, TGA, and adsorption measurements. MMMs containing rho-ZMOF crystals as filler were prepared using Matrimid<sup>®</sup> and 6FDA-DAM polyimides as the polymer matrix. Membranes were characterized with SEM, XRD, TGA and DSC. The CO<sub>2</sub>/CH<sub>4</sub> and CO<sub>2</sub>/N<sub>2</sub> separation performance of the membranes were determined by single gas permeability measurements. This work reveals that rho-ZMOF is a promising candidate for the separation of CO<sub>2</sub> but there are problems regarding the thermal and mechanical stability of rho-ZMOF crystals during membrane preparation procedure which involved mixing and thermal annealing.

## **RESISTIVE SWITCHING MEMORY OF ANODIC POROUS ALUMINA MEMBRANE**

Kouichi Takase, Shintaro Otsuka, Shimizu Tomohiro, Shingubara Shoso  
a. Corresponding author (takase@shotgun.phys.cst.nihon-u.ac.jp)

Resistive switching random access memory, which consists of simple metal/insulator/metal structure, has attracted much attention due to great advantages such as high-speed switching, nonvolatile properties, and has been expected to be a next generation memory. However, the switching voltage has a wide distribution and the poor reproducibility hinders the practical application. The resistive switching phenomena have been understood in terms of a formation and rupture of numerous nanofilaments as conduction paths formed with soft breakdown of an insulator. A limitation of the number of conductive paths is expected to lead to the suppression of the variation of switching voltage. In this study, two strategies for the limitation have been proposed using an anodic porous alumina (APA). The first is the reduction of the number of conductive paths by restriction of the contact area using the porous structure. The second is the lowering of the resistivity of the insulator, which makes it possible to grow filaments with the same characteristics by electrochemical treatments. Only the restriction of the contact area was not effective for the reduction and the switching reproducibility was poor. Additional electrochemical treatment of the APA could improve the switching voltage variation width.

## **ENHANCEMENT OF HEAT TRANSFER FROM A TUBE BY USING OPEN CELL ALUMINUM FOAM**

Gözde Uğurlular<sup>1</sup>, Moghtada Mobedi<sup>2,a</sup>

1. Energy Eng. Program, Izmir Inst. of Technology, Urla, 35410 Izmir, Turkey

2. Mechanical Eng. Dept., Izmir Inst. of Technology, Urla 35430, Izmir, Turkey

a. Corresponding author (moghtadamobedi@iyte.edu.tr)

Many methods have been developed to enhance heat transfer in heat exchangers. Among different methods, the use of metal foam has taken attention of researchers in recent years. Metal foam has high effective thermal conductivity and huge heat transfer surface area. It provides high rate of fluid mixing while causes smaller increase of pressure drop due to its high permeability.

A numerical study is performed to investigate the enhancement rate of heat transfer from a tube by using aluminum foam. Heat transfer and pressure drop for flow over a tube in a free channel is calculated. Then the channel is filled with aluminum foam, and the heat transfer rate and pressure drop are determined for the foam assisted channel. The enhancement rate of heat transfer and pressure drop due to the use of foam is calculated by comparison of results of two cases. The comparisons are presented via diagrams for different Reynolds number and five aluminum foam structures having different porosities. It is found that the open cell aluminum foam improves heat transfer from a tube. However, the goodness factor is higher for flows with low Reynolds number. The enhancement rate of heat transfer and pressure drop considerably changes with the foam structure.

## **MICROSTRUCTURAL EVOLUTION IN STAINLESS STEEL FIBERS FOR POROUS METALS**

Yong Liu, Xiuyun Zhao, Yan Wang, Ping Feng, Huiping Tang

a. Corresponding author (yonliu11@yahoo.com.cn)

Porous metal structures from fibers have been widely used for chemical engineering, energy and medical industries. However, the microstructures of metal fibers are critical to the mechanical properties of the porous structures. The presentation described our recent results on the sintering behaviors of micron-level stainless steel fibers, including the growth of sintering necks and grain growth. It indicates that the sintering necking depends largely on the intersection angles of fibers, and small-angled or parallel fibers tend to sinter together closely due to more contact area. For large-angled or perpendicular fibers, it is difficult to form sintering necks. The sintering kinetics shows that the activation energy of stainless fibers is higher than that of powder particles. The grain growth kinetics of fibers of different sizes was also studied. Fine fibers show a fast grain growth rate. However, all the fibers have a maximum grain size after long time of annealing. Finally, a combination theoretical analyses on the sintering behavior and grain growth was provided.

## **FOURIER TRANSFORM INFRARED, SOLID-STATE NUCLEAR MAGNETIC RESONANCE, AND X-RAY DIFFRACTION STUDIES OF NATURAL AND ACID-TREATED BENTONITES FROM TURKEY**

Özgür Alver<sup>1,a</sup> and Burcu Erdoğan Alver<sup>2</sup>

1. Dept. of Physics, Science Faculty, Anadolu Univ., Eskisehir, Turkey; and Plant, Drug and Scientific Research Centre, Anadolu Univ., Eskisehir, Turkey
2. Dept. of Physics, Science Faculty, Anadolu Univ., Eskisehir, Turkey
- a. Corresponding author (ozguralver@anadolu.edu.tr)

Bentonites are composed predominantly of the smectite group of minerals. Smectites have a 2:1 layer structure formed by two silica tetrahedral sheets joined to a central octahedral sheet. In this study, natural bentonite samples were obtained from Nuriye deposits of the Ünye region of Turkey. Natural bentonite and 6M HCl-treated samples for 6 hr, 12 hr, and 24 hr at 90 °C were labeled as B1, B2, B3, and B4, respectively. Natural and acid-treated bentonites were characterized by FT-IR between the region of 4000 and 400 cm<sup>-1</sup> and the obtained results were supported by <sup>29</sup>Si, <sup>27</sup>Al MAS NMR and XRD measurement techniques. Effects of acid treatment were monitored by following the destruction of the original bentonite sample upon the acid treatment with different (6 hr, 12 hr, and 24 hr) acid exposure times. Following 24-hr acid treatment, the tetrahedral Si<sup>4+</sup> structure was not fully collapsed but most of it turns into three-dimensional SiO<sub>2</sub> impurity.

## **ULTRASONIC CHARACTERIZATION OF POROUS Si<sub>3</sub>N<sub>4</sub> CERAMICS PRODUCED BY DIFFERENT PORE FORMERS**

Elif EREN<sup>1,a</sup>, Gülsüm TOPATEŞ<sup>2</sup>,

1. Nevsehir Univ., Dept. of Ceramic and Glass Design, 50800, Hacibektas, Nevsehir, TURKEY
2. Anadolu Univ., Dept. of Materials Sci. and Eng., 26480, Eskisehir, TURKEY
- a. Corresponding author (gtopates@anadolu.edu.tr)

Porous Si<sub>3</sub>N<sub>4</sub> ceramics were fabricated by partial sintering and pore former. While potato starch consists of elliptic and round particles, rice starch has angular and coarse particles. The porosity of fabricated ceramics varied between 52-57% and pore size were restricted to 1-3 µm as a result of a small grain width of β-Si<sub>3</sub>N<sub>4</sub> grains and interlocking structure formed by these grains. Elastic and bulk moduli of the samples were measured by ultrasonic measurement using ultrasonic A-scan. The A-scan format provides a quantitative display of signal amplitudes and time-of-flight data obtained at a single point on the surface of the sample. The time of flight of the ultrasonic waves (longitudinal and shear waves) was measured with contact ultrasonic transducers operating in pulse-echo mode. The elastic modulus of sample without pore former was 30 and it decreased to 16 for potato and 14 GPa for rice starch added samples. Same trend also observed for bulk modulus. Even though using similar size and same amount of pore former slight differences were observed as a result of different geometry of potato and rice starch particles and hence pore geometry. The study aims to make a correlation between pore geometry some mechanical properties using image analysis and sonic measurement.

## AN INVESTIGATION OF THE PERMEABILITY OF POROUS $\text{Si}_3\text{N}_4$ CERAMICS

Gülsüm TOPATEŞ<sup>1,2,a</sup>, Ferhat KARA<sup>1</sup>, Hasan MANDAL<sup>2</sup>

1. Anadolu Univ., Dept. of Materials Sci. and Eng., 26480, Eskisehir, TURKEY
  3. Çanakkale Onsekiz Mart Univ., Çan Vocational College, 17400 Çanakkale, TURKEY
  2. Sabanci Univ., Material Sci. and Eng. Programme, 34956, Istanbul, TURKEY
- a. Corresponding author (gtopates@anadolu.edu.tr)

Studies that have been carried out to fulfill the increasing expectations from diesel particulate filter materials have been focused on finding new materials and tailoring filter's structure. In this study, processing of  $\text{Si}_3\text{N}_4$  that can be the alternative of commercial ceramic diesel particulate filters was investigated by considering structure-property-performance relationship. Therefore, porous  $\text{Si}_3\text{N}_4$  with different microstructures were produced and pressure loss and permeability of these materials were investigated.

Studies showed that permeability of  $\text{Si}_3\text{N}_4$  was affected by pore size and microstructure rather than the porosity of the material. As  $k_1$  permeability value of produced  $\text{Si}_3\text{N}_4$  materials with a traditional microstructure was  $7.9 \times 10^{-14} \text{ m}^2$ , it's possible to enhance this value to a degree of  $20.4 \times 10^{-14} \text{ m}^2$  by obtaining coarse and equiaxed grains in the microstructure. In spite of the increment in permeability, its value is still lower for practical applications such as diesel particulate filter (DPF) (wall flow filter) substrates where it should be  $10^{-12} \text{ m}^2$ .

## DEVELOPMENT OF ANTICORROSION COMPOSITE POLYMER MATERIALS AND COATINGS BASED ON THEM WITH USING POWDERY WASTES OF VARIOUS PRODUCTIONS

SayIbjan Negmatov<sup>1</sup>, Khamza ShodIev<sup>1</sup>, MadIna Babakhanova<sup>1</sup>,  
JahongIr Negmatov<sup>1</sup>, MukhIda Babakhanova<sup>1</sup>, Mallka Negmatova<sup>1</sup>,  
BakhodIr SobIrov<sup>1</sup>, Lola NosIrova<sup>1</sup>

1. State UnItary EnterprIse "Fan va TaraqqIyot", Tashkent State TechnIcal UnIversItiy, UzbekIstan
- a. Corresponding author: (polycomft2005@rambler.ru)

The paper demonstrates corrosion composite polymeric materials based on epoxy resin ED-20 and powder coatings using fillers from wastes of various industries, such as phosphogypsum (PG), fosfoshlak (FSH), kaolin, bentonite, gold processing plant waste Marjanbulak Navoi Mining and Metallurgical Combine (OZIF), and as a plasticizer gossipol resin (HS).

During the filling of the active ingredients and the mechanically activated powder is hardening of the polymer matrix, providing a high homogeneity and improves physical, mechanical and performance properties. Inhibition of transport of substances through the film, when filling in the first place, the result of increasing the rigidity of the molecular chains and reduce the rate of relaxation processes. Therefore, corrosion resistance of developed coatings is improved.

Thus it can be concluded that the coating using the mechanically activated powder production waste can significantly improve the physical and mechanical properties and reduce the time of the curing compositions. The use of local raw materials and waste products for corrosion protection coatings enables effective reduction in the cost of anticorrosive protection and operating costs with a high degree of reliability and durability of the equipment required in aggressive environments.

## **Cu(II) ION ADSORPTION CAPACITY OF CaP MODIFIED SILK/NYLON-6 NANOFIBER MEMBRANE**

Eda Yalçın<sup>1,2</sup>, Murat Demirbilek<sup>1</sup>, Cem Bayram<sup>1,3</sup>, Ahmet Çabuk<sup>6</sup>, Zeynep Karahaliloğlu<sup>1,4</sup>, Mesut ŞAM<sup>4</sup>, Necdet Sağlam<sup>1</sup>, Emir Baki Denkbaş<sup>1,5</sup>

1. Hacettepe Univ. Nanotechnology and Nanomedicine Division, Beytepe, Ankara
  2. Aksaray Univ. School of Health Sciences, Aksaray
  3. Aksaray Univ. Faculty of Science & Education, Dept. of Chemistry, Aksaray
  4. Aksaray Univ. Faculty of Science & Education, Dept. of Biology, Aksaray
  5. Hacettepe Univ. Faculty of Science, Dept. of Chemistry, Beytepe, Ankara
  6. Osmangazi Univ., Faculty of Science, Dept. of Biology, Eskişehir
- a. Corresponding author (edaylcn85@windowslive.com)

Copper is widely used in different fields such as electrical industries. The fact that copper is an essential metal in a number of enzymes for all forms of life, it become toxic, causing cancer and oxidation when ingested in elevated levels in drinkable water [1]. In this study, silk/nylon-6 nanofiber membrane which modified with calcium phosphate crystal (CaP) was evaluated as a filter membrane for Cu(II) adsorption from the waste water. Electrospinning parameters, including solution concentration, voltage, flow rate, and distance between tip and collector were optimized and silk/nylon-6 nanofiber membrane was obtained by electrospinning. As results of the study, average diameter is 250 nm silk/nylon-6 nanofiber membranes were obtained and covered successfully with calcium/phosphate crystals [2]. The effect of various parameters on adsorption process such as solution pH, initial copper concentration were studied at room temperature to optimize the conditions by continuous flow system. Adsorption parameters was obtain by AAS and Cu(II) adsorption capacity of modified with CaP crystal silk/nylon6 nanofiber membrane was calculated. The maximum adsorption capacity of the membrane was determined as 30 mg l<sup>-1</sup> initial Cu(II) at pH 5.0.

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## **INVESTIGATION OF ORANGE II ADSORPTION ONTO POLY(VINYLMIDAZOLE) HYDROGEL AND ITS QUATERNIZED DERIVATIVES**

Murat Erdem<sup>1,a</sup>, Muhand K. T. Al Tememi, Adnan Özcan<sup>1</sup>, Bilge Erdem<sup>1</sup>

1. Dept. of Chemistry, Faculty of Science, Anadolu Univ., 26470 Eskişehir, Turkey
- a. Corresponding author (merdem@anadolu.edu.tr)

In this study, 1.2% cross linked poly(vinylimidazole) hydrogel was synthesized by using free radical polymerization and then this hydrogel was quaternized partially by straight-chained alkylhalides having different numbers of carbon atoms. The functional groups of the synthesized polymer and its partially quaternized derivatives were analyzed by using Fourier Transform Infrared Spectroscopy (FTIR); the surface morphologies were investigated by Scanning Electron Microscope (SEM). The partial quaternization of poly(vinylimidazole) hydrogel was supported by Energy Dispersive X-ray Spectroscopy (EDAX) and zeta potential measurements. The equilibrium swelling ratio of hydrogels was determined in pure water at room temperature by gravimetric method. Poly(vinylimidazole) hydrogel and its partially quaternized derivatives were used as an adsorbent to remove of Orange II from aqueous solutions. The effects of pH, the initial dye concentration and contact time on the adsorption process were studied and from the obtained data; the isotherm and kinetic parameters of adsorption were calculated. Kinetic evaluations were performed by Lagergren-first-order and pseudo-second-order kinetic models and adsorption equilibrium was studied by Langmuir and Freundlich isotherm models.

## REMOVAL OF ATRAZINE FROM WATER BY HIGHLY POROUS POLYMER ADSORBENT-EFFECT OF TEMPERATURE AND IONIC STRENGTH

Idil Yılmaz-Ipek<sup>1</sup>

1. Chem.Eng.Dept.of Ege Univ., 35100, Bornova, Izmir TURKEY  
a. Corresponding author (idil.ipek@yahoo.com)

Atrazine is the most extensively applied herbicide to control broad-leaf plants and weeds due to its high efficiency and low cost. It constitutes one of the most important pollutants in ground water of many countries and it is therefore important to control its concentration in the environment. As a consequence of its solubility, high chemical and biological stability in soils, widespread use and considerable leaching potential, it has been detected in surface, ground, and drinking waters. Recently, atrazine is recognized as an endocrine disruptor for mammals and aquatic life. US-EPA has set a maximum contaminant level for atrazine as 3 ppb. It is one of the most difficult pesticides to remove from drinking water supplies. Due to its hydrophilic and highly refractory nature, conventional treatment techniques such as coagulation, filtration and chlorination have been found to be incapable of achieving significant removal of atrazine. Adsorption is regarded as a promising method for the removal of this compound. In this study, the effects of temperature and ionic strength on adsorption of atrazine were investigated using highly crosslinked porous polymer adsorbent Purolite PAD 400. Atrazine was analyzed using HPLC (Shimadzu) equipped with a UV-VIS detector and a C-18 column (250 mm x 4.6 mm x 5  $\mu$ m). Isotherm data were evaluated with Langmuir and Freundlich models. Additionally, thermodynamic analysis was performed to get the idea about the influence of temperature on atrazine adsorption.

## WO<sub>3</sub> NANO-PARTICLES IN BULK WATER

Mitsutake Oshikiri<sup>1,a</sup>

1. National Inst. for Materials Science, Tsukuba, 305-0031 Japan,  
a. Corresponding author (oshikiri.mitsutake@nims.go.jp)

The material tungsten oxide (WO<sub>3</sub>) is well-known as an important photo-catalyst which can produce oxygen from water and also a promising material to decompose many kinds of harmful organic compounds by visible light irradiation. Aiming to obtain the clue to elucidate the origin of the excellent photo-catalytic properties, detailed fundamental properties of the WO<sub>3</sub> nano-particle in bulk water with respect to the structure relaxation, water molecular adsorption features, and the electronic structures of the inhomogeneous whole system have been investigated by first principles approach.

The atomic dynamics were investigated by Car-Parrinello molecular dynamics simulation using a super cell (~5 cubic nm) including a WO<sub>3</sub> nano-particle (~1.4 nm in diameter) and water at room temperature. Main results are as follows. (1) The structure of the WO<sub>3</sub> nano-particle is stable in water at 300K but some of the water molecules are dissociated at the surficial W sites. (2) Investigating the theoretical electronic structures, it has been understood that the so-called surface level does not always suppress the oxidization process (i.e. O<sub>2</sub> generation) of adsorbed water molecules in the inhomogeneous WO<sub>3</sub> + water system although normally it can be one of the dominant factors to suppress the process in photo-catalysis in metal oxides.

## **HYBRID NANOCOMPOSITE MATERIAL SYNTHESIS FOR THE REMOVAL OF ACID ORANGE 8 FROM WASTEWATER BY ADSORPTION METHOD**

Bilge Erdem<sup>1,a</sup>, Murat Erdem<sup>1</sup>, Aysel Çerkezoğlu<sup>1</sup>

<sup>1</sup>Dept. of Chemistry, Faculty of Science, Anadolu Univ., 26470 Eskişehir, Turkey  
a. Corresponding author (bilgee@anadolu.edu.tr)

Water contamination resulted from synthetic textile dyes is a major problem since it has harmful effects on environmental and human health. Adsorption is a simple and effective method for the removal of dye contaminants from wastewater. Although natural clays are commonly used and low cost adsorbents for adsorption processes, polymer/clay nanocomposites are more effective adsorbents as they have hydrophobic forms.

In this study, poly[2-(methacryloyloxy)ethyl]dimethylhexadecyl-ammonium bromide/bentonite (PQDMA/B) nanocomposites having different amounts (wt% 3, 5, 7, 10) of clay were prepared by in situ suspension polymerization as adsorbent for the removal of Acid Orange 8 from wastewater. Polymer-clay nanocomposites were characterized by using Fourier Transform Infrared (FTIR) spectrophotometer, Thermogravimetric Analyzer (TGA), X-ray Diffraction Analyzer (XRD), Energy Dispersive X-ray attached Scanning Electron Microscope (SEM-EDX), surface area analyzer and zetameter. The effects of pH and contact time onto adsorption process were examined using a batch adsorption technique. Optimum pH value and equilibrium contact time for the adsorption were found as 2.5 and 120 minute, respectively. The kinetic parameters showed that Acid Orange 8 adsorption follows the pseudo-second-order kinetic model. The obtained results showed that PQDMA nanocomposites with bentonite filler could be employed alternatively in wastewater treatment for the removal of textile dye contaminant.

## **THE REPRODUCIBILITY OF THE Al MATRIX COMPOSITE MATERIAL REINFORCED WITH B<sub>4</sub>C VIA HOT PRESSING TECHNIQUE**

Engin NAS<sup>1,a</sup>, Hasan GÖKKAYA<sup>2</sup>

1. Duzce Univ., Cumayeri Vocational School, Industrial Molding, 81700, Cumayeri, Düzce

2. Karabuk Univ., Faculty of Eng., Machine Eng., 78050 Karabuk

a. Corresponding author (enginnas@duzce.edu.tr)

In this study, the reproducibility of composite materials by using 8 % B<sub>4</sub>C (<10 μ) and 92 % Al (<200 μ) powders in weight via hot pressing technique was examined. To be able to have a homogeneous mixture of B<sub>4</sub>C and Al powders, they were mixed with turbula mixing device for twenty minutes. For pre-shaping, mixed powders were cold pressed in a mold prepared with 110 bar pressure. After pressing process, the mold was heated to 595 °C, and it was left for cooling in atmospheric environment after it waited under 45 bar pressure for fifteen minutes. The results confirmed that Al matrix composite materials reinforced with B<sub>4</sub>C can be produced via hot pressing technique.

## **SINTERABILITY COMPARISON OF THE Al/SiC AND Al/MoSi<sub>2</sub> POWDER SYSTEMS UNDER MICROWAVE SINTERING CONDITIONS**

Mehmet Çakmakkaya<sup>1a</sup>, M.Serhat Başpınar<sup>2</sup>, Ahmet Yönetken<sup>3</sup> and Ayhan Erol<sup>4</sup>

1. Afyon Kocatepe Univ., Faculty of Technology, Automotive Eng. Dept., Turkey
2. Afyon Kocatepe Univ., Technical Education Faculty., Metal Education. Dept., Turkey
3. Afyon Kocatepe Univ., Eng. Faculty, Dept. of Electric Eng., Turkey
4. Afyon Kocatepe Univ., Faculty of Technology, Metallurgy and Material Sci.Dept., Turkey  
a. Corresponding author (cakmakkaya@aku.edu.tr)

Aluminum cooler panels were extensively used in micro scale electronic and also in macro scale electrical power systems. Conventionally used aluminum cooler systems falls under excessive heating and cooling cycles. Therefore, Al/SiC systems replaced instead of it where critical conditions exists. Although SiC is good in heat conductivity, it lowers the heat conductivity of the Al/SiC system. The main objective of this study was to investigate the sintering behavior of Al/MoSi<sub>2</sub> where MoSi<sub>2</sub> is more conductive than SiC. Atmosphere controlled microwave sintering technique was used for the sintering process. Two main powder system were prepared with different SiC and MoSi<sub>2</sub> addition (5, 10, 15% vol.) with aluminum. After the preliminary studies it was concluded that the wetting of the MoSi<sub>2</sub> powder surface with aluminum is problem and non-homogeneous sintering surfaces was obtained. In order to solve this problem MoSi<sub>2</sub> powder surfaces were coated with Ni by electroless coating technique. It was concluded that Al/MoSi<sub>2</sub> powder system with Ni coating has better sintering and densification behavior than the other powder systems.

## **SYNTHESIS AND CHARACTERIZATION OF FLUOROPROBE LABELED MESOPOROUS HYBRID MATERIALS**

Fehmi Karagöz, Orhan Güney  
a. Corresponding author (karagozf@itu.edu.tr)

Inorganic sol-gel-derived materials had been investigated and commercialized and due to the profound understanding of the underlying chemical and technical processes are still present as important examples of large-scale applications of the sol-gel technology. The term sol-gel comes from the idea of transitioning the liquid mixture solution of colloidal particles (sol) into an interconnected polymer network (gel). Inorganic-organic (hybrid) materials combine the most important properties of their constituents, like high transparency (glasslike), low processing temperatures (polymer-like) and sufficient thermal stability (silicone-like). The high surface area and open pore networks of mesoporous materials with tunable binding characteristics are ideal for application to the detection of a range of chemical analytes. Research into the application of mesoporous silicas for controlled release of small molecules may also lead to new avenues for sensing, whether related to the release of reporter molecules in response to an analyte or perhaps to the delivery of receptor molecules for interaction with an analyte. In this work, fluoroprobe labeled organosilane was synthesized and used to prepare the mesoporous hybrid materials. Emission response, pH sensing behavior and optical chemical sensing property of the hybrid system was investigated by fluorescence spectroscopy upon responding to the chemical species in aqueous solution.

## **TOMOGRAPHY BASED ANALYSIS OF FLUID FLOW THROUGH A POROUS MEDIA**

Eren Ucar<sup>1</sup>, Moghtada Mobedi<sup>1</sup>, Gokhan Altuntas<sup>2</sup>, ErikGlatt<sup>3</sup>

1. Mechanical Eng. Dept., Izmir Inst. of Technology, Urla 35430, Izmir, Turkey
2. Dept. of Mechanical Sciences, Eng. Faculty, Celal Bayar Univ., Muradiye 45100, Turkey
3. Fraunhofer-Institut für Techno-und Wirtschaftsmathematik, 67663 Kaiserslautern, Germany  
a. Corresponding author (moghtadamobedi@iyte.edu.tr)

A three dimensional numerical study on analysing of fluid flow through a porous medium is performed by using micro-computer tomography technique. The porous medium is a volcanic rock sample and originally has a cylindrical shape with length of 7.907 mm and diameter of 11.470 mm. Micro-computer tomography of this material was carried out to construct the 3D pore level digital representation. Each slice of the obtained images has 4000 x 4000 pixels and the distance between two slices is 3.23  $\mu\text{m}$ . To find the solution of the problem, Cartesian coordinate is preferred and a cubic region with 216  $\text{mm}^3$  ( $6 \times 6 \times 6 \text{ mm}^3$ ) extracted from the center of the received images. Two commercial programs are used to obtain velocity and pressure distributions in the region of interest. Geodict programme is used to recreate a virtual model and to generate voxel based mesh. Then, the ANSYS Fluent programme is used to solve fluid flow equations for the generated voxels. The velocity and pressure distributions in the pores of the considered region are obtained and plotted. The pressure difference through the computational domain is obtained and the permeability of volcanic rock sample is determined by using Darcy's law.

## **PREPARATION OF POLYANILINE IN THE PRESENCE OF CARBOXYLIC ACID CONTAINING CELLULOSE AND USING IT FOR REMOVAL OF DYES**

Esmâ Ahlatcıoğlu<sup>1,a</sup>, Gulcin T. Turan<sup>1</sup>, B. Filiz Senkal<sup>1</sup>

1. Dept. of Chemistry, Istanbul Technical Univ., Istanbul 34469, Turkey  
a. Corresponding author (esmahlatcioglu@gmail.com)

Dyes usually have a synthetic origin and complex aromatic molecular structures which make them more stable and more difficult to biodegrade. Polyaniline (PANI) is one of the most versatile conducting polymers with many unique advantages, like ease to prepare, good environmental stability, enhanced conductivity, suitable for making composites.

In this study, poly (acrylonitrile) (PAN) has been grafted onto cotton cellulose by redox polymerization method. Then, PAN grafted cellulose was hydrolysed with interacted with NaOH and acetic acid respectively. The carboxylic acid groups on the surface brushes were neutralized with aniline, and the adsorbed aniline was polymerized by oxidizing with ammonium persulfate to give self-doped polyaniline. The sorption capacity of the reactive red was found 0.236 g/ g sorbent.

## PURIFICATION OF ALCOHOL CONTAINING MESH WITH POWDER FILTERING MATERIALS

A.F. Ilyushchenko<sup>1</sup>, V.M. KaptsevIch<sup>2</sup>, N.N. YakImovIch<sup>3</sup>, R.A. KusIn<sup>2</sup>, I.N. Chernyak<sup>1,a</sup>,  
N.S. Ruchay<sup>4</sup>, A.I. LembovIch<sup>4</sup>

1. State Sci. Inst. "Powder metallurgy Institute", Platonov st., 41, 220005, Minsk, Republic of Belarus
2. Education Establishment "Belarussian State Agriculture Tech. Univ.", Nezavisimosti av., 99, Minsk, Republic of Belarus
3. State Sci. Inst. "Physical and Organic Chemistry Institute", Minsk, Surganova st. 13, 220072, Republic of Belarus
4. Education Establishment "Belarussian State Tech. Univ.", Sverdlova st., 13a, 220050, Minsk, Republic of Belarus  
a. Corresponding author (nll23nllpm@tut.by)

The findings of investigations dealing with the appropriate effectiveness in separating yeast cells from fermented mesh with the help of powder filtering materials (PFM), set up in microfiltering module, are presented in the report. The aim of paper is the confirmation of possible use with respect to tangential filtration for implementation of mesh fermentation in continuous process mode. Bioreactor was simulated by the capacity with alcohol mesh (suspension of yeasts *Saccharomyces cerevisiae* with concentration 20 g/l). Compressed nitrogen suspension was supplied to filtering element where it was divided into two flows – concentrate and filtrate.

PFM out of titanium powders (with sizes of average pores 6.1; 8.5; 40 mkm) and corrosion resistant steel PKH18N15 (sizes of average pores 15 mkm) were tested. It has been established that PFM out of titanium powder with the average size of pores 40 mkm (retains 10% yeast cells) possesses lower effectiveness. Somewhat higher effectiveness is noted in filtering material out of corrosion resistant steel powder with average size of pores 15-30 %. Filter elements out of powders of grade titanium with average sizes of pores 10.3 and 6.1 mkm provided one hundred percent separation. It has been proved that PFM provide the capturing of yeast cells.

## CHARACTERIZATION AND CO<sub>2</sub>/CH<sub>4</sub> sod-ZMOF/MATRIMID MIXED-MATRIX MEMBRANES

Ayşe Kılıç, ÇiğdemAtalay-Oral, AhmetSirkecioğlu, Ş. BirgülTantekin-Ersolmaz,M.  
GöktuğAhunbay<sup>†</sup>

- <sup>†</sup> Istanbul Technical Univ., Dept. of Chemical Eng., Istanbul, Turkey,  
a. Corresponding author (ahunbaym@itu.edu.tr)

Recently, utilization of nanoporous metal-organic frameworks (MOFs) as dispersed phase in mixed matrix membranes (MMMs) has become an attractive research area. In this study, sod-ZMOF crystals were synthesized to develop sod-ZMOF/Matrimid<sup>®</sup> MMMs for natural gas purification. Following the characterization of sod-ZMOF crystals with XRD, TGA, SEM analyses, they were incorporated into Matrimid<sup>®</sup> polyimide matrix to form dense MMMs by solvent-casting method. As-synthesized sod-ZMOF samples were also ion-exchanged with alkalis (Na<sup>+</sup> and K<sup>+</sup>) to examine the effect of ion-exchange on the material characteristics and gas separation properties of the MMMs. Prepared membranes were characterized with SEM, XRD, TGA and DSC. The CO<sub>2</sub>/CH<sub>4</sub> separation performances of the membranes were also examined by measuring single and mixed gas permeabilities. SEM images of the MMMs, showed no apparent voids or defects at the filler/polymer interface and that ZMOF particles were dispersed homogeneously in the polymer matrix. The gas permeability measurements indicated that incorporation of sod-ZMOF particles into the Matrimid<sup>®</sup> matrix enhanced the permeabilities with almost no loss of selectivities. Although several gas adsorption studies with ZMOFs have been reported in the literature, ZMOFs were used as fillers in MMMs and their gas separation properties were investigated for the first time in this work.

## **REMOVAL OF MALACHITE GREEN (MG) DYE FROM WASTEWATER SOLUTION BY ADSORPTION USING KHULAYS NATURAL BENTONITE**

S. S. Al-Shahrani<sup>1,a</sup>

1. Dept. of Chemical and Material Eng., King Abdulaziz Univ., Jeddah, Saudi Arabia  
a. Corresponding author (ssaalshahrani@kau.edu.sa)

Application of Khulays Natural bentonite to remove malachite green (MG) from wastewater was investigated. The removal characteristics of MG from wastewater were investigated under various operating variables such as contact time, initial MG concentration, and solution pH at various temperature ranges at 25, 35, 45, 55 and 65 °C. Batchscale equilibrium adsorption was carried out for a wide range of initial dye concentration. The results showed that the sorption equilibrium of MG on Khulays natural bentonite was achieved after 210 min. The sorption data suggests that solution pH was the most important parameter in controlling MG sorption onto bentonite. They also showed that increasing the initial MG concentration decreased MG green removal percentage due to the saturation of clay with MG. The adsorption of MG increased with increase in solution pH. The adsorption isotherm data were well fitted with both the linearized Langmuir and Freundlich models. Furthermore, malachite green adsorption onto Khulays bentonite was well represented by the pseudo-second-order kinetic model. Kulays natural can be considered as a promising adsorbent for the removal of dyes from wastewater.

## **SUPERACIDIC MESOPOROUS SULFATED TITANIA-SILICATES FOR DEHYDRATION OF FRUCTOSE**

Emre Kılıç<sup>1</sup>, Selahattin Yılmaz<sup>1,a</sup>

1. Izmir Institute of Technology, Dept. of Chemical Engineering, Izmir, Turkey  
a. Corresponding author (selahattinyilmaz@iyte.edu.tr)

Mesoporous titania-silicates are known as superacidic and thermally stable materials. In the present study, sulfated titania-silicate catalysts were prepared via sol-gel and hydrothermal method. They were tested for fructose dehydration. Reaction tests were carried out in dimethylsulfoxide (DMSO) at 110 °C under atmospheric pressure. Fructose initial concentration was 6 wt % and catalyst amount was 0.5 g. Different sulfated catalysts were also used for comparison. Maximum HMF selectivity (93 %) was obtained by sol-gel prepared sulfated titanIa silicate. It was attributed to the mesoporous structure, presence of strong superacid sites, especially Bronsted sites and highly active chelating bidentate bonds formed during sulfation.

## **PECULARITIES OF THE GAS DISCHARGE PROCESSES IN THE NANOPOROUS ZEOLITE**

K. Koseoglu<sup>1</sup>, V.I. Orbukh<sup>2</sup>, N.N. Lebedeva<sup>2</sup>, S. Ozturk<sup>1</sup> and B.G. Salamov<sup>1,3</sup>

<sup>1</sup>Physics Dept., Faculty of Sciences, Gazi Univ., Ankara, Turkey,

<sup>2</sup>Baku State Univ., Inst. for Physical Problems, AZ 1148 Baku, Azerbaijan

<sup>3</sup>National Academy of Science, Inst. of Physics, AZ-1143 Baku Baku, Azerbaijan

a. Corresponding author (bala@gazi.edu.tr)

Electrical properties of zeolites are intensively studied because nanopores are filled by various atoms and ions. In such systems the same current voltage characteristics (CVC) with various parameters are observed. It consists of a high-ohmic range at low voltages, which with increasing voltage is replaced by low-ohmic range. It is suggested that the doping of zeolite reveals the semiconductor properties in the system. In earlier studies we have shown that in the pure zeolite samples the same CVCs are obtained at low pressures. The stationary current out in a zeolite plate is interpreted as a combination of ionic and discharge current in the zeolite pores. When the gas discharge gap between the zeolite and the anode plate is filled with air a glow was visually observed. For a zeolite powder such a phenomena was observed only when mixture prepared by using of zeolite powder with a Si powder.

## **INVESTIGATION OF ZINC EVAPORATION DURING SINTERING OF PM CU- 28 ZN**

Rozita Rouzegar, Maziyar azadbeh

a. Corresponding author (r.rouzegar@yahoo.com)

Cu- Zn alloys are of major interest for various industrial applications. These alloys are technically produced by powder metallurgy. In this research, evaporation of zinc element from sintered Cu- 28 Zn prealloyed specimens was investigated. Through sintering with increasing the temperature above 900°C zinc evaporation was started, so made an increase in the volume of pores. Zn evaporation made rearrangement in the structure, so volume increasing of pores occurred. Evaluation of evaporation of zinc element by increasing in volume of pores was modeled in the form of spheres.

## THERMAL AND STRUCTURAL CHARACTERIZATION PROPERTIES OF CATION EXCHANGED BENTONITE

Burcu Erdoğan Alver<sup>1</sup>, Meryem Sakızcı<sup>1</sup>, Ertuğrul Yörükoğulları<sup>1</sup>

<sup>1</sup>Dept. of Physics, Science Faculty, Anadolu Univ., 26470, Eskisehir, Turkey,  
a. Corresponding author (burcuerdogan@anadolu.edu.tr)

Bentonite is one of the clay minerals, hydrated aluminium silicate. Its major component is montmorillonite, which belongs to the group of silicate minerals known as dioctahedral smectites. Structure of this material is formed from two tetrahedral sheets with  $\text{Si}^{4+}$  as a central atom and one octahedral sheet containing  $\text{Al}^{3+}$  which can be substituted by  $\text{Fe}^{3+}$  or/and  $\text{Mg}^{2+}$  [1]. Bentonites are greatly affected from the acid activation, ion exchange, heating and hydrothermal treatments, and some other physicochemical process [2]. In this study, thermal and structural properties of natural bentonite and its cation exchanged forms (NaB, KB, CaB, MgB and HB) from Turkey were characterized by thermogravimetry (TG-DTG), differential thermal analysis (DTA), X-ray diffraction (XRD), and surface area measurement techniques. The bentonite sample was obtained from Turkey. The clay samples were air dried at room temperature and ground to pass through a  $\leq 53 \mu\text{m}$  sieve.  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{2+}$  and  $\text{H}^+$  ionic forms of bentonite were prepared by the Batch method, using 1 M solutions at 90 °C for 5 hours.

## PROCESSING OF GLASS SCRAP RECYCLING

BURCU ERTUĞ<sup>1,a</sup>

1. Istanbul Technical Univ., Dept. of Metallurgical and Materials Eng., 34469 Maslak, Istanbul, Turkey.  
a. Corresponding author (burcuertug@gmail.com)

Among the diverse types of waste, glass is one of the most valuable recycling materials because it can be revived and recycled completely and hardly decomposes. The glass recycle process basically involves collecting, sorting, then crushing and grinding after which glass cullet is produced as the secondary raw material. Removing of the contaminants from the glass cullet, and then melting are the next steps. The glass cullets are employed to produce brand new glasses, most of them are silicate based glasses. Liquid Crystal Display (LCD) glass, Printed Circuit Boards (PCBs) and Cathode Ray Tubes (CRT) are recycled to fabricate new products. In this study, recent developments in the recycling of glass, are discussed in terms of glass production processes.

## **SYNTHESIS, CHARACTERIZATION AND PROPERTIES OF COPOLY(AMIDE-THIOAMIDE)S. CRISTAL LIQUID POLYMER**

Nassima Khellafi<sup>1</sup>, Ghezalla Tabak<sup>2</sup>

1. Dept. of polymers, Faculty of chemistry, university of sciences and technology HOUARI BOUMEDIENE USTHB BP 32 el Alia

2. Laboratory of macromolecular chemistry and thio-organic chemistry .  
ALGIERS 16111 Algeria.

a. Corresponding author (tabakghe@yahoo.fr)

Copoly(amide-thioamide)s were synthesized by polycondensation of bisthioamide-amines and iso ,terephtaloyl dichlorure or 2,6 naphthyl dichlorure in N methyl pyrrolidone. Series of bisthioamide-amines bearing flexible chain or aromatic cycle were prepared by reaction of bisdithioesters and an excess of diamines at 45°C in solvent toluene. The copoly(amide-thioamide)s, were obtained in moderate to good yields (30-45%) and possessed inherent viscosities in the range of 0,4-2,28 dL/g. All these polymers were amorphous except the ( 4d ) which present a tendency to form liquid cristal mesophases and could be easily dissolved in amide-type polar aprotic solvent. They showed good thermal stability with glass transition temperature Tg from 109°C -209°C in nitrogen atmosphere. An increase of diamine length result in an decrease of Tg. An increase of the aromatic contents leads to formation of polymers with high molecular weight, an increasing of Tg, cristallinity and thermal stability of the copolymer samples and a reduction of their solubility. Semi aromatic polythioamides have been synthesized, based on aliphatic diamines and bisdithioesters.

## **A PROMISING APPROACH FOR RECYCLING OF GLASS FIBER REINFORCED COMPOSITES USING SUB-CRITICAL WATER**

AslihanKazan<sup>1</sup>, Mehmet Pala<sup>2</sup>, JaleYanik<sup>2</sup>, OzlemYesilCeliktas<sup>1,a</sup>

1. Dept. of Bioengineering, Faculty of Eng., Ege Univ., 35100 Bornova-Izmir, Turkey

2. Dept. of Chemistry, Faculty of Science, Ege Univ., 35100 Bornova-Izmir, Turkey

a. Corresponding author (aslihankazan@yahoo.com)

The disposal of composite products in an environmentally friendly way is one of the most important challenges since the total global production of composite materials will exceed 10.3 MT by 2015. As disposal of composites into landfills becomes more difficult, the industry is being forced to recycle greater quantities of material. Fiberglass is the most commonly used reinforcement material therefore recycling is a challenge. The aim of this study was to recover glass fibers from waste composite derived from the roofage production process. The samples were subjected to the hydrolysis process under subcritical water conditions. The effect of temperature (260-325 °C), time (15-120 min) on the recovery of glassfibers and the properties of liquid fraction were investigated. The glassfibers can be successfully recovered from composites at sub-critical conditions using water. The results of the TOC analysis of the liquid fraction exhibited a decreasing trend for increasing temperatures, where TOC values were 19.7 g/L and 8.9 g/L for 260 and 325 °C, respectively. Therefore the optimum conditions were elicited as 325°C and 110 bar to recover the glass fibers, whereas the value-added compounds such as monomers of resin, benzoic acid and terephthalic acid can be recovered as well.

## COMPARISON BETWEEN ILLITE AND ACTIVATED CARBON FOR THE ADSORPTION OF THE ANTIBIOTIC CIPROFLOXACIN

Esra CAN DOĞAN<sup>1,a</sup>, Nevim GENÇ<sup>1</sup>, Ali Oğuzhan NARCI<sup>1</sup>

1. Kocaeli Univ., Environmental Eng., KOCAELI

a. Corresponding author (esracan@kocaeli.edu.tr)

Ciprofloxacin (CIP) is a second generation fluoroquinolone antibiotic of high use. Even under low concentrations CIP could still be toxic to some microorganisms. Thus, from a risk assessment point of view, CIP might be considered as an environmental hazard. The biodegradation or removal of CIP from aqueous solution is difficult. Among the techniques for removal of CIP from wastewater, adsorption has been proved to be an effective and attractive process because of its inexpensive nature and ease of operation. In this study, batch adsorption experiments were carried out for the removal of CIP from aqueous solution using illite and activated carbon as adsorbent. The pseudo-second, the pseudo-first and the Elovich equations were used to describe the sorption of pollutants from aqueous solutions. CIP adsorption capacities on illite and activated carbon were approximately 77-105 mg/g, 78-79 mg/g for CIP concentration of 20-40 mg/L at initial pH, 150rpm, 30 min.

## MICROSTRUCTURE OF SiO<sub>2</sub>GLASSES DOPED WITH ZnSe QUANTUM DOTS AND Nd<sup>3+</sup> IONS

Thami Elboukhari<sup>1</sup>, Hakan Kaygusuz<sup>2</sup>, Murat Erdem<sup>3</sup>, Gönül Özen<sup>1</sup>

<sup>1</sup>Istanbul Technical Univ., Dept. of Physics Eng., Istanbul – Turkey

<sup>2</sup>Istanbul Technical Univ., Dept. of Chemistry, Istanbul – Turkey

<sup>3</sup>Istanbul Technical Univ., Dept. of Physics, Istanbul – Turkey

a. Corresponding author (boukhari@itu.edu.tr)

Glasses doped with quantum dots are attractive materials due to their optical properties. Among the synthesis methods, sol-gel technique is one of the most applied ones. This work reports synthesis of SiO<sub>2</sub> glasses doped with ZnSe quantum dots and Nd<sup>3+</sup> ions for the first time. Samples were prepared by sol-gel method. Samples were annealed at 410 °C and 600 °C for one hour. X-Ray diffraction technique was used to identify the crystalline phases of ZnSe quantum dots. Average sizes of ZnSe were determined using Scherrer's equation and the FW (1/5/(4/5))M method. The size of the nanoparticles were found to be in the range of 4-10 nm. It is found that presence of Nd<sup>3+</sup> ions led to smaller quantum dot sizes and narrow size distribution. Spectrometric measurements were performed to measure the absorptions of the samples. Band gap energies are observed in these measurements. Based on these data, direct and indirect optical band gap, Urbach energies were calculated using the Tauc method. Nd<sup>3+</sup> oscillator strength for energy crossing at 410 °C and at 600 °C annealed samples were calculated. the oscillator strength of the sample which is annealed at 600 °C, gave higher results than the sample annealed at 410 °C.

## **CO<sub>2</sub>/CH<sub>4</sub> AND CO<sub>2</sub>/N<sub>2</sub> SEPARATION IN ION-EXCHANGED SOD-ZMOFS VIA MOLECULAR SIMULATION**

Mehmet Göktuğ Ahunbay, Barış Demir, Hasan Onur Erdem, Mehmet Göktuğ Ahunbay  
a. Corresponding author (ahunbaym@itu.edu.tr)

Zeolite-like metal organic frameworks with sodalite-type framework (sod-ZMOFs) are promising candidates for natural gas (CO<sub>2</sub>/CH<sub>4</sub>) and flue gas (CO<sub>2</sub>/N<sub>2</sub>) separation and purification applications. Their anionic frameworks and the extra-framework cations in the pores of molecular dimensions increase interactions with guest molecules and improve their separation, storage, or ion-exchange capabilities. The indium-based sod-ZMOF, with imidazolecarboxylic acid as the organic linker, has higher CO<sub>2</sub> adsorption capacity than ZIF-8, which has an analogous structure based on sodalite-topology. The charge-compensating extra-framework ions inside the cavities of these MOFs can be ion-exchanged with alkali metals to improve CO<sub>2</sub> separation performance. In this study, adsorption and diffusion of CO<sub>2</sub>/CH<sub>4</sub> and CO<sub>2</sub>/N<sub>2</sub> gas pairs in the sod-ZMOFs were studied using Grand Canonical Monte Carlo and Molecular Dynamics simulations. The simulations were carried out with “as-synthesized” as well as Li<sup>+</sup>, Na<sup>+</sup> and K<sup>+</sup> exchanged sod-ZMOFs. The CO<sub>2</sub> selectivity of the sod-ZMOFs was compared based on the type of the cation and the ion-exchange ratio over a wide range of pressure. The simulations showed that the selectivity depends not only on the cation type and ion-exchange ratio but also on the location of the cations in the framework, while the highest selectivity was achieved in K<sup>+</sup> exchanged sod-ZMOFs.

## **PROPERTIES OF SELF COMPACTING LIGHTWEIGHT CONCRETE WITH PERLITE AGGREGATE**

Hasan Bozkurt<sup>a</sup>, Cenk Karakurt  
a. Corresponding author (hasan.bozkurt@bilecik.edu.tr)

There is an increasing demand on new construction materials due to developing expectations of users in construction industry. Self-compacting lightweight concrete can be considered as an important example for these materials. Conventional concretes have a lot of application areas however normal weight concrete's unit weight is high thus own weight of reinforced concrete structures are higher. This situation increase the earthquake loads affect on the structure. It is possible to reduce the possible earthquake effects on structures by using Self-Compacting Lightweight Concrete (SCLC) in reinforced concrete structures. In addition the thermal and sound insulation properties and workability of SCLC is better than conventional concrete due to the porous and consistency of the composite. In this study, SCLC specimens were produced using different ranges of expanded perlite aggregates. Blast furnace slag and marble dust were used as fine filler mineral materials in SCLC mixtures. The flow table, L-box, V funnel tests were carried out in order to determine the workability properties of the concrete specimens. The hardened concrete properties were determined by unit weight, compressive strength and ultrasound pulse velocity tests. According to test results it can be concluded that the SCLC can be used as lightweight material in construction applications.

# EFFECTS OF COMPOSITION AND SINTERING TEMPERATURE ON MECHANICAL PROPERTIES OF Al-Si/SiC<sub>p</sub> METAL MATRIX COMPOSITES

Jeongil Bang<sup>1</sup>, Yi Je Cho<sup>1</sup>, Yong Jin Kim<sup>2</sup>, Yong Ho Park<sup>1</sup>

1. Pusan National Univ., Busan, 609-735, Republic of Korea
2. Korea Inst. of Materials Science, Changwon, 642-831, Republic of Korea  
a. Corresponding author (wjddlf2578@pusan.ac.kr)

The Al MMC parts using powder metallurgy have superior mechanical properties compared to the as-casted aluminum components and are lighter than iron-based components. Especially, hypo-eutectic Al-Si alloys have high fluidity, corrosion resistance and ductility. If they are combined with reinforcements, high strength and wear resistance can be obtained. However, despite of these advantages, hypo-eutectic Al-Si alloys have lower strength and hardness than hyper-eutectic alloys due to lack of Si. There have been many researches to increase the mechanical properties by adding particle reinforcements like TiC, SiC and AlN. Adding more reinforcements can decrease fluidity, formability and sinterability thus it makes difficult to obtain dense microstructure and even decrease mechanical properties.

In this study, hypo-eutectic Al-Si/20vol.%SiC composite powder made by gas atomizing and hyper-eutectic Alumix231 powder were blended with certain fractions and sintered by hot press at 565°C, 575°C and 585°C respectively. And T6 heat-treatments were performed. The microstructures of as-sintered and T6 heat-treated Al MMCs were observed by X-ray Diffraction (XRD), Optical Microscope (OM) and Field Emission Scanning Electron Microscope (FE-SEM). The mechanical properties of composites were analyzed by Universal testing machine and Rockwell hardness tester.

## ZIRCONIUM-BASED METAL-ORGANIC FRAMEWORKS

W. Morris<sup>1</sup>, B. Voloskiy<sup>1</sup>, S. Demir<sup>\* 1,2</sup>, F. Gándara<sup>1</sup>, P. L. McGrier<sup>3</sup>, H. Furukawa<sup>1</sup>, D. Cascio<sup>4</sup>, J. F. Stoddart<sup>3</sup> and O. M. Yaghi<sup>1,5</sup>

1. Center for Reticular Chemistry, Center for Global Mentoring, and Dept. of Chemistry and Biochemistry Univ. of California, Los Angeles, USA;
2. Faculty of Arts and Sciences, Dept. of Chemistry, Recep Tayyip Erdoğan Univ., Rize, Turkey;
3. Center for the Chemistry of Integrated Systems, Dept. of Chemistry, and Dept. of Material Sci. and Eng., Northwestern Univ., USA;
4. UCLA-DOE Inst. of Genomics and Proteomics and Dept. of Biological Chemistry, David Geffen School of Medicine, Univ. of California, Los Angeles, USA;
5. Univ. of California, Berkeley, USA; Lawrence Berkeley National Laboratory, USA; Graduate School of EEWS, Korea  
a. Corresponding author (selcuk.demir@erdogan.edu.tr)

Zr-based metal-organic frameworks (Zr-MOFs) have exceptional chemical stability, and expanding the chemistry of Zr-MOFs is crucial for applications. We have synthesized and structurally characterized three new MOFs [MOF-525, Zr<sub>6</sub>O<sub>4</sub>(OH)<sub>4</sub>(TCPP-H<sub>2</sub>)<sub>3</sub>, MOF-535, Zr<sub>6</sub>O<sub>4</sub>(OH)<sub>4</sub>(XF)<sub>3</sub>, and MOF-545, Zr<sub>6</sub>O<sub>8</sub>(H<sub>2</sub>O)<sub>8</sub> (TCPP-H<sub>2</sub>)<sub>2</sub>, where porphyrin H<sub>4</sub>-TCPP-H<sub>2</sub> and cruciform H<sub>4</sub>-XF] based on two new topologies, **ftw** and **csq**. While the structure of MOF-525 was obtained by analysis of powder X-ray diffraction data, the structures of MOF-535 and 545 were resolved from synchrotron single crystal diffraction data. In addition to their large surface areas, both porphyrin-containing MOFs are remarkably chemically stable, maintaining their structures under aqueous and organic conditions. MOF-525 and 545 were metalated with iron (III) and copper (II) to yield the metalated analogs without losing their high surface area and chemical stability.

## **SELECTIVE ADSORPTION OF TARGETED METAL IONS BY IMPRINTED POLYSILOXANE GELS**

Orhan Güney, Fehmi Karagoz  
a. Corresponding author (oguney@itu.edu.tr)

Polysiloxanes, a common family of inorganic polymers, are used for molecular imprinting because of their ease of fabrication, good molecule imprinting, and high template recognition. Sol-gel processing is one technique used in fabricating amorphous inorganic polymers. The advantage of using sol-gel processing is that integration of the template ion or molecule into the polymer is done easily and the polymerization process takes only a matter of seconds. Imprinted polymers are formed with a cross-linking agent, a functional monomer, and the template ion or molecule. The cross-linking agent binds to the functional monomers upon polymerization, which embeds the template molecule in a polymer matrix. Because the functional monomers are bound to the template in a specific position within the polymer, removal of the ion or molecule will result in an imprint with both spatial and chemical preservation. The objective of this study was to determine the effectiveness of different approaches to molecular imprinting by testing for preferential binding of targeted metal ion on imprinted polysiloxane gels. Gels were synthesized by using a silanated polyalkylene glycol, an organosilane as functional monomer and also cross-linker in the presence of targeted metal ion.

## **DEVELOPMENT OF THREE WAY CATALYTIC CONVERTERS FOR ELIMINATION OF HYDROCARBONS, CARBON MONOXIDE AND NITRIC OXIDE IN AUTOMOTIVE EXHAUST**

Aylin Civan<sup>1,a</sup>, Duygu Gerçeker<sup>1</sup>, Işık Önal<sup>1</sup>

1. Middle East Technical University, Chemical Engineering Dept., Ankara, Turkey  
a. Corresponding author (civan.aylin@metu.edu.tr)

Pd-Rh containing and Pd-only three-way catalysts were synthesized by impregnation of metals on ceria-zirconia mixed oxide. The catalytic activity tests were carried out using a dynamic test system constructed to simulate the automotive exhaust conditions. The activities of the fresh and thermally aged monolithic catalysts were compared in terms of light-off temperatures. All catalysts showed resistance against thermal aging and did not lose activity. The light-off temperatures of the Pd-Rh containing catalyst C1 and Pd-only catalyst C2 appeared to be very close to each other, indicating that the absence of Rh in the catalyst composition did not make a dramatic change on the activity. Also, the other Pd-only catalyst C3 showed a remarkable catalytic activity despite its very low amount of metal.

## THE EFFECTS OF POROSITY RATIO OF THE WELDED TUFFS ON SOUND AND HEAT INSULATION

Murat SERT<sup>1,a</sup>, Sevgi GÜRCAN<sup>1</sup> and H. Tark ÖZKAHRAMAN<sup>2</sup>

1. Afyon Kocatepe University, Mining Engineering Dept., Afyonkarahisar, Turkey
2. Suleyman Demirel University, Mining Engineering Dept., Isparta, Turkey  
a. Corresponding author (msert@aku.edu.tr)

Welded tuffs have long been used in the construction business. These stones were focused on as choice during the periods when the technology was undeveloped due to their characteristics as ability of being processed easily, lightweight and insulation properties. Such constructions as churches and mosques where the welded tuffs have been used as the basic structural member have been subsisted for hundreds of years.

Welded tuff is a kind of a volcanic rock with lots of pores. Such pores are observed to be in small circular shapes in general and joined to one another with small deformations.

In this study, the relationships between porosity ratios, mineralogical - petrographical properties and sound and heat permeability values of eight different types of welded tuffs from Nevşehir region are evaluated. In addition, their usability in the different industrial fields is studied comparing them to less porous massive natural stones.

## ACIDIC GROUPS TREATED SILICA SUPPORTED CATALYSTS FOR ETHERIFICATION OF GLYCEROL

Nalan Ozbay<sup>1</sup>, Nuray Oktar<sup>1</sup>, Gulsen Dogu<sup>1</sup>

1. Gazi Univ., Chemical Eng. Dept., Ankara Turkey  
a. Corresponding author (oktarnuray@gmail.com)

Increase of production rate of biodiesel through transesterification of oils, creates a large surplus of its byproduct glycerol. Etherification of glycerol with isobutene or tert-butyl alcohol (TBA) is a promising process that can convert it to the value added oxygenated compounds, which can be used as fuel additives. In this study, a series of H<sub>2</sub>SO<sub>4</sub> and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> treated silica supported catalysts (H<sub>2</sub>SO<sub>4</sub>/Aerosil200, H<sub>2</sub>SO<sub>4</sub>/Siral30, H<sub>2</sub>SO<sub>4</sub>/Siral40, (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>/Aerosil200, (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>/Siral30, (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>/Siral40) were prepared and tested in the production of fuel additives by etherification reaction of glycerol with TBA. The reaction was performed in liquid phase, in a continuous flow reactor, with a feed ratio of TBA/G=8/1 and in a temperature range of 80-175°C. H<sub>2</sub>SO<sub>4</sub>/Siral40 and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>/Siral 40 catalysts are suggested to be the best according to their glycerol conversion values of 15% and 13% respectively, at 175°C within a space time of 18gcm<sup>-3</sup>s. The catalysts were characterized by BET, TGA, DRIFT's and Hammett acidity determination methods. BET results showed that H<sub>2</sub>SO<sub>4</sub> and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> loaded catalysts had lower surface areas than the fresh supports. Pyridine adsorbed DRIFTs results showed the characteristic peaks of Lewis and Bronsted acid sites. Hammett acid strengths of the H<sub>2</sub>SO<sub>4</sub> and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> incorporated catalysts were found as -8.2<H<sub>0</sub><-11.35 and -5.6<H<sub>0</sub><-8.2 respectively.

## **MOLECULARLY IMPRINTED POLYMERIC MICROSPHERES FOR REMOVAL OF BISPHENOL A**

Joanna Wolska, Marek Bryjak<sup>1,a</sup>  
a. Corresponding author( joanna.wolska@pwr.wroc.pl)

Endocrine disruptor (EDs) are chemicals that perturb the endocrine system either by acting as agonists or antagonists to hormone receptors. Many classes of chemicals including dioxins, bisphenol A (BPA), polycyclic aromatic hydrocarbons have the ability to interfere with hormonal system. The EDs are active at very low concentrations, thus it is necessary to develop the effective method for their removal. In this study we prepared the MIP materials for BPA using membrane emulsification (EM) and suspension polymerization method that can be used to adsorb BPA and other phenols from aqueous solutions. Uniformly sized polymeric molecularly imprinted microspheres have been synthesized from methyl methacrylate and ethylene glycol dimethacrylate in presence of BPA as a template. At the beginning the best monomer compositions were selected by bulk polymerization of eight different mixtures. For selected monomers compositions, which had the highest affinity to BPA, the two-step process (ME and suspension polymerization) were used. Materials prepared by two-step process showed the higher efficiency in the BPA removing than their analogues prepared by bulk polymerization. The best material was synthesized from monomers mixture of MMA:EGDMA 4:6 and with 3wt.% of BPA.

## **REMOVING PHTHALIC ACID ESTERS BY MOLECULARLY IMPRINTED POLYMERS**

Joanna Wolska, Duygu Yapici, Marek Bryjak  
a. Corresponding author( joanna.wolska@pwr.wroc.pl)

Phthalates, widely used in plastics, coatings and cosmetics industries form a class of refractory organic compounds. Some of the phthalate esters have received more and more attention in recent years since they are considered as estrogenic disrupting compounds. The most commonly used phthalates are: dimethyl phthalate (DMP), diethyl phthalate (DEP), dibutyl phthalate (DBP), bis(2-ethylhexyl) phthalate (DEHP). DEP and DMP characterized by toxicity are commonly used as solvents for cellulose acetate, in the manufacture of celluloid for pharmaceutical coatings. The presented study deals with preparation of molecularly imprinted polymers useful for removal of DEP from aqueous solutions. Methyl methacrylate-methacrylic acid-ethylene glycol dimethacrylate copolymers were applied as polymer matrix and they were synthesized in block and suspension polymerizations with several porofors. Suspension polymerization was carried out after membrane emulsification of the reactants. On the base of sorption studies it was determined that the best sorbents were obtained for syntheses in the presence of hexane and the uptake of DEP for molecularly imprinted sorbents was larger than for sorbent prepared in the absence of phthalates.

## **MORPHOLOGY AND MICROSTRUCTURE OF LCSMF CATHODE NANO POWDERS SYNTHESIZED BY GLYCINE - NITRATE PROCESS**

Ö. Yıldız<sup>a</sup>, A.M. Soydan<sup>b</sup>, E.F. Ipçizade<sup>b</sup>, D. Akin<sup>b</sup>, Ö. Uçak<sup>b</sup>, Ali Ata<sup>b</sup>, F. Şenel<sup>c</sup>

<sup>a</sup> Kocaeli Univ., Faculty of Eng., Dept. of Metallurgical and Materials Eng.,  
TR-41380 Kocaeli / Turkey

<sup>b</sup> Gebze Inst. of Technology, Faculty of Eng., Dept. of Material Sciences and Eng., TR-41400 Gebze,  
Kocaeli / Turkey

<sup>c</sup> Yıldırım Beyazıt Univ., Faculty of Eng., Dept. of Mechanical Eng.,  
Ankara / Turkey

a.Corresponding author (oemeryildiz@gmail.com)

Objective of the presented study was to investigate the effects of Glycine – Nitrate Process (GNP) parameters and Ceria addition on Lanthanum Strontium Manganite Ferrite (LSMF) intermediate and lower temperature solid oxide fuel cell (IT&LT-SOFC) cathode materials. GNP contains a self-sustaining combustion i

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## **INFLUENCE OF PROCESS PARAMETERS ON THE MORPHOLOGY AND MICROSTRUCTURE OF CERIA BASED ANODE NANO-POWDERS SYNTHESIZED BY GLYCINE-NITRATE GEL COMBUSTION**

Ö. YILDIZ<sup>1</sup>, A.M. SOYDAN<sup>2</sup>, D. AKIN<sup>2</sup>, E.F. İPÇİZADE<sup>2</sup>, Ö. UÇAK<sup>2</sup>, Ali ATA<sup>2</sup>

1. Kocaeli Univ., Faculty of Eng., Dept. of Metallurgical and Materials Eng., TR-41380 Kocaeli, Turkey,

2. Gebze Inst. of Technology, Faculty of Eng., Dept. of Material Sciences and Eng., TR-41400  
Gebze/Kocaeli, Turkey.

a.Corresponding author (oemeryildiz@gmail.com)

Glycine-Nitrate Process (GNP) a highly popular powder manufacturing technique with its high production capacity and simplicity, offers the production of nano fuel cell powders with desired powder characteristics. Combustion based methods provides the production of nano-powders with homogeneous microstructure at lower operating temperatures. In this study, effects of process parameters, such as glycine / nitrate ratio, solution's Ph, molar Ce, Ni, Co, Fe, V, Cu metal ratio of the solution, on Ce based anode powder characteristics' including morphology and microstructure were investigated by using X-ray diffraction, scanning electron microscopy, transmission electron microscopy, DSC-TGA and nanosizer analysis. Conducted studies presents significant improvement results on the characteristics of Solid Oxide Fuel Cells' (SOFC) anode materials. Investigations carried out at this project were financially supported by Kale Ceramic Company under the project STZ00892-1.

## **ELECTRO CERAMIC COMPOSITIONS WITH THE IMPROVED PROPERTIES ON THE BASIS OF LOCAL MINERAL RAW MATERIAL**

Ra'isa Abdullaeva<sup>1</sup>, Soyibjon Negmatov<sup>1</sup>, Vasila Tulyaganova<sup>1</sup>, Surayo Yulchieva<sup>1</sup>,  
Djura Islamov<sup>1</sup>

1. GUP "Science and Progress" Under Toshkent State Technical University,
  - a. Corresponding author: (polycomft2005@rambler.ru)

The present research work is devoted to study of structures, properties of mineral raw materials, development of structure and technology of reception magnesium containing of electro ceramic materials on their basis. With the purpose of development of structure steatite, forsterite, cordierite of electro ceramics on the basis of local mineral raw materials.

On the basis of raw materials kaolin, bentonite, talk, burnt talk, quartz containing of a withdrawal (waste) the structure steatite of ceramics is developed. By researches is established, that samples steatite of ceramics burnt at optimum temperature have dense fine-grained structure. The basic crystal phase is metasilicate magnesium ( $MgO \cdot SiO_2$ ) its contents makes 50-55 %, besides structure of a researched material contains quartz, cristobalite, forsterite and some grains mullite, and about 30-35% glassy a phase.

Established, that the received material has dense, homogeneous structure, contained 80-82 of % forsterite ( $2MgO \cdot SiO_2$ ) size of grains 1-18 microns,  $N_g = 1,668$ ;  $N_p = 1,636$ , glassy a phase 10-18 % and magnesium met silicate, quartz, mullite in insignificant quantity. Besides on a basis kaolin, bentonite, pegmatite, aluminum and quartz we develop a high-voltage electro ceramic material on which properties meets the requirements the standard.

## **INVESTIGATION OF THE COMBINING RATIO EFFECT ON DISPERSIVE COMPONENT OF SURFACE ENERGY OF BORON INDUSTRY SOLID WASTE-PVC COMPOSITE MATERIALS**

Hayrullah Çetinkaya<sup>1,a</sup>, Demet Topaloğlu Yazıcı<sup>2</sup>

1. Dept. of Chemical Eng., Faculty of Eng., Izmir Inst. of Technology, 35430 Izmir, Turkey
2. Dept. of Chemical Eng., Faculty of Eng. and Architecture, Eskişehir Osmangazi Univ., 26480 Eskişehir, Turkey

- a. Corresponding author (hayrullahcetinkaya@iyte.edu.tr)

In this study, composite materials were prepared by solution blending method using polyvinyl chloride (PVC) as matrix and different proportions of (5, 10 and 20 wt %) boron clay which is an industrial waste of Etibor Inc. Kırka Borax plants includes 22 wt % boron, as filler. The most important factor in determining the purpose of this study is to research the evaluation of the usage of boron in boron waste directly in a new material without any recovering process. For this purpose, some properties of prepared materials were investigated, and the effect of the weight proportion of filler on surface energy values of powder materials was determined. The dispersive component of the surface energies of prepared composites and composite components were determined by inverse gas chromatography at infinite dilution region. The dispersive component of the surface energy values are known as providing information of the similarity relation of material surfaces. The fillers have been used in this study without any chemical treatment; have closer dispersive component of the surface energy values to the matrix than commonly used, chemically treated fillers.

## **DETERMINATION OF THEOPHYLLINE ON HYBRID SOL-GEL DERIVED CARBON NANOPARTICLES FILM**

Sevgi Güney, Hakan Bermek  
a. Corresponding author (kartal@itu.edu.tr)

Molecular imprinting is becoming an important method for the design of smart materials mimicking molecular recognition by natural receptors. Molecular imprinting is carried out by polymerizing a combination of a target molecule (template), functional monomers and an excess of cross-linker. The template molecule is entrapped into the polymer network during the polymerization process. After the removal of the template from the cross-linked polymer matrix, a molecular recognition site with appropriate size and chemical functionality is produced to rebind the template. Molecularly imprint polymers (MIPs) are promising materials being used widely in the design of recognition elements in biosensors. There are several methods of forming molecularly imprinted films, including sol-gel, electrochemical polymerization, in situ polymerization and self-assembly. In this study, a novel sensor based on imprinted sol-gel material for sensitive determination of theophylline was developed. MIPs were employed to achieve a suitable conformation for theophylline and also to improve the selectivity of the sensor. Carbon nanoparticles were introduced for immobilization of imprinted sol-gel material and for the enhancement of electronic transmission. The imprinted sensor was employed to detect theophylline in a drug sample.

## **PREPARATION AND CHARACTERIZATION OF ACTIVATED CARBONS DERIVED FROM TOMATO WASTE**

R. Z. Yarbay Şahin<sup>1,a</sup>, N. Özbay<sup>1</sup>, E. Önal<sup>1</sup> and A. Ş. Yargıç<sup>1</sup>

1. Chemical and Process Eng. Dept., Bilecik Seyh Edebali Univ., TURKEY.  
a. Corresponding author (zerrin.yarbay@bilecik.edu.tr)

Activated carbons are porous materials and have large total surface area to adsorb many chemicals in the forms of organic/inorganic species dissolved in aqueous media or in gaseous environment . Although powder or granular activated carbon is very effective and efficient for adsorption, its regeneration is difficult and expensive. For this reason, long-lasting, effective and economical adsorbents are being investigated. Activated carbons derived from agricultural products have high surface areas and are utilized as raw material . Tomato is one of the agricultural cultivations most extensively produced and consumed in Turkey. Therefore, the use of the biomass residue of the tomato industry as an activated carbon is investigated.

In this study, tomato waste was first carbonized under static atmosphere at 500 °C. Obtained solid product was impregnated with 100% wt HCl to help break down lignin complex to improve the performance as an adsorbent; and then activated at 500 °C for 15 min in constant flow of sweeping gas (N<sub>2</sub>) with a heating rate of 15°C/min, washed with distilled water until the pH of the washing solution reached 6–8 and dried at ambient temperature. Activated carbon and solid product were characterized by ultimate, proximate analyses, FT-IR, SEM and zeta potential.

## RESEARCH AND DEVELOPMENT OF COMPOSITE POWDER POLYMER MATERIALS AND PRODUCTION OF COTTON MACHINE PARTS ON THEIR BASES

Nadira Abed-Negmatova<sup>1</sup>, Giyas Gulyamov<sup>1</sup>, Sayibzhan Negmatov<sup>1</sup>, Jakhongir Negmatov<sup>1</sup>, Shukhrat Bozorboyev<sup>1</sup>, Sherzod Eminov<sup>1</sup>, Nurillo ikramov<sup>1</sup>

1. State Unitary Enterprise "Fan va Taraqqiyot", Tashkent State Technical University, Uzbekistan

a. Corresponding author: (polycomft2005@rambler.ru)

Study analysis of the effect of different fillers on physical, mechanical and tribological properties of the compositions shows that glass, wollastonite, cotton lint, cement increase the coefficient of friction and reduce the wear rate. Graphite, carbon black, kaolin, talc reduce the coefficient of friction, but increase the wear of composite materials, improves thermal and electrical conductivity, and thus, lower the temperature and amount of static electricity in area of friction pairs contact. Researched that best physical, mechanical and tribological properties of the interaction with cotton composite polymeric materials are fillers with mineral fillers and Carbon-Graphite. Studied that for minimum value of the coefficient of friction best content of fillers is: 5-30 mass part of carbon, graphite, 10-30 m.p. of talc, kaolin. For minimum wear rate during friction with cotton fillers' optimal content is: 10-40 m.p. of fiber, lint, wollastonite, cement, 5-15 m.p. of kaolin and talc. Considering researched studies we designed antifriction and anti-friction wear-resistant polyethylene compositions of functional purpose for details of the working bodies of cotton processing machinery.

## MESOPOROUS TITANIA, ZIRCONIA AND ALUMINA SUPPORTED NICKEL CATALYSTS FOR DRY REFORMING OF METHANE

H. Mustu<sup>1</sup>, H. Arbag<sup>1,a</sup>, S. Yasyerli<sup>1</sup>, N. Yasyerli<sup>1</sup>, G. Dogu<sup>a</sup>, T. Dogu<sup>2</sup>

1. Dept. of Chemical Eng., Gazi Univ., 06570 Ankara, Turkey

2. Dept. of Chemical Eng., Middle East Technical Univ., Ankara, Turkey

a. Corresponding author (harbag@gazi.edu.tr)

Coke deposition and catalyst deactivation are the main drawbacks of conventional alumina and zeolite supported Ni catalysts for dry reforming of methane. Mesoporous catalyst supports with less acidity are considered to be less prone to catalyst deactivation due to coke formation. Consequently, design and characterization of catalysts with ordered mesopores have attracted much attention in recent years. In this study, Ni incorporated mesoporous TiO<sub>2</sub>, ZrO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> supported catalysts were prepared, characterized and tested in dry reforming of methane. Synthesis of ZrO<sub>2</sub> and TiO<sub>2</sub> were performed following hydrothermal routes using Pluronic P-123 as the surfactant. However, mesoporous alumina was prepared following a sol-gel procedure. Nitrogen adsorption-desorption isotherms, XRD patterns, SEM and TEM analysis of these materials showed formation of mesoporous structures with narrow pore size distributions. BET surface area values of these alumina, titania and zirconia supports were found as 192, 81 and 209 m<sup>2</sup>/g, respectively. Ni impregnated materials showed high activity and quite stable catalytic performance in dry reforming of methane. Quite low coke formation was observed, especially with the mesoporous zirconia based material.

## **EFFECT OF GEOMETRICAL DEFECTS ON MECHANICAL PROPERTIES OF METALLIC FOAMS USING FINITE ELEMENT ANALYSIS**

Yi Je Cho<sup>1,a</sup>, Jeongil Bang<sup>1</sup>, Ki Chang Bae<sup>1</sup> and Yong Ho Park<sup>1</sup>

1. Dept. of Material Sci. and Eng., Pusan National Univ.,  
San 30 Jangjeon-dong, Geumjeong-gu, Busan 609-735, Republic of Korea  
a. Corresponding author (yijecho@pusan.ac.kr)

Metallic foams have high energy absorption ability and very light weight compared to conventional bulk metallic materials, which make them an alternative material for applications such as airplane, automobile, structural and space industry. However, even with these advantages, the geometrical defects, such as wiggly, buckled or broken cell walls, cells of exceptional size or shape, and micro pores in cell walls, caused by the instability of the manufacturing process, make them difficult to apply to industrial usages.

On the other hand, micromechanical modeling of metallic foams continues to play a substantial role in the understanding new materials systems. The use of unit cells or representative volume element, together with finite element analysis tool is well established for the investigation of effective properties and to analyze the correlation between the geometrical factors and effective properties of metallic foams. Using this method, a detailed understanding of the defects of metallic foams can be made.

In this present work, the effect of geometrical defects on mechanical properties of metallic foams was investigated. Representative volume elements of porous structures having different kinds of defects were reconstructed. The effect of geometrical defects on compressive deformation properties of metallic foams were analyzed using finite element method.

## **THE PRODUCTION OF CARBONACEOUS MATERIALS FROM PEACH PULP BY PYROLYSIS**

Nurgül ÖZBAY<sup>1</sup>, Esin APAYDIN-VAROL<sup>2</sup>, Ayşe Eren PÜTÜN<sup>2</sup>

1. Dept. of Process and Chemical Eng., Bilecik Seyh Edebali Univ., Bilecik, Turkey  
2. Dept. of Chemical Eng., Anadolu Univ., 26555, Eskişehir, Turkey  
a. Corresponding author (nurgul.ozbay@bilecik.edu.tr)

The feasibility of using food industry wastes as renewable sources of energy by means of pyrolysis processes takes great attention during the last decades. The most interesting point of pyrolysis processes is the char which is a solid carbonaceous residue with a high content of fixed carbon that can be used directly as fuel, briquettes or precursor for activated carbon production.

The objective of this work is the preparation of carbonaceous materials from both peach pulp and chemically impregnated peach pulp via pyrolysis in a fixed-bed reactor under inert atmosphere and at temperatures ranging from 400 to 700°C. Effects of phosphoric acid usage as an activating agent on the produced chars were investigated by various characterization techniques such as: FTIR, SEM, and elemental analysis. The SEM analysis indicated that the pyrolysis led to the formation of meso-micro pores resulting in higher surface areas. FTIR studies showed a gradual decrease in the amounts of OH and CH<sub>3</sub> with increasing pyrolysis temperature. Both the H/C and O/C ratios of the chars decreased with increase in temperature being an indicative of hydrogen and oxygen loss and a gradual enrichment of char with carbon.

## **POLYMER-DERIVED CARBON MATERIALS AND THEIR CHARACTERIZATION**

Sylwia Ronka<sup>a</sup>

a. Corresponding author (sylwia.ronka@pwr.wroc.pl)

The synthetic carbon materials prepared from polymers are expected to have reproducible characteristics and controlled pore size, as well as good mechanical and thermal properties, so they can be applied as catalyst supports and adsorbents in many separations. Morphology of polymer-derived carbons can be, to some extent, controlled by the choice of the precursor material, i.e. the porosity of the polymeric resin, its chemical composition and the choice of carbonization conditions. Therefore, it has been decided to investigate the influence of these parameters on the yield and morphology of prepared materials. This work presents the methods of preparation of phosphorus-containing carbons and their characterization. These materials have been prepared by the carbonization (850 °C, Ar) and following CO<sub>2</sub> activation of H<sup>+</sup>, Cs<sup>+</sup>, Cu<sup>2+</sup>, Co<sup>2+</sup>, Fe<sup>3+</sup> form of phosphorylated S/DVB copolymers. The resulting carbons were characterized by elemental analysis, SEM, XPS, XRD and low temperature nitrogen adsorption/desorption.

## **NUMERICAL SIMULATION OF THE DOUBLE DIFFUSION FROM THE MICROSPHERES OBTAINED BY EMULSIFICATION**

Lynda LAMOUDI<sup>a</sup>, Kamel DAOUD

a. Corresponding author (lynda\_lamoudi@voila.fr)

In works in the domain of the micro encapsulation, the elaborate mathematical models don't permit to translate the process of drug delivery faithfully from a matrix system; indeed, it appears difficult to put simultaneously in equation the speed of diffusion of the drug, the speed of erosion, the speed of penetration of the solvent etc...and most works limit themselves to simplifications of the equations governing the phenomenon of a liberation controlled of the active ingredient. In a double emulsification of water in oil in water, the drug, in this case the penicillin, is incorporated in aqueous solution in the internal phase of the emulsion lubricates in water. This last is constituted of a mixture of polymers to know, the Eudragit and the polyethylene glycol dissolved in the acetone. The internal phase of the emulsion evaporated under reduced pressure, the solution is freeze-dried thus in order to get a powder. According to some authors, they gave out the hypothesis that in the case of the tablets, when the speed of relaxation of the polymeric chains is a lot more than the speed of diffusion by gradient of concentration, the front of solvent penetrates to a quasi-constant speed in the matrix.

## INVESTIGATION OF THE COMPACTION BEHAVIOUR OF Ag<sub>8</sub>ZnO COMPOSITE PRODUCED BY MECHANICAL ALLOYING

Serkan BIYIK <sup>1,a</sup>, Murat AYDIN <sup>2</sup>

<sup>1</sup>Karadeniz Technical Univ., Dept. of Metallurgical and Materials Eng., Trabzon, Turkey

<sup>2</sup>Karadeniz Technical Univ., Dept. of Mechanical Eng., Trabzon, Turkey

a. Corresponding author (serkanbiyik@ktu.edu.tr)

In this study, silver and zinc oxide powders were processed by mechanical alloying and powder metallurgy techniques to obtain Ag<sub>8</sub>ZnO composite, and the green density, porosity and microhardness values of this composite at different compaction pressures were investigated. Planetary type ball mill was used to achieve homogeneous distribution of the reinforcement (zinc oxide) in the matrix (silver). For this reason, particle size and morphology at different milling times were determined, and the relationship between particle size and milling duration was examined. The optimum ball-milling time is approximately 0.5 h. In addition, four different pressure values, namely 40, 60, 80 and 100 bars, were selected to investigate the effect of compaction pressure on green density, hardness and porosity ratio. The compaction was performed separately for each pressure level, and the green compacts produced by this way were analyzed by using SEM coupled with energy dispersive X-ray spectroscopy (EDX). The experimental results showed that the highest green density and microhardness values were obtained with the compaction pressure of 100 bar. Besides, the porosity ratio constantly decreases with increasing compaction pressure, and reaches its minimal at 100 bar. The EDX map characterization showed that zinc oxide distribution was homogeneous in the silver matrix.

## SYNTHESIS OF GLASSY VOLCANIC ROCK SUPPORTED PHOTOCATALYST

Dilek Duranoğlu

a. Corresponding author (dilekdur@gmail.com)

Traditional water treatment technologies do not remove the pollutants completely and concentrate them by transferring to another phases. These concentrated toxic contaminants cause another environmental disposal problem. Advanced oxidation technologies, which degrade persistent organic molecules into biodegradable compounds and eventually water and carbon dioxide, took place in literature as innovative water treatment technologies. Although TiO<sub>2</sub> nanoparticles are very effective photocatalyst used in advanced oxidation technologies, it is required very expensive microfiltration processes for separating nanoparticles from water after their usage in water treatment. This problem has been solved by attaching the nanoparticles onto a support material. As a support material, a kind of glassy volcanic rock, perlite, has been used in this study due to its high silicon content and porous structure. It can be found easily in low-cost in nature, has lower density and higher light transparency comparing to other porous materials like activated carbon, zeolite and clay. Impregnation and calcination methods have been applied in order to immobilize titanium particles onto perlite granules. The effects Ti/perlite, temperature and particle size of perlite have been investigated. The glassy volcanic rock supported photocatalyst has been characterized by X-Ray Diffraction Spectrometer, BET surface area, pore size distribution, and SEM.

## UTILIZING THE COMPUTERIZED TOMOGRAPHY FOR POROSITY ANALYSIS OF MORTAR AND CONCRETE

Ilker TEKIN

a. Corresponding author (ilkertekin@yahoo.com)

Mortars and concrete are the materials that use cement as binder. While fine aggregate is used in the mortars, concrete contains both fine and coarse aggregate. Cementitious materials have some significant defects such as porosity in their structures. Porous permeability of materials is controlled by pore structure, and durability factors such as freeze-thaw behavior and sulfate deterioration affect permeability. Usually porosity appears 3-10% in the conventional concrete and up to 45% in the mortars. These voids have different sizes, and they are classified as cement gel pores, capillary pores and air voids. There are several methods that are used to determine the void ratio such as water absorption, optical microscopy, SEM, mercury intrusion porosimetry, solvent absorption, nuclear magnetic resonance and computerized tomography (CT) in the cementitious materials. CT is a non-destructive method that utilizes density information. Therefore, it is an effective method to investigate air phase in cementitious materials which have different densities. In this study, it is explained how to perform macro porosity analysis in the mortars and concrete by CT technique. Experiments are discussed in relation with void structure, voids distribution and void ratio for mortar and concrete. Performing morphology study of the concrete is also explained.

## GADOLINIUM AND NEODYMIUM DOPED CERIA ELECTROLYTES FOR IT-SOLID OXIDE FUEL CELLS PREPARED BY POLYOL METHOD

Göknur Dönmez<sup>1</sup>, Vedat Sarıboğa<sup>1</sup>, M.A. Faruk Öksüzömer<sup>1</sup>, Tuba Gürkaynak Altınçekiç<sup>1</sup>

Istanbul Univ., Faculty of Eng., Chemical Eng. Dept., Istanbul, Turkey

a. Corresponding author (goknurdonmez@gmail.com)

SOFCs have attracted considerable research interest because of its higher energy efficiency, rapid electrode kinetics without using expensive electrocatalysts such as Pt, relative resistance to impurities in the fuel, the possibility of processing CO, CH<sub>4</sub> and other carbon based fuels, and flexibility to stacks of cells using interconnect materials generating power generation units. Conventional SOFC materials include YSZ solid electrolytes, LSM cathodes electrode and Ni-YSZ anode electrodes. YSZ electrolytes have been extensively investigated because of their high mechanical and chemical stability under the oxidizing and reducing conditions, low electronic conductivity, and relative low cost. However, YSZ based fuel cells require high operation temperature in order to achieve sufficient ion conductivity. High operation temperature places many restrictions on the selection of compatible electrode, interconnect and housing materials resulting in complicated fabrication procedures, elevated fuel cell manufacture costs, and reduce durability. Therefore the development of IT-SOFCs that combine the rapid electrode kinetics and higher efficiencies of solid oxide fuel cells with an intermediate operating temperature would reduce fabrication costs making fuel cell technology an attractive approach for alternative energy transformation devices. To achieve this goal, research efforts have been directed towards the development of electrolyte materials having higher ionic conductivities at moderate temperatures and new electrodes exhibiting high catalytic activity and stability with respect to other fuel cell components. Rare earth doped ceria materials have been identified as intermediate temperature electrolytes having much higher ion conductivities compared to YSZ. In this work, we aimed to determine the influence of dopant type and dopant concentration on the ionic conductivity. The gadolinium and neodymium doped ceria powders were prepared by the polyol method. The obtained powders were calcined, then pressed to pellets and sintered. SEM, EIS analyses and density measurements were made by using the pellets. The polyol process leads to the production of nanocrystalline powders after calcination. The XRD pattern of the samples confirmed the fluorite structure of CeO<sub>2</sub>. The effect of dopant concentration on conductivity was also studied. From the EIS, gadolinium doped ceria seems to be more promising than neodymium doped ceria electrolyte for IT-SOFCs according to our results.

## ADSORPTION OF CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub> AND C<sub>3</sub>H<sub>8</sub> ON FLEXIBLE MIL-53 (Al) MOF

Prashant Mishra<sup>1</sup>, Hari Prasad Uppara<sup>1</sup>, Zeeshan Zafar<sup>1</sup>, Bishnupada Mandal<sup>1</sup>, Sasidhar Gumma<sup>1,a</sup>

1. Dept. of Chemical Eng., Indian Inst. of Technology Guwahati  
Guwahati - 781039, Assam, India.

a. Corresponding author (s.gumma@iitg.ernet.in)

MIL-53 (Al) is one of the most stable metal organic framework (MOF); it exhibits structural transformation (so-called breathing phenomena) on exposure to certain guest molecules or by changing the temperature. Adsorption studies of CO<sub>2</sub> and CH<sub>4</sub> on this MOF are well reported in literature however, adsorption data for other industrially relevant gases such as CO, N<sub>2</sub> and C<sub>3</sub>H<sub>8</sub> is limited. In this work, high pressure equilibrium adsorption isotherms for five gases (CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub> and C<sub>3</sub>H<sub>8</sub>) were measured at three different temperatures (294, 314 and 350 K) on MIL-53 (Al). CO<sub>2</sub> and C<sub>3</sub>H<sub>8</sub>, which have better adsorption affinity (due to their higher polarizability and quadrupole moment) induced breathing phenomena during their adsorption at 294 and 314 K. On the other hand CO did not show breathing phenomena even though it has permanent dipole moment. CH<sub>4</sub> and N<sub>2</sub> also did not exhibit breathing phenomena at three given temperatures. The experimental data of CO, CH<sub>4</sub> and N<sub>2</sub> was correlated with virial models. For CO<sub>2</sub> and C<sub>3</sub>H<sub>8</sub>, normal distribution function was used to correlate structural transformation with pressure then fitting parameters corresponding to narrow pores and large pores of MIL-53 (Al) were also obtained.

## HIGH CARBON SELECTIVITY WITH ZEOLITIC IMIDAZOLATE FRAMEWORKS

Seda Keskin<sup>1</sup>, Selçuk Demir<sup>2,a</sup>

1. Dept. of Chemical and Biological Eng., Koç Univ., Istanbul, Turkey

2. Faculty of Arts and Sciences, Dept. of Chemistry, Recep Tayyip Erdoğan Univ., Rize, Turkey

a. Corresponding author (selcuk.demir@erdogan.edu.tr)

Zeolitic Imidazolate Frameworks (ZIFs) are an important class of porous materials, and because of their high thermal and chemical stability, designable pore structures and functionality, ZIFs are attracting greater interest. ZIFs are especially useful for the capture of CO<sub>2</sub>, selective separation of gas mixtures, and catalysis [1-5]. The adsorption selectivity of [Zn(im)<sub>2</sub>] of the **coi** and **zni** topology for CH<sub>4</sub>/H<sub>2</sub>, and CO<sub>2</sub>/H<sub>2</sub> are displayed a superior ability than previously reported ZIFs, according to the the grand canonical Monte Carlo simulations.

## **STRUCTURAL AND OPTICAL CHARACTERIZATION OF POROUS ANODIC ALUMINA-AL NANOCOMPOSITE FILMS ON BOROFLOAT SUBSTRATES**

Hande Cavus Arslan<sup>1,2</sup>, Ibrahim Yusufoglu<sup>2</sup>, Mustafa M. Aslan<sup>1,a</sup>

1. Materials Inst., TUBITAK Marmara Research Center, 41470 Gebze - Kocaeli, Turkey;
  2. Dept. of Metallurgical and Materials Eng., Istanbul Univ., 34320 - Istanbul - Turkey
- a. Corresponding author ( mustafa.aslan@tubitak.gov.tr )

We studied structural and optical properties of porous anodic alumina (PAA) / Aluminum (Al) nanocomposite films fabricated by partial anodization of 200-nm-thick Al evaporated thermally onto borofloat substrates. Anodization process was carried out in 0.03 M oxalic acid at 40V for 0, 5, 10, 15 and 20 minutes. Surface and cross-sectional structures of the films were characterized by scanning electron microscopy (SEM). Results indicate that the pore diameters of surface nanostructures are around 26 nm and their interpore distance ranges from 78 to 112 nm. SEM results also show that thicknesses of PAA and Al layers can be controlled by anodization time: Al layer thickness decreases to zero while PAA layer increases to 290 nm by increasing anodization time to 20 minutes. In addition, we observed visible color variations between the samples anodized for different times. Both total and diffusive reflection measurements from PAA/Al films in between 250 nm and 800 nm wavelength show the typical interference patterns. The PAA/Al films with adjustable surface nanostructures and their tunable interferometric responses hold a promise as novel interferometric sensor structures.

## **CHARACTERIZATION OF POROUS HYDROXYAPATITE PRODUCED ON TI6Al4V BY PLASMA ELECTROLYTIC OXIDATION**

Salih Durdu<sup>1,a</sup>, Işıl Kutbay<sup>1</sup>, Metin Usta<sup>1</sup>

1. The Dept. of Materials Sci. and Eng., Gebze Inst. of Technology, 41400, Gebze/TURKEY
- a. Corresponding author (sdurdu@gyte.edu.tr, durdusalih@gmail.com)

In this study, hydroxyapatite (HAp) and calcium apatite based ceramic composite coatings were produced on Ti6Al4V alloy by plasma electrolytic oxidation (PEO) in the electrolyte consisting of calcium acetate (CA) and  $\beta$ -calcium glycerophosphate ( $\beta$ -Ca GP) at 0.140 A/cm<sup>2</sup> current densities for 1, 2, 3, 4, 5, 20, 40 and 60 minutes. The phase structure, surface morphology of the coatings and functional groups of the molecules were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM) and energy dispersive spectroscopy (EDX-mapping), respectively. The XRD results indicated that anatase-TiO<sub>2</sub>, rutile-TiO<sub>2</sub>, Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> (TCP), CaTiO<sub>3</sub> (perovskite) and Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>(OH)<sub>2</sub> (HAp) phases were formed on the surface of the coated titanium alloy. The peo coatings have very porous surface structure due to the existence of micro discharge channels during process. According to the EDS mapping results, uniform Ca and P elements were observed on the surface of PEO coatings.

## **A COMPARATIVE ADSORPTION STUDY: RICE HUSK AGAINST ACID ACTIVATED RICE HUSK BY USING RHODAMINE B**

MehmetKAYA<sup>1</sup>, Ömer SUNGUR<sup>1</sup>, Ahmet TABAK<sup>1</sup> and Özge GÖKTEKİN<sup>1</sup>

1. RecepTayyipErdogan Univ., Faculty of Arts and Sciences, <sup>a</sup>Dept. of Chemistry, 53100, Rize, Turkey  
a.Corresponding author (mehmet.kaya@erdogan.edu.tr)

Rice Husk (RH) and Acid Activated Rice Husk (AARH) were used as adsorbents for removal of Rhodamine B (Rh-B) from aqueous solution. AARH was prepared from rice husk treated with hydrochloric acid and RH was collected directly from mill. The effect of system variables such as contact time, initial concentration and adsorbent dose were explored. Adsorption properties and structural characterization of Rh-B/Rice Husk composites and raw Rice Husk samples was studied by using UV-VIS, XRD, FTIR and thermal analysis techniques. It was explored quantity of adsorbate by fixing amount of adsorbent and quantity of interacting adsorbent by fixing Rh-B concentration. The Langmuir and Freundlich isotherm models were applied to the experimental data. All results were discussed by using some adsorption parameters obtained from spectroscopic and thermal analysis techniques.

## **EFFECTS OF PROCESS PARAMETERS ON HYDROXYAPATITE CRYSTALLIZATION**

Özlem Doğan, Büşra Bodur, Mualla Öner  
a.Corresponding author (dogano@yildiz.edu.tr)

Hydroxyapatite ( $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ , HAP) differs from other calcium phosphate salts in terms of its high biocompatibility, slow degradation, and the similarities of its chemical structure with bone. HAP have been widely used in biomedical applications for repairing bone defects in dental and orthopedic sites, immediate tooth replacement, augmentation of alveolar ridges, and pulp capping material due to the above mentioned characteristics. In addition, the recent studies have shown that HAP is an effective adsorbent for heavy metals such as lead, zinc, copper, cobalt, cadmium, and pharmaceutical active ingredients, dyes, enzymes and proteins. In this work, the effects of temperature and reactant concentration for the HAP crystallization were investigated by wet chemical synthesis under controlled temperature, pH, and atmospheric conditions. The obtained crystals were characterized by SEM, BET, FT-IR and X-Ray powder diffraction methods. SEM images showed that the samples are rod-shaped. The surface area, micropore volume and particle size of crystals were changed by depending on temperature, and the concentration of reactants.

## COMPARISON OF Mg-Al SORBENTS PREPARED BY DIFFERENT SYNTHESIS METHODS FOR THE SORPTION OF CO<sub>2</sub>

D.D. Eslek Koyuncu<sup>1</sup>, Sena Yasyerli<sup>1</sup>, Nail Yaşyerli<sup>1</sup>

1. Chemical Eng., Gazi Univ., Ankara, Turkey

a. Corresponding author (deslek@gazi.edu.tr)

Removal of carbon dioxide from flue gas streams by sorbents at high temperatures attracted significant attention of the researchers in the field of energy. Hydrotalcites, layered double hydroxides (LDH) with general formula of  $Mg_6Al_2(OH)_{16}CO_3 \cdot 4H_2O$ , were reported as a promising sorbent for CO<sub>2</sub> removal. The aim of this work is to compare Mg-Al sorbents prepared by different synthesis methods. In this study, four synthesis methods; co-precipitation, complexation, sol-gel and hydrothermal, were used to prepare Mg-Al sorbent with a Mg/Al molar ratio of 3 for CO<sub>2</sub> removal. Synthesized materials were characterized by XRD, SEM, ICP-MS and N<sub>2</sub> adsorption-desorption analysis. ICP-MS result of Mg-Al prepared by co-precipitation indicated the similar Mg/Al ratio (2.98) as ratio in the synthesis solution (3.0). After calcinations, XRD patterns of all sorbents prepared by different methods showed Mg(Al)O “periclase” structure, which was active phase for CO<sub>2</sub> removal. The surface areas of Mg-Al sorbents prepared by co-precipitation, complexation, sol-gel and hydrothermal were found as 133, 182, 152 and 198 m<sup>2</sup>/g, respectively. Mg-Al prepared by complexation had quite narrow pore size distribution with a 5 nm pore diameter while other sorbents had larger pore diameter (>10 nm). The N<sub>2</sub> adsorption-desorption isotherms of all sorbents were Type IV indicating mesoporous structure.

## PREPARATION AND CHARACTERIZATION OF OXIDE NANOPOWDERS

Gulnihal Ozek Yelken<sup>a</sup>

a. Corresponding author (gulnihalyelken@iyte.edu.tr)

Porous ceramics have attracted significant attention because of their successful use in a broad range of applications including electronic sensors, catalysts, construction materials, membranes, biomaterials. Control and manipulation of stability, rheology, and forming characteristics depend on detailed analysis of the interactions among the particles. It is known that sol-gel method is an alternative method to produce ceramic powders. The present study deals with the synthesis and characterization of alumina and silica nanopowders which can be a potentially utilized material for many areas. Based on sol-gel method, the synthesis started from chemical nature precursors. The powders obtained after drying the gel were heat treated. The effects of water/alkoxide ratio, H<sup>+</sup>/alkoxide ratio on the catalysis of the hydrolysis-condensation reactions and the peptization process were investigated by using N<sub>2</sub> adsorption-desorption isotherms, thermo gravimetric analysis and FTIR. X-ray diffraction was used in order to characterize the powders in terms of their crystallinity degree and crystallite size. Microstructural and morphological characterization was performed using scanning electron microscopy (SEM). Electrochemical behaviors were investigated by electrophoretic measurement. This study also summarizes theory, experimental techniques, and the reported data pertaining to the zeta potential of oxide powders.

## **CHARACTERIZATION OF POROUS COATINGS ON AZ31 MG ALLOY BY PLASMA ELECTROLYTIC OXIDATION**

Salim Levent Aktuğ<sup>1,a</sup>, Salih Durdu<sup>2</sup>, Işıl Kutbay<sup>3</sup>, Aysun Demirtaş<sup>4</sup>, Selin Bayramoğlu<sup>5</sup>, Metin Usta<sup>6</sup>

1,2,3,4,5,6. Gebze Institute of Technology, Kocaeli, Turkey  
a. Corresponding author (saktug@gyte.edu.tr)

In this study, AZ31 Mg alloy produced by twin roll casting was coated by plasma electrolytic oxidation (PEO) in solutions, consisting of 4 g/L Na<sub>2</sub>SiO<sub>3</sub>.5H<sub>2</sub>O + 1,5 g/L KOH (called as E1) and 8 g/L Na<sub>2</sub>SiO<sub>3</sub>.5H<sub>2</sub>O + 1,5 g/L KOH (called as E2) electrolytes at 0,14 A/cm<sup>2</sup> current density for 60 minutes. The average coating thicknesses are 73 to 68 µm for E1 and E2, respectively. XRD results indicated that Mg<sub>2</sub>SiO<sub>4</sub> (Forsterite) and MgO (Periclase) phases were formed on the surface of the coated magnesium alloy. Average hardnesses of coatings were measured as 735 HV for E1 and 795 HV for E2, while the hardness of substrate is 70 HV. Surface roughnesses of coatings were measured as 5.75 and 6.23 µm for E1 and E2, respectively. PEO coatings exhibited superior wear resistance. The wear resistance of coating produced in E1 is greater than the one in E2.

## **PRODUCTION OF POROUS CERAMIC MATERIAL FROM KAOLIN DOPED PORCELAIN POLISHING WASTE**

Derya Kırsever<sup>a</sup>, Nil Toplan and H.Özkan Toplan

Sakarya University, Dept. of Metallurgical and Materials Engineering, Sakarya, TURKEY  
a. Corresponding author (dkirsever@sakarya.edu.tr)

The possibility of recycling residues, coming from the industrial polishing process of porcelain stoneware tiles, by the addition of kaolin to the raw materials was studied. Mixtures of polishing porcelain stoneware waste and kaolin were prepared at different compositions (up to wt. 10 % kaolin) and sintered at different temperatures (up to 1175<sup>0</sup>c). TG-DTA analysis of powder mixtures was performed. The sintered samples were also characterized to determine expansion and bulk density of the sintered samples. Microstructural analyses were characterized by scanning electron microscopy-energy dispersive spectroscopy.

## CHARACTERIZATION AND DETERMINATION OF BIOFILM FORMING POTENTIAL OF A WASTE SERICIN-RICH PROTEIN MIXTURE

Goksen Capar<sup>1,2,a</sup>, S.Saniye Aygun<sup>1</sup>, M. Ruşen Geçit<sup>1</sup> and Kang Li<sup>3</sup>

1. Middle East Technical University, Engineering Sciences Dept., Cankaya, Ankara, Turkey
  2. Ankara University, Water Management institute, , Ankara, Turkey
  3. imperial College, London, Dept. of Chemical Engineering, South Kensington Campus, London, UK
- a. Corresponding author ( gcapar@ankara.edu.tr)

A sericin-rich silk protein mixture ( $S_R$ ) recovered from silk wastewaters was obtained in powder form and characterized in terms of molecular weight, elemental composition, pH, moisture and ash contents. The biofilm forming potential of the protein powder for making packaging materials was determined. Films made of protein mixture were quite fragile, hence protein mixture was blended with polyvinyl alcohol (PVA) at 5/100 ratio. Films were cast on glass sheets where glycerol was used as a plasticizer. These films were characterized in terms of oxygen permeability and mechanical properties. Although PVA films were found to be impermeable to oxygen, addition of sericin-rich protein powder resulted in higher oxygen permeability of films. The mechanical properties were found suitable for packaging purposes. These results revealed that sericin-rich protein powder can be used as an additive in making biofilms for packaging purposes where oxygen transmission is not a problem.

## THE PRODUCTION OF NOVEL ACTIVATED CARBONS FROM CAROB PULPS: EFFECT OF $ZnCl_2$ IMPREGNATION RATIOS ON THE PORE STRUCTURE

Hasan SAYGILI<sup>1,a</sup> and Fuat GÜZEL<sup>2</sup>

1. Dept. of Chemistry, Science and Art Faculty, Batman Univ.,72060, Batman, TURKEY
  2. Dept. of Secondary Science and Mathematics Education, Education Faculty, Dicle Univ.,21280, Diyarbakır, TURKEY
- a. Corresponding author(hasan.saygili33@gmail.com)

In this study were investigated the effect of different impregnation ratios (IRs) on the pore structure of new activated carbons (ACs) derived from Carob pulps (CP) with chemical activation method using zinc chloride at 500°C under purified nitrogen (99.995%) flow of 100 cm<sup>3</sup>/min for 1 h. The pore structural analyses of ACs were characterized by nitrogen adsorption at 77 K. From the nitrogen adsorption data, the specific surface area ( $S_{BET}$ ) was calculated by the BET equation; the total pore volume ( $V_T$ ) was evaluated by converting the adsorption volume of nitrogen at relative pressure of 0.95 to equivalent liquid volume of adsorbate, while the micropore volume ( $V_{micro}$ ), micropore surface area ( $S_{micro}$ ) and external surface area ( $S_{external}$ ) were obtained using the t-plot method. Mesopore volumes ( $V_{meso}$ ) were calculated by the difference between  $V_T$  and  $V_{micro}$ . Results showed that as the IRs increased from 1 to 6, the  $S_{BET}$  and  $V_T$  of produced ACs increased from 921.1 to 1734.1 m<sup>2</sup>/g and 0.571 to 1.613 cm<sup>3</sup>/g respectively.

## UTILIZATION OF POLISHING PORCELAIN STONEWARE WASTE WITH TALC ADDITION IN THE PRODUCTION OF POROUS CERAMIC BODIES

Derya Kırsever<sup>1a</sup>, Nil Toplan<sup>1</sup> and H.Özkan Toplan<sup>1</sup>

1. Sakarya University, Dept. of Metallurgical and Materials Engineering, Sakarya, TURKEY  
a. Corresponding author (dkirsever@sakarya.edu.tr)

The present work aimed at studying the utilization of wastes from polishing to produce porcelain stoneware. mixtures containing polishing porcelain stoneware waste and talc were prepared at different compositions (up to 10 wt.% talc). The powder mixtures were compressed in a hydraulic press and sintered at different temperatures as 1100, 1125 and 1150°C. SEM, XRD, and TG-DTA analysis of the sintered samples were performed. Also, the sintered samples were also characterized to determine expansion (%) and water absorption (%) of the sintered samples.

## SYNTHESIS OF COPPER AND TIN INCORPORATED SBA-15 IN THE PRESENCE OF COMPETITIVE SALT

Filiz Akti<sup>1,a</sup>, Suna Balci<sup>1</sup>, Timur Dogu<sup>3</sup>

1. Dept. of Chemical Eng., Gazi Univ., 06570 Ankara, Turkey  
2. Dept. of Chemical Eng., Middle East Technical Univ., 06531 Ankara, Turkey  
a. Corresponding author (filizakti@gazi.edu.tr)

Sn- and Sn/Cu- SBA-15 catalysts were synthesized hydrothermally in presence of aluminum as a competitive salt. The synthesis carried out by the addition of active metals which were previously dissolved in ethyl or isopropyl alcohol before or after silica source addition to the synthesis solution. Active metals/Si ratio was settled as 0.06 and competitive salt Al/Si ratio as 0.001. The characteristic XRD peaks were preserved in metal-SBA-15 and  $d_{100}$ -spacing and wall thickness values ranged between 14.7-16.9 nm and 10.5-12.9 nm, respectively. Diffraction peaks contributing to tin were clearly observed for Sn-SBA-15 sample synthesized by dissolving the source in ethyl alcohol and the addition before the silica source. From  $N_2$  adsorption experiments, it was seen that the catalysts with structural properties reaching up to 1033  $m^2/g$  surface area, 1.45  $cm^3/g$  meso pore volume and 6.9 nm average meso pore radius, were successfully synthesized. Cu/Si ratio which was estimated from EDX as 0.01 for the directly synthesized Cu-SBA-15 reached up to 0.02 by use of Al and dissolving in alcohol. Sn/Si ratio in Sn-SBA-15 catalysts synthesized by use of metal source dissolved in isopropyl alcohol added before and after the silica source was determined as 0.002 and 0.03 respectively.

## SYNTHESIS OF MOF 5 AND CuTPA METAL-ORGANIC FRAMEWORKS

Ahmet Uğur Çiçek, Alev Güneş Yerkesikli, Seher Fehime Çakıcıoğlu Özkan  
a. Corresponding author (ahmetcicek@iyte.edu.tr)

Metal-organic frameworks (MOFs), new synthetic organic porous materials are consisting of metal oxide clusters and organic linkers. MOFs have extremely high porosities and well-defined pore sizes. The controllable length of the organic linker and the variation of the metal oxide allow for tailoring of the functionality, pore volume, and pore size over a wide atomic-scale range. MOFs provide a wealth of opportunities for the engineering of new functional materials with tunable properties and have been shown as promising materials for adsorption. Metal organic frameworks (MOF 5, Cu-TPA) were developed from terephthalic acid as a binder, copper and zinc as metal. Terephthalic acids with different purity were used in the production of metal organic frameworks (MOFs). The structural and textural properties were investigated by using volumetric nitrogen adsorption system (Micromeritics ASAP 2010), X-Ray diffractometer (XRD), scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FT-IR).

## AN INVESTIGATION OF THE ADSORPTION OF RHODAMINE B DYE ONTO VARIOUS MODIFIED BENTONITES

Bülent ÇAĞLAR<sup>1</sup>, Ebru ÇETİN<sup>1</sup>, Ahmet TABAK<sup>2</sup>, Osman ÇUBUK<sup>1</sup>, Mehmet KAYA<sup>2</sup> and  
Ömer SUNGUR<sup>2</sup>

1. Erzincan Univ., Faculty of Arts and Sciences, Dept. of Chemistry, 24100, Erzincan, Turkey
  2. Recep Tayyip Erdoğan Univ., Faculty of Arts and Sciences, <sup>2</sup>Dept. of Chemistry, 53100, Rize, Turkey
- a. Corresponding author (bcaglar@erzincan.edu.tr)

The structural and thermal properties of raw and modified Unye bentonites prepared by cation exchanges have previously been investigated in detail using elemental analysis, XRD, FT-IR and thermal analysis. The spectroscopic and thermal data of raw bentonite proved that the main component of sample is montmorillonite and the external clay components exist in less amount. The adsorption behaviour of rhodamine B from aqueous solution onto raw and cation exchanged bentonites was investigated as a function of parameters such as contact time, pH, initial dye concentration and temperature. The equilibrium time was found to be 200 min and maximum adsorption capacity of rhodamine B was observed at pH=2. The Freundlich and Langmuir isotherm models were applied and the Langmuir model was found to best fit the equilibrium isotherm data. The pseudo-first-order model and pseudo-second-order kinetic models were used to describe the kinetic data and kinetic data followed pseudo-second-order kinetic model. The negative Gibbs adsorption energies and positive adsorption enthalpy changes in the temperature range 25-45 °C pointed out that the adsorption of rhodamine B onto bentonite samples is feasible and endothermic. The results indicate that bentonites can be used as effective adsorbent for the removal of dyes from aqueous solutions

## CHARACTERIZATION AND FORMATION OF POROUS SURFACE ON MAGNESIUM COATED BY PLASMA ELECTROLYTIC OXIDATION

Büşra Özkal<sup>a</sup>, Dođukan Çetiner, Salih Durdu, Işıl Kutbay, Metin Usta

The Dept. of Materials Science and Engineering, Gebze Institute of Technology, 41400,  
Gebze/KOCAELİ

a. Corresponding author (busra\_ozkal89@hotmail.com; busraozkal89@gmail.com)

In this study, commercial pure magnesium was coated by plasma electrolytic oxidation (PEO) in 4.5 g/L Na<sub>3</sub>PO<sub>4</sub> + 1 g/L KOH electrolyte at 0.085 A/cm<sup>2</sup> current density for 15, 30 and 45 minutes. Coating thickness, phase composition, surface morphology, surface roughness, hardness and wear test were analyzed by eddy current method, X-ray diffraction (XRD), scanning electron microscopy (SEM), surface profilometer, micro vickers tester and tribometer, respectively. The average coating thicknesses were measured as 34, 55 and 17 µm for 15, 30 and 45 minutes, respectively. The XRD results showed that Mg<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> (Farringtonite) and MgO (Periclase) phases were detected on the coating. The PEO coatings have very porous surface structure due to the existence of micro discharge channels during process. Surface roughnesses of coatings were measured as 3.19, 4.21 and 4.08 µm for 15, 30 and 45 minutes, respectively. The PEO coatings exhibited superior wear resistance than uncoated magnesium.

## STUDIES ON THE BEHAVIOR OF ADSORPTION OF URANIUM ON MANUFACTURED NANO-PARTICLES

Ümit H. Kaynar<sup>1</sup>, Ümran Hiçsönmez<sup>2,a</sup>, Mehmet Ayvacıklı<sup>3</sup>, Sermin Çam Kaynar<sup>3</sup>,

1. Celal Bayar Univ., Education Faculty, Primary School Science Teaching,

2. Science-Art Faculty, Dept. of Chemistry,

3. Dept. of Physics, Manisa, Turkey

a. Corresponding author (u.h.kaynar@hotmail.com)

The adsorption of the uranyl ions from aqueous solutions on the synthesis of Nano-ZnO-particles has been investigated under different experimental conditions. Nano-particles, with its wide and direct band gap, are a promising semiconductor by virtue of its unique optical, electronic, thermal, and chemical properties. The latest investigations indicate that a series of specific morphologies and particles of ZnO could possess even more novel properties. Most of atoms on the surface of the nano-particles can easily bind with atoms. Therefore, nano-particles have high adsorption capacity. The adsorption of uranyl on nano-particles ZnO were examined as function of different Zn<sup>2+</sup>/Urea molar ratios (1:1, 1:3, 1:5 and 1:6), the contact times, pH of the solution, concentration of uranium (VI) and temperature. The SEM images of nano ZnO of powders (1:5) showed that the sizes of individual ZnO nanoparticles are less than 70nm. The adsorption ability was followed by a series of Langmuir and Freundlich isotherms. The adsorption percent for 1:1 nano-particles ZnO were 52% and for 1:5 nano-particles ZnO were 98%, respectively. The optimum conditions are found as at pH 5, contact time 1h, 1:5 nano-particles ZnO, 50ppm U(VI) concentration. Thermodynamics parameters showed endothermic of adsorption and the spontaneous nature of the process.

## THE INVESTIGATION OF TEMPERATURE EFFECT ON ADSORPTION OF CRYSTAL VIOLET ON NEW ACTIVATED CARBON PREPARED TOMATO (SOLANUM LYCOPERSICUM) PULP

Hasan SAYĞILI<sup>\*1</sup>, Gülbahar AKKAYA SAYĞILI<sup>2</sup>, Filiz KOYUNCU<sup>2</sup> and Fuat GÜZEL<sup>2</sup>

1. Dept. of Chemistry, Science and Art Faculty, Batman Univ.,72060, Batman, TURKEY
  2. Dept. of Secondary Science and Mathematics Education, Education Faculty, Dicle Univ.,21280, Diyarbakır, TURKEY
- a. Corresponding author (hasan.saygili33@gmail.com)

Activated carbons to remove of dyes from aqueous solutions have a great importance. However, commercially available activated carbons are still considered expensive. Therefore, in recent years, this has prompted a growing research interest in the production of activated carbons from renewable and cheaper precursors which are mainly industrial and agricultural by-products, especially for application concerning wastewater treatment. However, to our knowledge the use of Tomato pulp (TP) as a precursor for activated carbons has not previously been investigated. The objective of this study was to prepare activated carbon (AC) from TP with chemical activation utilizing  $ZnCl_2$  at 500 °C in  $N_2$  atmosphere and its ability to remove basic dye, Crystal Violet (CV) from aqueous solutions at different temperatures was studied. From the nitrogen adsorption isotherm data at 77 K, BET surface area, pore volume and mean pore radius were determined as 722.17  $m^2 g^{-1}$ , 0.476  $cm^3 g^{-1}$  26.44 Å, respectively. Experimental equilibrium data of CV were analyzed by the Langmuir and Freundlich isotherm models. The adsorption equilibrium data were best represented by Freundlich model. The maximum monolayer sorption capacities of AC for CV were found to be 53.19, 63.29, 64.50, 68.97  $mg g^{-1}$  at 20, 30, 40 and 50°C, respectively.

## POLY (2-HYDROXYETHYL METHACRYLATE)/BENTONITE (UNYE) COMPOSITES

Ömer SUNGUR<sup>1</sup>, Emir ÖZÇALIŞKAN<sup>2</sup>, Mehmet KAYA<sup>1</sup>, Ahmet TABAK<sup>1</sup>, Sinan AKGÖL<sup>2</sup>, and GÖKTEKİN<sup>1</sup>

- <sup>1</sup>Recep TayyipErdoganUniv., Faculty of Arts and Sciences, <sup>a</sup>Dept. of Chemistry, 53100, Rize, Turkey  
<sup>2</sup>Ege Univ., Faculty of Sciences, <sup>a</sup>Dept. of Biochemistry, Izmir, Turkey  
a. Corresponding author (omer.sungur@erdogan.edu.tr)

Poly(2-hydroxyethyl Methacrylate) (pHEMA)/bentonitecomposites were prepared by treating 2-hydroxyethyl Methacrylateduring polymerization with raw bentonite (Unye) and acid activated bentonite. The thermal stability and structural properties of these composites were investigated using X-ray diffraction (XRD), thermal analysis (TG/DTA/DSC), Fourier Transform Infrared (FTIR), and specific surface measurement (BET) techniques by giving special emphasis to the nature of the interaction between the polymer and the clay.

## LANTHANIDE REAGENTS AS THERMOMETRIC NMR-CONTRASTS FOR MRI TEMPERATURE MONITORING AND DIAGNOSIS

S.P. Babailov<sup>1,a</sup>

1. A.V.Nikolaev's Inst. of Inorganic Chemistry, Siberian Branch, Russian Academy of Sciences,  
Novosibirsk, 630090, Russian Federation  
a. Corresponding author (babajlov@niic.nsc.ru)

In recent years, coordination compounds of lanthanides(III) (Ln) have been used as pharmaceutical preparations for photodynamic therapy, contrast reagents for magnetic resonance imaging (MRI) and sensors for biology and medicine [ 1 , 2 ]. Here, we report some preliminary results of nuclear magnetic resonance (NMR) study on the structure and the dynamics of the Ln<sup>3+</sup> complexes with the crown-ethers intercalated in porous SiO<sub>2</sub>. It should be noted that a linear dependence of paramagnetic lanthanide-induced shifts in NMR spectra of lanthanide complexes on the reciprocal temperature was found. We found experimentally that this material is quite appropriate probe for in situ temperature determination in fluid media. Therefore, in principal, the material investigated is in vitro thermometric NMR sensor in reaction media (directly for in situ monitoring over temperature) and prospective thermometric sensor reagents for MRI 3D mapping of the temperature distribution of an animal or human body during some diseases, including different types of cancer. In addition, in future the Ln reagents can be efficient for MRI in monitoring in vivo of the dynamics of temperature distributions during response of the organism to therapy.

Therefore, the communication carries material on the molecular structure and the kinetic parameters of molecular dynamics for many Ln complexes. Additional advantage of the investigation is in the approach proposed which extends the range of measuring NMR rate constants of chemical exchange for paramagnetic 4f-elements complexes compared to diamagnetic ones.

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## THE EFFECT OF ACID PRETREATMENT ON POZZOLANIC ACTIVITY OF CLINOPTILOLITE NATURAL ZEOLITES

Burak UZAL<sup>a</sup>, Enver KÜÇÜKYILDIRIM  
a. Corresponding author (burak.uzal@agu.edu.tr)

It is known that natural zeolites have a significant level of pozzolanic activity which is defined as ability to react with lime to form binding products. This property of natural zeolites provides a potential to use them in cement and concrete compositions as a supplementary cementing material. In this study, the effect of acid pretreatment on reactivity of clinoptilolite-type natural zeolites was investigated. For this purpose, two zeolitic tuff sample obtained from Turkish deposits, which are mainly composed of clinoptilolite mineral, were subjected to pretreatment with HCl acid solution. Finely-ground zeolitic tuffs were tested before and after the pretreatment for chemical composition by ICP-MS, mineral composition by XRD, specific surface area by gas absorption (BET), and pozzolanic activity by measuring electrical conductivity of lime-zeolite suspensions. Strength activity index of the zeolites was also determined before and after the pretreatment in order to assess the effect of the pretreatment on mechanical strength of zeolite blended cementitious systems. HCl pretreatment resulted in a significant increase in BET surface area and accordingly lime reactivity of finely-ground clinoptilolite tuffs. However, a considerable positive effect was not observed for the strength activity of the zeolitic tuffs in blended Portland cement systems.

## **SYNTHESIS OF METALLIC COPPER NANOWIRES AT LOW TEMPERATURE**

Cansu Noberi<sup>1</sup>, Güncem Özgün Eren<sup>1</sup>, Merve Erk<sup>1</sup>, Figen Kaya<sup>1</sup> and Cengiz Kaya<sup>1</sup>

<sup>1</sup>Dept. of Metallurgical and Materials Eng., Yildiz Technical Univ., Davutpasa Campus, Esenler, Istanbul, Turkey

a. Corresponding author (cnoberi87@gmail.com)

In recent years, nanotubes and nanowires structures have been gained considerable attraction due to their optical, electrochemical and electrical properties and have been studied for wide range of application areas, such as antibacterial, catalysis and energy production. In this study, metallic Cu nanowires were synthesized using simple aqueous reduction method at low temperature. Copper (II) Nitrate, sodium hydroxide, ethylenediamine (EDA) and hydrazine were used as precursors.  $\text{Cu}(\text{NO}_3)_2$  used as a Cu source where both EDA and hydrazine used as a reduction agents. Obtained solution was heated till  $60^\circ\text{C}$  and held that temperature for an hour while the solution was mixed continuously using a magnetic stirrer. The pH value was very high nearing 13, which was lowered by using distilled water before separation of precipitations. As the precipitated nanofibres were in pure metallic state, after filtering they were stored inside the ethanol in order to prevent oxidation. Scanning electron microscopy (SEM) was used for identification of the morphology and size measurement of synthesized nanowires. Finally, X-ray (XRD) analysis was performed for the phase determination and confirmation of pure metallic copper structure.

## **FORMULATION AND IN VITRO EVALUATION OF SODIUM DICLOFENAC-CONTROLLED RELEASE TABLET**

Lynda LAMOUDI, Kamel DAOUD

a. Corresponding author (lynda\_lamoudi@voila.fr)

The aim of this study was to develop controlled release matrix formulation of Sodium Diclofenac and investigate the effects of both polymers on in vitro drug release. Matrix tablets were prepared by wet granulation technique manufactured in a fluidized bed using different concentration of hydroxy propyl methyl cellulose, Cellulose microcrystalline, Acryl-EZE and their combination in different ratios to examine their influence on tablet properties and drug release profile. Tablets were evaluated by measurement of hardness, friability, content uniformity, weight variation and drug release pattern. Release studies were carried out using USP type II apparatus in 900 ml of hydrochloric acid (pH 1.2) and sodium phosphate buffer (pH 6.8). The study revealed that the presence of Acryl-EZE in the matrix tablets is effective in protecting the dosage forms from release in acid environments such as gastric fluid. In pH=6.8 phosphate buffer, the drug release rate and mechanism of release from all matrices is mainly controlled by HPMC 15M. The model of Korsmeyer - Peppas was found to fit experimental dissolution results.

## NEW KIND OF ADSORBENT FOR THE REMOVAL OF ASTRAZON RED FROM INDUSTRIAL EFFLUENTS: ACTIVATED CARBON FROM SCENEDESMUS OBLIQUUS

Sevilay Cengiz<sup>1</sup>, Fatmagül Tanrıku<sup>2</sup>, Sevil Aksu<sup>2</sup>

1. Pamukkale Univ., Faculty of Arts and Sciences, Dept. of Molecular Biology and Genetics, Denizli, Turkey
2. Akdeniz Univ., Faculty of Sciences, Dept. of Chemistry, Antalya, Turkey  
a. Corresponding author (sevilay\_cengiz@yahoo.com)

In addition to a variety of valuable components, the property of rapid growth even on non-arable lands make the microalgae species an important part of many industries such as pharmaceutical, cosmetic, food and fuel [1-4]. It is obvious that the waste biomass material occurred in above industries should be evaluated in any application. In this context, the adsorption capacities of *Scenedesmus obliquus* and the activated carbon derived from *S.obliquus* (SOAC) were investigated in the present study. The chemical activation of raw material with  $ZnCl_2$  led to an increase in the specific surface area and total pore volume of the SOAC from  $0.0136 \text{ m}^2/\text{g}$  to  $423.7001 \text{ m}^2/\text{g}$  and from  $0.0012 \text{ cm}^3/\text{g}$  to  $0.1643 \text{ cm}^3/\text{g}$ , respectively. As a result of this, the percentage dye removal increased from 35.3% for raw material to 92.9% for SOAC. The kinetic experiments showed that the adsorption of Astrazon Red onto SOAC can be described with pseudo second-order model and the equilibrium isotherm data were best represented by the Langmuir model. The maximum adsorption capacity of SOAC was found to be  $181.82 \text{ mg/g}$  at  $25 \text{ }^\circ\text{C}$ .

## MODELING AND VALIDATION OF THE COHESION REDUCTION OF FINE PHARMACEUTICAL POWDERS VIA SURFACE MODIFICATION

Rajesh Davé  
a. Corresponding author (dave@njit.edu)

Flow and handling of fine powders is a topic of great interest to industry. High cohesion relative to their weight of fine powders leads to problems such as, agglomeration, poor flowability, electrostatic charging and low bulk density. In pharmaceutical industry, these lead to downstream problems such as poor content uniformity and marginal improvement in dissolution rate of fine API powders. To encounter these problems, nano-particle dry coating is shown to be a more rigorous approach. Surface modified pharmaceutical powders are produced using several devices, both based on batch and scalable continuous operation. Results illustrate the improvement in flow, fluidization, dispersion, lack of agglomeration, bulk density, and electrostatic tendency, all leading to potentially significant cost benefits in industrial processing, handling, storage and transportation. In order to understand the cause of cohesion reduction, contact modeling based on our multi-asperity advanced models where the influence of material properties, surface area coverage and spatial and size distribution of guest particles is presented. Models are qualitatively validated by bulk and particle scale experimental results, including detailed surface energy measurements that explain cohesion of pharmaceutical powders based on two major tuning parameters, surface roughness and surface energy.

## **EXPERIMENTAL INVESTIGATION OF THE EFFECT OF THERMAL CONDUCTIVITY OF DENSITY IN EPS**

MURAT KADIR YEŞİLYURT

a. Corresponding author (kadir.yesilyurt@bozok.edu.tr)

The need for energy is increasing every day, the need for this requirement would be decreased by the use of insulation materials in the world. EPS, which is synthetic thermal insulation material, has micro and macro structure of the porosity, which emerge during the production stage, to reduce heat transfer thus increasing the resistance of the thermal conductivity of building elements, depending on the point of application. Insulation material of EPS thermal conductivity values are determined according to the density change that can be used in practice is to find the appropriate density value. Thermal conductivity is a physical property of material which depends on temperature, material composition, moisture content, geometry and porosity. In this study investigated the temperature dependence of thermal conductivity of insulating materials of EPS. Different density values of samples (14 kg/m<sup>3</sup> – 32 kg/m<sup>3</sup>) are determined Lasercomp Fox 314 for the thermal conductivity changing with temperature. Carbon reinforced EPS samples were also experimentally measured and compared with the white EPS. As a result, carbon reinforced EPS insulating material has a lower thermal conductivity values of other EPS.

## **POLYMER-SILICA COMPOSITE AS A CARRIER FOR CONTROLLED DRUG DELIVERY SYSTEMS**

Agnieszka Kierys

a. Corresponding author (agnieszka.kierys@umcs.pl)

Although the concept of controlled pharmaceutical ingredient release from the carrier is not a new subject, however, it still arouses a great interest because of the undoubted advantages of the systems e.g. the dosing frequency reduction, maintaining drug levels in desired range for long time etc. Therefore, it is understandable, that the growing interest in the developing of innovative biomaterials for different applications, in particular, biomedical and pharmaceutical is observed. Here, we investigate the polymer-silica composite synthesized by utilizing the ability of porous polymers to swell. This feature of polymers opens up new avenues in the polymer/inorganic composite synthesis which can serve as a carrier in drug controlled delivery systems. A new type of composite was synthesized by the method which consists in swelling of porous polymer in the properly selected mixture of the model drug and a silica source. In consequence, the introduced drug diffusion is significantly limited and can be controlled due to its encapsulation and separation from the external environments by silica gel-barrier. The proposed method of polymer-drug-silica composite preparation constitutes one of the promising approaches to the preparation of drug delivery systems with sustained release. We demonstrate naproxen release profiles and report on the composite characteristics.

## **SYNTHESIS AND CHARACTERIZATION OF RARE EARTH DOPED YTTRIUM ALUMINUM GARNET (YAG) NANOPHOSPHORS AND CERAMICS**

R. Ergün<sup>1</sup>, C. Yılmaz<sup>1</sup>, U. Ünal<sup>2,a</sup>

<sup>1</sup>Graduate School of Materials Sci. and Eng., Koç Univ., Rumelifeneri yolu, Istanbul, Turkey

<sup>2</sup>Graduate School of Materials Sci. and Eng., Chemistry Dept., Koç University Surface Science and Technology Center (KUYTAM) Koç Univ., Rumelifeneri yolu, Istanbul, Turkey

a. Corresponding author (ugunal@ku.edu.tr)

In recent years it was discovered that it is possible to produce polycrystalline laser ceramic medium by solid-state reaction technique. This polycrystalline ceramic laser demonstrated a high-efficiency laser that was comparable to a single crystal laser [1]. The aim of the study is synthesis and characterization of rare earth doped polycrystalline ceramic YAG materials that can be used as a laser source.

As method, different precursors of Ce<sup>3+</sup> and Eu<sup>3+</sup> doped YAG were synthesized via co-precipitation, and Citrate methods. Y(NO<sub>3</sub>)<sub>3</sub>.6H<sub>2</sub>O, Al(NO<sub>3</sub>)<sub>3</sub>.6H<sub>2</sub>O were used as starting agents for YAG precursor while X(NO<sub>3</sub>)<sub>3</sub>.6H<sub>2</sub>O compounds of rare earths for dopant element. Precursor was calcined at various elevated temperatures in order to remove volatile fraction. During the heat treatment phase transition was observed. Slip casted or pressed powders were also vacuum sintered in order to investigate the formation of transparent ceramics. Samples were analyzed for their structural, morphological and optical properties.

## **PRODUCTION AND MECHANICAL CHARACTERIZATION OF POROUS Ti-6Al-4V ALLOYS**

E. Erkan AŞIK<sup>a</sup>, G. Ipek NAKAŞ, Şakir BOR

a. Corresponding author (eeasik@metu.edu.tr)

Titanium alloys are widely used in biomedical applications due to their mechanical properties, corrosion resistance, and biocompatibility. Biocompatibility of the alloys can be increased by producing them in the porous form which enables body fluid transportation and improves mechanical contact between the bone and the implant. In addition, mechanical properties of the foams can easily be adjusted so that it can imitate the mechanical behavior of the contacting bone and hence reduces stress shielding effect. In this study, porous Ti-6Al-4V alloys with a porosity content in the range of 51 to 65 vol% are produced by space holder technique. Spherical magnesium powders within a size range of 250-600 µm are used as spacers in order to obtain homogenously distributed spherical macropores. Produced foams are characterized by x-ray diffraction and scanning electron microscopy analysis. The microstructure of the foams were composed of lamellar structure of α and β phases. Produced foams are tested under quasi-static compressive loading exhibited elastic moduli in the range of 5 to 12 GPa and yield strength in the range of 70 to 165 MPa.

## **STRUCTURAL REARRANGEMENT OF POROUS POLYMERS BY WETTING IN DRUG ORGANIC MIXTURE**

Agnieszka Kierys<sup>a</sup>, Jacek Goworek, Radosław Zaleski  
a. Corresponding author (agnieszka.kierys@umcs.pl)

The purpose of this study was to examine the influence of the solvent on the structural characteristic of porous polymer. A several methods were employed to test the permanent changes of the pore system and the organization of polymer matrix. The polymers are essentially hydrophobic materials capable of taking up a significant amount of organic substances. Thus, they may be considered as a specific sorbents of organics from polar phases and as host materials in controlled drug release systems. A very important characteristic feature of polymers is swelling in a gas and liquid media. Usually swelling is a very long process. Much faster is absorption in porous polymers when solvent molecules taking part in pore filling penetrates also the thin walls of pores. As a result, the length and volume of pores increases. Swelling in many systems causes the change of pore structure as well as the arrangement of polymer matrix. Thus, it may be assumed as irreversible process. In the present paper we investigate the modification of the porous polymers after treatment with the organic solvents. The polymer structure before and after swelling was characterized by low temperature adsorption/desorption of N<sub>2</sub>, TEM, SEM and positron annihilation lifetime spectroscopy (PALS).

## **AMMONIUM RECOVERY BY MEANS OF A NATURAL ZEOLITE IN FLUIDIZED BEDS**

Ayşe Çeçen Erbil<sup>a</sup>, Elif Soyer, Marzieh Khedmati, Selda Yiğit Hünce  
a. Corresponding author (erbila@itu.edu.tr)

This study focuses on the optimal use of fluidized beds for removing ammonium ion by ion exchange with a natural zeolite. The main objective of this study is to analyze the effects of major operating parameters such as flow rate and particle size on the ammonium removal performance. This performance is best expressed in terms of breakthrough capacity/total column capacity. Capacities refer to be amount of the ammonium ion captured on the clinoptilolite until the breakthrough occurs or until all clinoptilolite in the column is exhausted, respectively. The ratio of the breakthrough capacity to the total column capacity depends on the operating parameters in the ion exchange column, whereas the total column capacity is a property of the zeolite and its conditioning. Major operating parameters in fluidized beds are the flow rate and bed height. Even though the flow rates in the fluidized beds studied are very high and subsequently the contact times are very short, fluidized beds show similar performances to those attained in fixed beds. Results indicate that the maximum ammonium removal expressed in terms of breakthrough capacity/total column capacity can reach a value of 0.70 which is comparable to a fixed bed performance.

## STUDY ON STRUCTURAL AND MAGNETIC PROPERTIES OF FeNi<sub>3</sub> NANOPARTICLES

A. Jafari<sup>1</sup>, S. Farjami Shayesteh.<sup>1,a</sup>, M. Saluti<sup>2</sup>, K. Boustani<sup>1</sup>

1. Nanostructure Lab, Univ. of Guilan, Namju St, Rasht, Iran
  2. Biology Research Center, Zanjan Branch, Islamic Azad Univ., Zanjan, Iran
- a. Corresponding author (saber@guilan.ac.ir)

In recent years, considerable efforts has been devoted to the design and controlled fabrication of nanostructured materials with functional properties. The interest in nanoscale materials stems from the fact that their properties (structural, magnetic, chemical and etc.) are a function of their size, composition, and structural order. In this work first, we synthesized FeNi<sub>3</sub> nanoparticles via co-precipitation method. In summary: a suitable amount of NiCl<sub>2</sub>.6H<sub>2</sub>O, FeCl<sub>2</sub>.4H<sub>2</sub>O were dissolved in distilled water. The solution of N<sub>2</sub>H<sub>4</sub>.H<sub>2</sub>O and NaOH was introduced to the water bath under vigorous stirring. 3 h later, FeNi<sub>3</sub> nanoparticles were obtained, magnetically separated and washed three times with distilled water and ethanol to remove possible remnants of the reaction. Then the obtained products were oven-dried. Then the prepared nanoparticles were annealed at 250, 350, 450, 550 °C. The X-ray diffraction (XRD) and vibrating sample magnetometer (VSM) was used to characterize structural and magnetic changes of FeNi<sub>3</sub> nanoparticles during the heat treatment at different temperatures, respectively. The results of XRD patterns show that with increasing annealing temperature, the size sample increases. VSM analysis shows that the saturation magnetizations of annealed nanoparticles with increasing annealing temperature were changed due to enlargement of nanoparticles size.

## PHYSICAL, GEOLOGICAL AND ENGINEERING PROPERTIES OF GYTTJA IN THE AFŞIN-ELBISTAN BASIN, TURKEY

Abdulkadir Ürünveren, Suphi Ural  
a. Corresponding author (aurunveren@cu.edu.tr)

In this study, physical, geological and engineering properties were examined. The Afşin-Elbistan lignite deposit is located North of Elbistan, Kahramanmaraş Province, in southeast Turkey. The Afşin-Elbistan basin encompasses an area of 900 km<sup>2</sup>, and its center lies about 1150 m above sea level. It is an intramontaneous subsidence basin, which was formed during the epirogenetic rise of the Taurus at the end of the Alpidic orogenesis. Controlled by the subsidence of the basin, a lake was formed during the Pliocene period in large parts of which deposition of almost calcareous clay (Limno-Peliticum) and calcareous Gyttja (Limno-Calcareum) took place throughout the Pliocene and the Quaternary. The lignite series consists of several seams, intercalated with humic and coaly limnic sediments such as clay and Gyttja. The term Gyttja refers to a formation that is a sapropelic, black or brown mud with organic matter and many gastropod shells. It is frequently encountered with significant calcareous silt, imparting a white color, and is highly inhomogeneous. The Gyttja can be regarded as impermeable to slightly permeable. Permeability of Gyttja is average  $2.18 \times 10^{-9}$  m/s and porosity is 64.1%. Electrical conductivity of Gyttja is 503 µS/cm.

## **FABRICATION OF NANOSTRUCTURED HYDROXYAPATITE BY CHEMICAL PRECIPITATION**

Gencer AĞTAŞ<sup>1</sup>, Fatih Erdem BAŞTAN<sup>1</sup>, Yıldız YARALI ÖZBEK<sup>1,a</sup>, Fatih ÜSTEL<sup>1</sup>

1. Sakarya Univ., Eng. Faculty, Dept. of Metallurgy and Materials Eng., 54187, Esentepe-Sakarya-Turkey  
a. Corresponding author (yyarali@sakarya.edu.tr)

Hydroxyapatite is used at surgery to increase growth of bone cells and obtain rapid improvement. Nanostructured hydroxyapatite powders were fabricated with chemical precipitation method. Calcium nitrate, orthophosphoric acid were used. Nanostructured powders have large surface area. Nanostructured hydroxyapatite powders were characterized by XRD (X-Ray Diffraction), SEM (Scanning Electron Microscope)

## **A COMPARATIVE STUDY ON PHASE TRANSITION IN Ti-Si-Al SYSTEM DURING MASHS REACTION**

Kian Kasraee

a. Corresponding author (kiankasraee@yahoo.com)

In this paper we investigated the influence of Aluminum substitution with some silicon atoms in the titanium silicide ( $Ti_5Si_3$ ). The effect of initial sample stoichiometry investigated on the product composition. We applied the  $X=0, 0.2, 0.4$  in the relative formula of the most stable titanium silicide  $Ti_5(Si_{1-X}Al_X)_3$ . then the samples mixed in the high energy planetary ball mill at varying of time in the aim of reach nano structure compound. Then sample compacted to pellets and sent to tubular furnace for synthesis in MASHS reaction. When the  $X=0$  the XRD Analyze shows only  $Ti_5Si_3$ , enhance the  $X$  to 0.2 the XRD pattern shows the same  $Ti_5Si_3$  peaks but the new peaks shift to lower angles. Further  $X$  increases to 0.4 peak from  $AlTi_3$  also appear in XRD pattern. the SEM micrograph from this sample shows two phases in microstructure Beside the major phase  $Ti_5Si_3$  the minor  $AlTi_3$  phase is also detects in final products. we use Williamson-hall formula for calcute the crystallite size of compounds and determine the mean crystallite size below the 100nm.

## **FABRICATION OF POROUS OF APATITE–WOLLASTONITE GLASS CERAMIC USING PRESSURELES SINTERING**

Zafer TATLI<sup>1</sup> and Fatih ÇALIŞKAN<sup>1</sup>

1. Metallurgical and Material Eng., Faculty of Technology, Sakarya Univ., Sakarya, TURKEY  
a. Corresponding author (ztatli@sakarya.edu.tr)

This research project is concerned with applying the manufacturing process of pressureles sintering to a new bioactive glass-ceramic apatite-wollastonite (A-W) which has excellent bioactivity and mechanical properties. The aim of this work was to produce porous bioactive glass-ceramic A-W components via pressureles sintering (PS) and to assess their suitability for use in bone replacement applications. Apatite-Wollastonite glass based on the system  $MgO \cdot SiO_2 \cdot P_2O_5 \cdot CaO \cdot CaF_2$  was produced. Sintered samples phase analysis by XRD, and micro-structure characterization by FTIR, SEM EDS elemental analysis, compression test, the mechanical properties of hardness and fracture toughness tests were characterized. Biocompatibility of the sintered samples will be tested in a simulated body fluid (SBF).

## **HIGH PRESSURE MICROFLUIDIZATION-ASSISTEDEXFOLIATIONOF NA-MONTMORILLONITE NANOCCLAYSIN EPOXY AND THETHERMAL PROPERTIES OF THE RESULTING COMPOSITES**

Ayşegül TUNA<sup>1,a</sup>, Yiğitalp OKUMUŞ<sup>1</sup>, Pınar KAYAIŞCI<sup>1</sup>, Abdullah Tuğrul SEYHAN<sup>1</sup>, Servet TURAN<sup>1</sup>

1. Dept. of Materials Sci. and Eng., Anadolu Univ., Eskisehir 26555, Turkey  
a. Corresponding author (aysegultunamlzmuh@gmail.com)

In this study, exfoliation of Na-Montmorillonite (Na-MMT) nanoclays in epoxy (0.05, 0.1 and 0.3 wt. %) was accomplished using a high pressure microprocessor and the thermal properties of the resulting composites were intensively investigated. Prior to subjected to high pressure microfluidization, as-received nanoclays were first treated with different type of solvent systems to help ease their separation into very thin individual layers as homogenously as possible. Scanning Electron (SEM) and Transmission Electron Microscopies (TEM) were then systematically conducted to examine and evaluate the degree of exfoliation obtained in the samples of interest. Various analytical tools, including Thermo-gravimetric Analyzer (TGA), Dynamic Scanning Calorimeter (DSC), Thermo-mechanical Analyzer (TMA) and Dynamic Mechanical Analyzer (DMA) were used to investigate the thermal and thermo-mechanical behavior of the resulting composites. All the findings obtained were discussed in a concise manner with an emphasis on benefits of using a high pressure microprocessor as a promising tool for processing of thermosetting resins with nanoparticles.

## DNA ADSORPTION ONTO SILICA AEROGEL

Senem Yetgin<sup>1</sup>, Devrim Balköse<sup>1</sup>

1. Dept. of Chemical Eng. Izmir Inst. of Technology, Izmir, Turkey

a. Corresponding author (senemyetgin@iyte.edu.tr)

Before solid phase extraction method (SPE) was discovered, DNA was purified by time consuming methods using toxic hazardous materials. SPE is directly or indirectly based on the DNA adsorption onto solid surfaces. DNA adsorption on sol gel derived silica was used in microchips under chaotropic conditions.

Silica aerogel was prepared by super critical ethanol drying of silica alcogel obtained by sol gel process from tetraethoxysilane in the present study. Supercritical drying process was carried out at 7.2 MPa and 250°C. The aerogel obtained had 1107 m<sup>2</sup>/g surface area and 4.2 nm pore diameter as determined by nitrogen gas adsorption at 77 K. The adsorption isotherms of calf thymus DNA from aqueous solutions were determined by measuring the DNA concentrations in solution in equilibrium with commercial silica gel from Sigma Aldrich and silica aerogel synthesized in the present study using NanoDrop UV-VIS spectrophotometer.

## MOLECULAR STRUCTURE OF PIPERAZINE-2,3,5,6-TETRAONE

Metin Bilge<sup>a</sup>, Yenal Gökpek, Mahir Tursun, Nesrin Emir, Cemal Parlak

a. Corresponding author (metin.bilge@ege.edu.tr)

Theoretical conformational analysis of piperazine-2,3,5,6-tetraone (pp2356to) has been performed in terms of the Becke-3-Lee-Yang-Parr (B3LYP) density functional theory (DFT) methods with 6-31++G(d) basis set. Calculations are employed in gas and solution phases. Solvent effects are investigated using benzene and methanol. Angular distribution of the probability density of populations of its conformers was determined by analysis of the potential energy surface (PES). pp2356to (C<sub>4</sub>H<sub>2</sub>N<sub>2</sub>O<sub>4</sub>) molecule is planar and located around an inversion center and, the four O atoms are in the 2,3,5,6-positions of the piperazine ring.

## **EVALUATION OF PHOSPHOGYPSUM POWDER AS AN ADDITIVE IN THE PRODUCTION OF PLASTER**

Tugba Iřitan<sup>1</sup>, Sinem Cevik Uzgur<sup>2</sup>, Bařak Mesci<sup>3</sup> and Elif Odabař<sup>4</sup>

1,2,3,4 Materials Science and Engineering, Ondokuz Mayıs University, Samsun/ TURKEY  
a. Corresponding author (tugba.isitan@omu.edu.tr)

In the light of the development in technology, materials used in construction industry and applications techniques are increasingly taking relevant shape. Today, the main expected economic developments in the industry, depending on the fitness for purpose, is to be more economical and more aesthetic. In order to meet these type expectations, more technical development and more diversity obtained in building materials industry. Concrete and cement mortar which is the main materials of construction industry doped with various additive materials gain the relevant properties. But, nowadays traditional plaster mortar production do not meet the desired specifications. For instance, after a rough application is made on the structure, the plaster mortar applications are to be difficult to hold on to the surface. Nowadays, construction materials technology have alternative solutions for this problem. Due to various additives to plaster mortars, the surface is making suitable for plaster applications. these additives can be some industrial wastes. In this study, usage of powder phosphogypsum which is obtained in production of phosphoric acid as by product or as a waste, is investigated as an additive for plaster mortar.

## **ADSORPTION KINETICS OF STEAM METHANE REFORMER (SMR) OFF GAS ON MIL-53(AL)**

Alev Güneř Yerkesikli<sup>1,a</sup> and Fehime akıcıođlu Özkan<sup>1</sup>

1. Izmir Institute of Technology, Chemical Engineering, Izmir, TURKEY  
a. Corresponding author (fehimeozkan@iyte.edu.tr)

Adsorption kinetics of steam methane reformer off-gas, H<sub>2</sub>, CO<sub>2</sub>, CH<sub>4</sub>, CO In MIL 53 (Al) adsorbent was studied by using the Zero Length Column (ZLC) method. analysis of the response curves obtained at 100 ml/ min helium flow rate for the temperature range of 301 K-373 K was used to obtain diffusion coefficient and Henry's constant. The results show that the calculated diffusivity values are strongly dependent on temperature. The study reveals that transport of gases is controlled by intra and inters particle resistances.

## **PRODUCTION CHEMICALLY ACTIVATED CARBON FROM INDUSTRIAL WASTE MATERIAL AND ITS ADSORPTION BEHAVIOR IN THE DYE REMOVAL**

E. Önal<sup>1,a</sup>, N. Özbay<sup>1</sup>, R. Z. Yarbay Şahin<sup>1</sup>, and A. Ş. Yargıç<sup>1</sup>

1 Chemical and Process Engineering Dept., Bilecik Seyh Edebali University, TURKEY.

a. Corresponding author: (eylem.onal@bilecik.edu.tr)

In the present work producing activated carbon by chemical activation from peach stone used as a biomass and characterization of product was studied. Within this purpose,  $K_2CO_3$  was used as chemical activation agent and impregnation ratio (50%) by mass was applied on biomass. Impregnation biomass samples were carbonized in a tubular furnace at 823 K and heating rate of  $15\text{ Kmin}^{-1}$  under sweeping gas ( $N_2$ ). Ultimate analysis, FT-IR, SEM, EDX, XRF and zeta potential analysis were applied to peach stone and activated carbon for characterization. The activated carbon obtained through carbonization of peach stone were used as an adsorbent for the removal of Direct Pink 3B.

## **APPLICATIONS OF IMAGE PROCESSING FOR THE ANALYSIS AND CHARACTERIZATION OF POROUS MEDIA**

Harun Koku<sup>1,a</sup>

<sup>1</sup>Middle East Technical Univ., Dept. of Chemical Eng., Ankara, Turkey

a. Corresponding author (harunk@metu.edu.tr)

High resolution microscopy techniques, in tandem with readily available image processing tools offer a unique and insightful look into the microstructure of porous materials. However, one has to be aware of the limitations and drawbacks of such an approach due to limited sampling size, and the possibility of artifact formation during sample preparation, imaging and image processing. Some of these factors are presented and discussed, for a case study of the analysis of porous polymeric materials, with emphasis on their topographic properties such as pore size distribution.

## **POROUS a-C:H and a-SiC:H COATINGS BY MODIFIED PECVD FOR MEDICAL APPLICATION**

J. Heeg<sup>a</sup>, A. Schütz, A. Lampka, B. Freymann, H. Brauns and M. Wienecke

Hochschule Wismar, Inst. of Surface and Thin Film Technology, PF 1210, 23952 Wismar, Germany  
a. Corresponding author (jan.heeg@hs-wismar.de)

Hydrogenated amorphous silicon carbide (a-SiC:H) and carbon (a-C:H) are promising because of its chemical inertness and biocompatibility. Still little is referred about these deposits with a controlled porosity. In this work porous coatings were prepared on Ti- and 316L noble steel substrates by modified PECVD technique. The plasma was excited using parallel-plate capacitive coupled RF system. For growing, Ar, C<sub>2</sub>H<sub>2</sub> and CH<sub>4</sub> have been used as working and precursor gas respectively. For a-SiC:H deposition additionally HMDSO was evaporated during the growing steps. During dry etch steps mixed Ar/O<sub>2</sub> plasma was used. The number of alternating steps, growing and etching, respectively, and the substrate bias tension were varied to study the impact to the resulting pore distribution. Morphology was investigated by SEM and TEM and confocal laser microscope. Hardness and Young modulus have been obtained by nano indentation tests. The adhesion was evaluated by bending tests and nano scratch tests. This investigation revealed that a-C:H and a-SiC:H coatings with homogeneously spread porosity can be achieved strongly controlled by the dry etch bias tension. The average pore diameter was between 3 and 20 μm. The films exhibited excellent adhesion and wear resistance and the obtained hardness was between 5 and 10 GPa.

## **MAGNESIA BASED CASTABLE REFRACTORY PRODUCTION AND UTILIZATION AREAS**

Hande Marulcuoğlu<sup>1</sup>, C. Betül Emrullahoğlu Abi

<sup>1</sup>Ondokuz Mayıs Univ., Eng. Faculty, Materials Science And Eng. Dept.  
2Afyon Kocatepe Univ., Eng. Faculty, Materials Science And Eng. Dept.  
a. Corresponding author (handemarulcuoglu@gmail.com)

The percentage of unshaped refractory usage in iron-steel, cement, metal industries and refuse incineration plants have increased in recent years. For castable refractories, the aim is to obtain maximum packing with low porosity via using optimum particle size distribution by means of thixotropic colloidal systems found in the structure. Of late years, investigations about the development and utilization of mgo based self flowing alkaline castables have been carried out. The real reason why MgO is preferred is the high melting point and widespread occurrence of this oxide within the refractory oxides. Nowadays, the area of usage of self flowing castables include metallurgical crucibles knitted products, process, and transport crucibles, melting plants, high-temperature plants of cement / lime industry.

## REMOVAL OF THE AMPICILLIN ANTIBIOTIC IN AQUEOUS SOLUTION BY PHOTO-FENTON/ULTRASONIC-FENTON PROCESSES

Gamze KOYUNCU<sup>1,a</sup>, Halil KUMBUR<sup>1</sup>, Habibe Elif GÜLŞEN<sup>1</sup>

1. Mersin Univ., Dept. Of Environmental Engineering, Mersin, Turkey  
a. Corresponding author (gamzekoyuncu.33@gmail.com)

For many years, antibiotics, are an important group of pharmaceuticals, have been used to prevent human and animal diseases. However, as a result of this intensive usage, they are flowed into the soil, sediments, ground water, surface water and drinking water by urine, feces, both metabolized and non-metabolized forms as fertilizer. As they have complex organic compounds on their structures which are hard biodegradable, can create a pollution without decomposition for months. High concentrations of antibiotics cause a deterioration of the ecological balance due to their toxic effects onto the microorganisms. Also, low concentrations of antibiotics cause to win an antibiotic resistance in pathogenic and non-pathogenic bacteria and genotoxicity. Therefore, it is significant that antibiotic pollution control. In recent years, the new chemical and biological processes have been searched by researchers about antibiotic degradation. One of these methods is advanced oxidation processes. In this study; the reduction of ampicillin in aqueous solution was investigated by photo-fenton (UV/Fe<sup>2+</sup>/H<sub>2</sub>O<sub>2</sub>)/ultrasonic-fenton (US/Fe<sup>2+</sup>/H<sub>2</sub>O<sub>2</sub>) processes, a drug belonging to the class of  $\beta$ -lactam antibiotics. It was determined physical-chemical conditions (pH, Fe<sup>2+</sup>, antibiotic-H<sub>2</sub>O<sub>2</sub> concentrations and reaction time) for the effects of reduction and treatment on ampicillin.

## MONOSIZED-POROUS, POLYCATIONIC BEADS: SYNTHESIS AND CHARACTERIZATION

Gunes Kibar<sup>1</sup>, Ali Tuncel<sup>2</sup>

1 .H.U. Bioengineering Division, TR-06532 Ankara, Turkey  
2. H.U. Nanotechnology and Nanomedicine Division TR-06532 Ankara, Turkey  
a. Corresponding author (kibar@hacettepe.edu.tr)

Monosized porous poly(1-(3-sulfopropyl)-2-vinylpyridinium hydroxide) (SPVPH) based beads in the size range of 4-7  $\mu$ m were obtained by the copolymerization of corresponding monomer with different diacrylate based crosslinking agents using a newly developed staged template polymerization protocol. For this purpose, different crosslinking agents glycerol dimethacrylate (GDMA), ethylene glycol dimethacrylate (EGDMA) were used. The feed monomer composition, the seed latex/monomer ratio and the diluent concentration was changed to have final beads with different size and porous properties. The porous characteristics (the median pore size, pore size distribution and porosity) were determined by mercury intrusion porosimeter. The specific surface area was determined with surface area and pore size analyser using BET method. The size characteristics and surface/internal morphology of the beads were investigated by scanning electron microscopy. The bead synthesized seem promising materials as potential stationary phase for HILIC applications.

## **NEW, MONOSIZED-POROUS POLYIONIC BEADS: SYNTHESIS AND CHARACTERIZATION**

Gunes Kibar<sup>1</sup>, Ali Tuncel<sup>2</sup>

1 .H.U. Bioengineering Division,TR-06532 Ankara, Turkey

2. H.U. Nanotechnology and Nanomedicine DivisionTR-06532 Ankara, Turkey

a. Corresponding author (kibar@hacettepe.edu.tr)

Generating a novel functional anionic packing material for chromatographic application, it was synthesized monodisperse-porous hydrophilic poly (mono-2-(methacryloyloxy)ethyl succinate)(MMES) based beads by using a new staged template polymerization protocol. The type of crosslinking agent was changed in the synthesis runs and different acrylate based crosslinking agents such as glycerol dimethacrylate (GDMA), ethylene glycol dimethacrylate (EGDMA), poly(ethylene glycol) dimethacrylate (PEGDMA),1,4-Butanediol dimethacrylate(BDDMA) were included. The proposed staged template polymerization involves to used monosizedpolyglycidyl methacrylate beads ca 2  $\mu\text{m}$  in size as the starting material in the synthesis of final monosized-porous beads. The feed monomer composition, the seed latex/monomer ratio and the diluent concentration was changed to have final beads with different size and porous properties. The porous characteristics (the median pore size, pore size distribution and porosity) were determined by mercury intrusion porosimeter. The specific surface area was determined with surface area and pore size analysis using BET method. The size characteristics and surface/internal morphology of the beads were investigated by scanning electron microscopy.

## **HIGH PRESSURE MICROFLUIDIZATION-ASSISTED PROCESSING OF POLYACRYLAMIDE MODIFIED ZINC OXIDE COMPOSITES**

Yiğitalp Okumuş, Ayşegül Tuna, Duygu YILMAZ, Abdullah Tuğrul SEYHAN

a. Corresponding author (okumusyigitalp@gmail.com)

ZnO-PAM composites have recently attracted great scientific attention due to the fact that functionalized polyacrylamide groups assists in controlling morphology of ZnO. Porous zinc oxide (ZnO) is also a very good candidate for sensor applications. In this study, ZnO-PAM composites have been prepared by using microfluidics, which has known as a excellent performance technique. As starting materials zinc oxide powder was dispersed homogenously in PAM – water solution (% 50 w/w) with different amounts by microfluidics technique (MF). PAM – zinc oxide composites have been obtained after heat treatment. Pyrolysis process have been applied to remove pore former PAM from the structure that results in porous ZnO. In this study, ZnO-PAM composites and following to this, porous ZnO have been studied to investigate effect of PAM on ZnO-PAM composites and PAM as pore formers in ZnO

## INFLUENCE OF FOAMING AGENT ON STRUCTURE AND MECHANICAL PROPERTIES OF PE PIPES

Isminur Gokgoz Erkoc<sup>1</sup>, Zafer Gemici<sup>1</sup> Mehmet Palabiyik<sup>2</sup>, Hamit Kenan<sup>2</sup>

1. Mir ARGE A.Ş, YTU Teknopark, A1 Blok Esenler/Istanbul
2. Istanbul Teknik Universitesi, Makine Fakultesi, Gümüssuyu/Istanbul
  - a. Corresponding author (isminurgokgoz@mirholding.com.tr)

Today, the plastic pipe industry competitive conditions forced companies to make innovation in product and production methods continuously. In recent years, rising raw material prices have oriented the studies for saving raw materials. For that reason some composites have used some filler materials to save raw materials. The main goal of this study is to use foamed materials instead of composite materials. As it is known, polymer foams are preferred in different fields for their low density, material savings, perfect strength/weight ratio, price eligibility, high heat and sound insulation, high fatigue life, good thermal stability and low thermal conductivity properties. In plastic pipe industry the foaming technology has been used in only Polyvinylchloride (PVC) three layer waste water pipes not Polyethylene (PE) and Polypropylene (PP) pipes yet. The major reason for this is the difficulty of foaming process of PP and PE compared to PVC. This study aimed to develop ribbed foam PE sewage pipes. Studies include process applications which will be conducted on pipe manufacturing lines and product performance tests. If the project completed successfully not only the costs will be diminished but also the new products will be represented to the pipe industry.

## MONOSIZED-POROUS BEADS FUNCTIONALIZED WITH ZWITTERIONIC MOLECULAR BRUSHES VIA SURFACE INITIATED LIVING POLYMERIZATION

Çiğdem Kip<sup>1,a</sup>, Güneş Kibar<sup>2</sup>, Bekir Çelebi, Ali Tuncel<sup>3</sup>

1. H.U. Dept. of Chemical Eng., TR-06532 Ankara, Turkey
- 2.H.U. Bioengineering Division, TR-06532 Ankara, Turkey
3. H.U. Nanotechnology and Nanomedicine Division TR-06532 Ankara, Turkey
  - a. Corresponding author (cigdemg@hacettepe.edu.tr)

Atom transfer radical polymerization ATRP is a well-known technique to add functional groups on chemical structures. Basically this technique needs an organic halide which is generated by some ATRP initiators to create activated complex organic radicals. Poly (3-chloro-2-hydroxypropyl methacrylate co Ethylene glycol dimethacrylate) Poly (HPMA-Cl-co-EGDMA) particles synthesized by a seeded polymerization protocol are useful for surface initiated ATRP studies since a chlorine moiety exists on the porous surface. By utilizing this property of the poly (HPMA-Cl-co-EGDMA) beads, zwitterionic molecular brushes on the particles were generated via surface initiated atom transfer radical polymerization protocols applied by following different surface chemistries. In these studies, three different chemical routes were followed. In the first one, surface initiated ATRP of [3-(Methacryloylamino)propyl]dimethyl(3-sulfopropyl)ammonium hydroxide (MESH) was performed by initializing the polymerization with the terminal chlorine moiety on the particles. In the second route, the terminal chlorine functionality was exchanged with the bromine via a series of surface reaction and the ATRP of MESH was initiated via bromine. In the third one, a spacer-arm was introduced to have a chlorine functionality sufficiently far from the particle surface and the ATRP of MESH was initiated from the chlorine. The zwitterionic poly(MESH) content and the average molecular weights of molecular brushes and their effects on the porous properties of the particles were investigated using appropriate methods like elemental analysis, GPC, SEM-EDX and mercury intrusion porosimeter.

## THE INFLUENCE OF MICROSTRUCTURE OF HIGH CR-ALLOYED STEEL ON HIGH TEMPERATURE OXIDATION RESISTANCE

R. Shvab<sup>a</sup>, E. Dudrova, O. Bergman, S. Bengtsson  
a. Corresponding author (rshvab@imr.saske.sk)

High temperature oxidation resistance of two high Cr-alloyed austenitic stainless steels with the same chemical compositions and different microstructures was investigated in two oxidation atmospheres, (wt.%) – 75%N<sub>2</sub>, 23%O<sub>2</sub>, 1%Ar, 1%H<sub>2</sub>O and 71%N<sub>2</sub>, 14%CO<sub>2</sub>, 12%H<sub>2</sub>O, 1-2%CO, NO<sub>x</sub>, C<sub>x</sub>H<sub>y</sub>. Microstructure of first stainless steel, prepared by conventional powder metallurgy, consists of fine distributed small carbide particles size of ~1 μm mostly on boundaries of austenitic grains size of 3-5 μm. The austenite matrix of second steel, prepared by casting, contains a network of eutectic carbide that outlines the boundaries of the original dendrites and primary carbidic phase having a lamellar structure (ledeburit). Mean austenitic grain size of this material is ~100 μm. Both oxidation experiments were done at 1050°C for 5 hours. Results did not show significant difference in oxidation behaviour of materials in above mentioned atmospheres. The difference was between the materials which is connected with their microstructures. Oxidation of sintered material is controlled by open porosity and carbides decomposition at the surface and extends locally to the depth of ~10 μm. Corrosion in cast material is developing mostly on grain boundaries, which are depleted with chromium. Oxidation processes in cast material extend to the depth of ~40 μm.

## CELLULOSE NANOWHISKER/PLA COMPOSITES: PROCESSING AND CHARACTERIZATION

Ayşe Kurt<sup>1</sup>, Hande Celebi<sup>2</sup>, A.Tugrul Seyhan<sup>3</sup>, Aydın Dogan<sup>4</sup>

<sup>1</sup>Advanced Technologies Research Unit, Program in Nanotechnology, Anadolu Univ., Turkey,

<sup>2</sup>Dept. of Chemical Eng., Anadolu Univ., Turkey,

<sup>3,4</sup>Dept. of Materials Sci. and Eng., Anadolu Univ., Turkey.

a. Corresponding author (aysekurt@anadolu.edu.tr)

Polylactic acid (PLA) is the most important biodegradable and biobased polymer and is being used many fields such as food packaging and biomedical sectors. Its range of applications is limited by its brittleness and low thermal stability and limited crystallinity along with low crystallization rate.

Recently, cellulose nanowhiskers (CNWs) have been used to reinforce biopolymer matrix like PLA due to their high aspect ratio, good mechanical properties and fully degradable and renewable property. However, incompatibility between hydrophobic PLA matrix and hydrophilic CNW limits the preparation of nanocomposites.

In this study, CNW were produced by the sulphuric acid hydrolysis of microcrystalline cellulose (MCC). The synthesized CNWs were characterized in terms of physical and chemical properties. The surface of CNWs was modified by using a coupling agent in order to improve interaction of the PLA/CNW interface. The bionanocomposites were prepared by using melt compounding method. The thermal and mechanical properties of the prepared composites were measured by TGA, DSC and tensile tests.

## MICROSTRUCTURE PROPERTIES OF BIOCOMPATIBLE BONE-LIKE HYDROXYAPATITE KAREL SOUKUP, VLADIMÍR HEJTMÁNEK AND OLGA ŠOLCOVÁ

Karel Soukup<sup>1,a</sup>, Vladimír Hejtmánek<sup>1</sup>, Olga Šolcová<sup>1</sup>

1. Inst. of Chemical Process Fundamentals of the ASCR, v. v. i., Rozvojová 135, CZ-165 02 Prague 6, Czech Republic

a. Corresponding author (soukup@icpf.cas.cz)

Biocompatible hydroxyapatite can be utilized as a bone substitute owing to its chemical as well as microstructural similarity to the real bone. In order to prepare materials having the targeted effects for medical applications, knowledge of the microstructure characteristics typical of its pore network is of the prime importance. Within this study, both texture and transport characteristics of the biocompatible bone-like hydroxyapatite were evaluated. Standard texture methods based on the physical adsorption of nitrogen, the high-pressure mercury porosimetry and the helium pycnometry were used for determination of the texture characteristics. The tested bone-like hydroxyapatite samples revealed porosity ranging from 0.64 to 0.75 with the BET surface area from 70 to 75 m<sup>2</sup>/g. The inverse liquid chromatography technique was utilized for the transport parameter determination of the biocompatible hydroxyapatite in liquids under conditions of the linear chromatography. Polystyrene samples which are able to replace real biopolymers (amino acids, proteins, etc.) owing to possibility to control molar weight in a wide range order of magnitude were preferentially used as the appropriate model solutes.

## POROUS CARBON-RICH A-SIC AS BASE MATERIAL FOR COLD EMITTERS

Nazarov A.N.<sup>1,a</sup>, Gordienko S.O.<sup>1</sup>, Lytvyn P.M.<sup>1</sup>, Stadnik A.A.<sup>1</sup>, Gomeniyuk Yu.Yu<sup>1</sup>, Vasin A.V.<sup>1</sup>, Rusavsky A.V.<sup>1</sup>, Lysenko V.S.<sup>1</sup>

1. Inst. of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine

a. Corresponding author (nazarov51@yahoo.com)

In present report we focus our attention on examination of nano-porous carbon-rich a-SiC/Si heterostructures for cold electron emitter. Silicon-carbon alloy thin films were deposited by magnetron sputtering technique on Si wafer followed by high-temperature vacuum annealing. Electrical parameters of hetero-structures were studied. Emission current was studied in vacuum of 10<sup>-7</sup> Tor. Chemical composition and local carbon structure were studied by scanning electron microscopy equipped with Auger electron scanning system and by micro-Raman measurements.

It was shown that higher emission current is observed in the samples with higher carbon concentration and in the structures fabricated on n-type Si. Current density of 10<sup>-3</sup> A/cm was observed at 17 μV/cm for the p-type Si wafer and 13 μV/cm for n-type Si wafer. The E-J characteristics show Fowler-Nordheim law with field effect factor of 940 for p-type Si wafer and 800 for n-type Si wafer. The E-J characteristics were well reproducible and emission current was stable with deviation about 15% for 60 minutes examination. Correlation of columnar-like growth morphology, nanoporosity and emission characteristics were studied and discussed.

## **INVESTIGATION OF THE FOAMING BEHAVIOUR OF B4C REINFORCED ALUMINUM FOAMS OF PRODUCTION VIA HOT PRESSING METHODS**

Halil KARAKOÇ, Ramazan ÇITAK, Hanifi ÇINICI<sup>a</sup>  
a. Corresponding author (hcinici@gazi.edu.tr)

In this study, Alumix 231, 1% titanium hydrate (TiH<sub>2</sub>) and various amount of B<sub>4</sub>C (3%, 6%, 9% and 12 % by weight) powders were mixed. Firstly, powders are compressed at 50 MPa at room temperature. Secondly, the constant temperature (450 °C) and constant pressures (200MPa) for a period of 30 minutes was then subjected to hot pressing. After compression specimens have been made foamable tablets. Samples obtained from the foamable tablets subjected to the process of foaming temperature of 710 °C so Al-based B<sub>4</sub>C reinforced metallic foams were produced. Produced metallic foams pressing pressure were studied on the foaming behavior. Effects of B<sub>4</sub>C addition on foamability behavior of metallic foams were investigated.

## **MESOPOROUS ZINC FERRITE: SYNTHESIS AND MAGNETIC PROPERTIES**

Muhammet Toprak<sup>a</sup>, Najmeh Najmoddin, Ali Beitollahi, Hamidreza Rezaie  
a. Corresponding author (toprak@kth.se)

The zinc ferrite, ZnFe<sub>2</sub>O<sub>4</sub>, one of the iron based cubic spinel series, shows striking changes in its magnetic properties by reducing the grain size to the nanometer-sized range. Bulk zinc ferrite is a completely normal spinel structure with Zn ions in the tetrahedral or A sites and Fe ions in the octahedral or B sites. Due to antiferromagnetic superexchange interactions between B-B ions, bulk zinc ferrite is antiferromagnetic at T<sub>N</sub> = 10 K. However, the magnetic structure of ZnFe<sub>2</sub>O<sub>4</sub> can be largely altered by developing a nonequilibrium state, i.e., redistribution of iron ions at A and B sites. Here, we propose a facile preparation of single phase mesoporous ZnFe<sub>2</sub>O<sub>4</sub> through a novel nanocasting route with the aid of vinyl- functionalized mesoporous silica as a hard template. The confined space of silica template brings different magnetic properties to the final product against its bulk counterpart. We will present the details of the developed route along with the magnetic characterization results of the fabricated mesoporous ZnFe<sub>2</sub>O<sub>4</sub>.

## **BIOGENIC SILICA MATERIALS WITH DIFFERENT SURFACE AREA FROM RICE HUSK ASH AS INORGANIC FILLER FOR DENTAL COMPOSITES**

Yeliz Başaran-Elalmış<sup>1,a</sup>, Sevil Yücel<sup>1</sup> and Ismail Aydın<sup>2</sup>

1. Yıldız Technical Univ., Faculty of Chemical and Metallurgical Eng., Dept. of Bioengineering, Esenler, Istanbul/TURKIYE
2. Istanbul Univ., Eng. Faculty, Chemical Eng. Dept., Avcılar, , Istanbul/TURKIYE  
a. Corresponding author (yelizbasaran@gmail.com)

Rice husk, an agricultural waste, is a by-product of rice milling process and poses an environmental hazard. Applications of rice husk are limited. Rice husk ash (RHA) is rich in silica (about 60%) and can be an economically viable raw material for production of silica gels and powders. In this study, silica was produced from sodium silicate solution, obtained from RHA, at different pH values in order to have silica samples with different surface area and particle size. Dental composites consist of organic monomers, inorganic filler, polymerization initiator system and silane coupling agent. Usually the filler particles are either barium silicate glass, quartz or zirconium silicate, often combined with very small-sized particles of colloidal silica. Silica particle size and surface area are important parameters effecting mechanical properties, polymerization shrinkage, hydrolytic behavior of dental composites. In present study silica was produced at pH 4, 7, 9. BET surface areas of produced samples were determined as 281.80, 123.43, 51.81 m<sup>2</sup>/g respectively. According to the SEM images obtained powders are micrometer sized particles in average and particle size distributions are not homogenous. XRD shows that samples were amorphous. As a result silica obtained from RHA at different pH values can be utilized in dental composites as filler.

## **THE PROCESSING OF A DENTAL CROWNS TECHNICAL CERAMICS MATERIAL USING WITH ULTRASONIC METHOD**

Zuhal ER<sup>1,a</sup>, Eyüp GAZIOĞLU<sup>2</sup>

1. Istanbul Teknik Üniversitesi, Fen-Edebiyat Fakültesi (Dnz. Fak.), Fizik Mühendisliği Bölümü, Maslak-34469 Istanbul
2. Mipasan Ltd. Şti Koruma San.Sit. Blok No:54 Üstkaynarca-Pendik/IST  
a. Corresponding author (erzuh@itu.edu.tr)

Ceramics consists of metal and (C, N, O or S) non-metallic element is fragile and not easily formatted. There are several studies that is the removal and fracture toughness of ceramic materials in order to increase its fragilities work done and they have successful results. In line with the rapidly advancing technology; high wear resistance, strength, electrical and thermal properties materials, the advanced ceramic products and engineering ceramics, so-called technical ceramics has been developed. At this point, the processing of technical ceramic materials requires advanced technology. Production of technical ceramics in general, wet and dry system, is carried out in two ways. Nowadays increasingly gaining importance of this issue, dental crowns product processed using with Ultrasonic Methods. This study is on the good properties and thermal shock resistance of the highest level of dental crowns which is made of technical ceramic product processed used by MIPASAN Ltd. Comp.'s advanced technology. In this study, ultrasonic machining of the product by material wear, surface roughness, increase the dimensional tolerance specifications emphasize the advantages provided. In addition to, this ultrasonic processing method by the dimension of the material with a certain frequency can be emphasized to contribute to the production of technical ceramics.

## EFFECTS OF ANNEALING TEMPERATURE ON LATTICE STRAIN OF $\text{Fe}_3\text{O}_4$ MAGNETIC NANOPARTICLE

A. Jafari<sup>1</sup>, S. Farjami Shayesteh.<sup>1,a</sup> M. Saluti<sup>2</sup>, K. Boustani<sup>1</sup>

1. Nanostructure Lab, Univ. of Guilan, Namju St, Rasht, Iran
2. Biology Research Center, Zanzan Branch, Islamic Azad Univ., Zanzan, Iran  
a. Corresponding author (saber@guilan.ac.ir)

A perfect crystal would extend infinitely in all directions; therefore, no crystals are perfect due to their finite size. This deviation from perfect crystallinity leads to a broadening of the diffraction Peaks [1]. The two main properties extracted from peak width analysis are the crystallite size and lattice strain. At present, annealing effect on the strain and phase transition of  $\text{Fe}_3\text{O}_4$  nanoparticle was investigated. First,  $\text{Fe}_3\text{O}_4$  nanoparticles by co-precipitation method were synthesized as following:  $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$  and  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$  (with 1:2 molar ratio) were dissolved in 25 mL of DI water. Then, the resulting solution was added into the 200ml of NaOH solution. The generated precipitation were collected and washed with distilled water, then oven-dried [2]. Then, annealing were performed at 350, 450, 550, 650 and 750°C in order to probe effect of annealing on the structure and lattice strain of  $\text{Fe}_3\text{O}_4$  nanoparticles. The X-ray diffraction (XRD) was used to characterize structural and chemical changes during the annealing temperatures. The XRD patterns revealed that by increasing of annealing temperature, the degree of crystallinity and particle size were increased. Also by increasing of annealing temperature, at 650 °C, the chemical phase of magnetic nanoparticles was converted from magnetite ( $\text{Fe}_3\text{O}_4$ ) to hematite ( $\alpha\text{-Fe}_2\text{O}_3$ ).

## INVESTIGATION OF ELECTRICAL PROPERTIES OF POLYFURAN/TiO<sub>2</sub> NANOCOMPOSITES

Ceyda CANOLUK<sup>1</sup>, Kevser IŞIK<sup>1</sup>, Songül ŞEN GÜR SOY<sup>1</sup>

1. Mehmet Akif Ersoy Univ., Faculty of Arts and Sciences, Dept. of Chemistry, 15030 Burdur, Türkiye  
a. Corresponding author (girl\_18\_izmir@hotmail.com)

In recent years, increasing of research on electrically conductive polymers and composites is the result of expansion of application fields of conductive polymers. Conductive polymers have many advantages according to metals such as low-cost, simple fabrication techniques, easy-deposition on various substrates and flexible molecular structures. However, polyfuran has very narrow application area compared to the other conductive polymers [1]. The dissolution of metal oxide nanoparticles in the polymer matrix, properties of polymer and inorganic particles become combines and interesting materials emerged [2]. In this study, nanocomposites of polyfuran were prepared by chemical oxidation method in non-aqueous media. Electrical properties of composites prepared by using different amounts of TiO<sub>2</sub> were investigated by thermal aging experiments using with variable temperature ranges and constant temperatures.

## **HARD MAGNETIC NANOPOWDERS; ENHANCEMENT OF COERCIVITY IN THE PRESENCE OF POLYMERIC MATRIXES**

Gholamreza Nabiyouni<sup>1,a</sup>, Davood Ghanbari<sup>2</sup>, Asieh Yousefnejad<sup>1</sup>, Minoo Seraj<sup>1</sup>

1. Dept. of Physics, Faculty of Science, Arak Univ., Arak 38156-88349, Iran

2. Young Researchers Club, Arak Branch, Islamic Azad Univ., Arak, Iran

a. Corresponding author (g-nabiyouni@araku.ac.ir)

Hard magnetic BaFe<sub>12</sub>O<sub>19</sub> nanoparticles were synthesized via a facile sonochemical reaction between Ba(NO<sub>3</sub>)<sub>2</sub> and Fe (NO<sub>3</sub>)<sub>3</sub>. BaFe<sub>12</sub>O<sub>19</sub> nanoparticles were then added to acrylonitrile-butadiene-Styrene (ABS), polystyrene, Poly carbonate (PC), and cellulose acetate polymer (CAP) in order to make magnetic nanocomposites. Nanoparticles and nanocomposites were then characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier transform infrared (FT-IR) spectroscopy techniques. The magnetic properties of the samples were also investigated using an alternating gradient force magnetometer (AGFM). We found that the BaFe<sub>12</sub>O<sub>19</sub> nanoparticles exhibit a ferromagnetic behaviour at room temperature, with a saturation magnetization of 53 emu/g and a coercivity of 2430 Oe. Distribution of the BaFe<sub>12</sub>O<sub>19</sub> nanoparticles into the polymeric matrixes increases the coercivity dramatically. The maximum coercivity of 4150 Oe was found for BaFe<sub>12</sub>O<sub>19</sub> distributed to the polycarbonate matrix, forming PC/BaFe<sub>12</sub>O<sub>19</sub> nanocomposite.

## **ELECTRICAL CONDUCTIVITY FOR EVALUATING SUPERSOLIDUS LIQUID PHASE SINTERING OF BRASS Cu28Zn ALLOY**

ShirinRezapasand, MaziyarAzadbeh

a. Corresponding author (shirinkl@yahoo.com)

Measuring of electrical conductivity is a non-destructive technique and may also be done easily and quickly. This research reports a study on relationship between density and electrical conductivity of sintered Cu28Zn alloy. Besides assessing the influence of the pore structure on the conductivity a relationship between conductivity and mechanical properties is pursued. A new equation for calculating the electrical conductivity is proposed. In this equation the effective resistivity of porous compacts is a function of the fully dense materials conductivity and the porosity and dimensional of compacts. The proposed equation has been experimentally validated with sintered compacts of brass Cu-28Zn powder. Results confirm very good agreement with theoretical predictions.

## **NATURAL CONVECTION IN A RECTANGULAR CAVITY FILLED WITH A HEAT GENERATING POROUS MEDIUM SATURATED WITH NANOFLUIDS**

Aydin Zehforoosh<sup>a</sup>, Siamak Hossainpour  
a. Corresponding author (a\_zehforoosh@sut.ac.ir)

Steady-state free convection heat transfer behavior of nanofluids is investigated numerically inside a rectangular cavity filled with a heat generating porous medium. The temperature of the vertical walls is constant, and the horizontal walls are adiabatic. The governing equations are obtained based on the Brinkman's extension of Darcy's law and the nanofluid model proposed by Tiwari and Das. The effects of variations of different parameters such as Darcy numbers, Rayleigh number, solid volume fraction, heat generating rate and thermal conductivity are investigated and the flow and temperature fields are presented and discussed. It is found that at low Rayleigh number, increasing the value of the solid volume fraction parameter of nanofluids can improve the value of the average Nusselt number. At high Rayleigh numbers, elevating the solid volume fraction parameter of nanofluids reduces the value of the average Nusselt number. On the other hand It has been observed that increase in porosity of the medium is found to have significant effect on peak temperature and peak velocities, Because there is an overall reduction in damping resistance offered by porous matrix which leads to higher velocity and this in turn results steeper temperature gradient and large Nusselt number at higher porosity.

## **FABRICATION OF BULK DIFFERENT KINDS OF ALUMINA FILTERS BY DIFFERENT FOAMING METHODS**

Burcu Nilgün Çetiner<sup>a</sup>, Özgür Çınar  
a. Corresponding author (nilgun.cetiner@marmara.edu.tr)

Porous ceramics are attractive materials because of their successful use in a wide range of applications such as filters utilized for the filtration of the entrained solids in molten metals, especially molten aluminum, electronic sensors, catalysts, construction materials. In the most of these applications, some features including microstructure, porosity, permeability, mechanical properties need to be in between specific intervals. In our research we tried several ways of foam production; foaming agents such as H<sub>2</sub>O<sub>2</sub>, porogens such as PVA (Poly vinyl alcohol) and finally polyurethane foams using like pore templates, with different kinds of alumina; commercial (Sigma Aldrich) and Seydişehir. After each procedure, samples were sintered at the same temperature (1700 oC). The XRD analysis was performed after each sintering process. The sintered alumina specimens are characterised by microstructural analysis including pycnometer and using SEM. The dilatational behaviour of the alumina ceramic filter was analysed using dilatometer.

## **FABRICATION OF HOLLOW HYDROXYAPATITE MICROSPHERES BY SPRAY DRYING**

Fatih Erdem BAŞTAN, Gencer AĞTAŞ, Yıldız YARALI ÖZBEK, Fatih ÜSTEL

Sakarya Univ., Eng. Faculty, Dept. of Metallurgy and Materials Eng., 54187, Esentepe-Sakarya-  
Turkey

a. Corresponding author (fatiherdembastan@gmail.com)

Hydroxyapatite (HAP) is the main mineral of bone and teeth. It has excellent biocompatibility, bioactivity and osteoconductivity. Different hydroxyapatite powder shapes can be produced by spray drying method. The aim of this study was fabrication of hollow hydroxyapatite particles. In this study, hydroxyapatite was produced with chemical precipitation. 5 wt. % PVA (polyvinyl alcohol) was used to obtain hollow hydroxyapatite microspheres in slurry. Different parameters were used at spray dryer because of understanding the effect of parameters. X-Ray Diffraction and Scanning Electron Microscopy were used to investigate the phase and morphology structure.

## **PRODUCTION OF POROUS HYDROXYAPATITE BEADS FOR BIOMATERIAL APPLICATIONS**

Ayşe Gül Akyürekli, Duygu Yılmaz, Mevlüt Gürbüz, Aydın Doğan

a. Corresponding author (aysegl\_88@hotmail.com)

Hydroxyapatite (HAP) is well known calcium phosphate based ceramic. In recent years, porous bone like HAP is extensively used to reconstruct the bone defects due to its excellent biocompatibility, bioactivity and osteoconductivity. Therefore, the purpose of this study was to fabricate highly porous HAP beads using organic pore forming agent. HAP nano powders were synthesized by wet chemical method. Organic pore forming agent and HAP nano powder in PVA added gel media were mixed and granulated in different bead size. Preformed beads were sintered at 1300°C to possess porous spherical beads. Microstructure of the fabricated HAP beads was characterized by scanning electron microscopy. Homogeneously distributed porous beads with highly dense interconnected pore channels were observed from the results. The fabricated porous beads can be used to reconstruct bone defects in dental and orthopedics applications.

## **TECHNICAL PROPERTIES OF SEPIOLITE FIBER-REINFORCED AAC**

Taner Kavas<sup>1,a</sup>, A. Doğan Soyal<sup>2</sup>, Recep Uysal<sup>2</sup>, Uğur Uzgan<sup>2</sup> and Abdullah Tan<sup>3</sup>

1. AKU, Faculty of Eng., Dept. of Material Sci. and EngineerIng, Afyonkarahisar, Turkiye
  2. AKG, Gazbeton Enterprises of Industry and Trade Inc., Dept. of R&D, Izmir, Turkiye
  3. AKG, Gazbeton Enterprises of Industry and Trade Inc., Dept. of R&D, KIrkkale, TurkIye
- a. Corresponding author (tkavas@aku.edu.tr)

In this study, technical properties that sepiolite mineral (SM) added to the structure of Autoclaved Aerated Concrete (AAC) were investigated by means of various characterization techniques. for this purpose, mud receipts of R<sub>0</sub>, R<sub>1</sub>, R<sub>3</sub>, R<sub>5</sub> were prepared with addition of sepiolite (In ratIo of 0, 1, 3, and 5 wt.%) to raw material mixture containing cement, lime, silica sand, gypsum, aluminum and mixing water. Sufficient amount of casting mud were produced from prepared receipts. Specimens were shaped in metal molds by slip casting techniques with addition of an aqueous solution of aluminum during mixing of mud to obtain homogeneity. The shaped samples were autoclaved at 200°C and 12 bar pressure for 4.5 hours after sufficient cutting hardness. mechanical (comprehensive strength), chemical (XRF), mineralogical (XRD) and micro-structural (sem) analyses were carried out. The experimental results provided that the sepiolite mineral addition up to 5 wt.% to a standard AAC improves mechanical properties, decreases density and increases a factor of final sepiolite fiber reinforced autoclaved aerated concrete structure.

## **OPTIMIZATION OF PROCESS PARAMETERS FOR ARSENIC REMOVAL BY IRON CONTAINING ADSORBENTS USING BOX- BEHNKEN DESIGN**

Asli Özge Avci Tuna<sup>1,a</sup>, Esra Bilgin Simsek<sup>2</sup> and Ulker Beker<sup>3</sup>

1. Yildiz Technical University, Chemical Engineering Dept., Istanbul, Turkey
  2. Yalova University, Chemical and Process Engineering Dept., Yalova, Turkey
  3. Yildiz Technical University, Chemical Engineering Dept., Istanbul, Turkey
- a. Corresponding author (asliozge85@gmail.com)

In this study, arsenate removal by activated carbon based-iron containing adsorbents was carried out. Adsorption processes have been frequently applied to statistical analysis for maximization of removal efficiency and optimization all of the operating conditions, such as solution pH, initial concentration and temperature. A three-level, three-factor Box-Behnken Experimental Design was employed to find the optimum combination of process parameters for maximizing As(V) adsorption capacity of activated carbon-based iron containing adsorbents. The iron containing hybrid adsorbents were prepared by precipitation of iron oxide salts on activated carbon. The results showed that the adsorption capacities were ranged between 0.100 and 6.121 mg g<sup>-1</sup>. The statistical significance of variables was determined using the analysis of variance (ANOVA). The validity of the constructed model was evaluated by lack of fit, coefficient of determination (R<sup>2</sup>), adjusted coefficient of determination (adjusted R<sup>2</sup>) and F-values. The high values of F indicate that the model can be explained by the regression equation.

## FABRICATION OF SUPERHYDROPHOBIC AND SELF-CLEANING PDMS-SILICA COATINGS

Merve Metin, Sennur Deniz<sup>a</sup>

Yıldız Technical Univ., Chemical-Metallurgical Faculty, Chemical Eng. Dept.,  
Davutpaşa cd. Nr: 127, 34210, Esenler-Istanbul, Turkey  
a. Corresponding author (deniz@yildiz.edu.tr)

Hydrophobia in chemistry literature means water repellent feature. This feature is seen on the nature of some plants and animals. As water drops on the hydrophobic and non-polar surface, water molecules do not bond with hydrogen molecules, they are bond with each other. When surface removes the water drop, drags the impurities. Thus provides a self-cleaning feature that is known “Lotus Effect”.

Superhydrophobic polydimethylsiloxane (PDMS)-silica nanocomposite double layer coating was fabricated by applying a thin layer of low surface energy fluoroalkyl silane (FAS-TES) as topcoat. PDMS-silica nanocomposite coating solution was prepared by mixing PDMS solution with nonporous fumed nanosilica in toluene. The final mixture of PDMS and silica was applied on to the cleaned aluminum substrates by spin coating method. The coated surfaces were allowed to cure at room temperature for 24 h. A topcoat of FAS-TES was applied on PDMS and PDMS-silica nanocomposite coatings. The double layer coatings were dried at room temperature, and then at 100°C. The hydrophobic silica films were characterized by Atomic Force Microscopy (AFM). The water contact angle (WCA) of the coatings was measured by sessile drop method using a contact angle analyzer. The coating with FAS-TES topcoat was superhydrophobic with static WCA of 146°.

## ANTI-BACTERIAL EFFECTS OF TiO<sub>2</sub>, SiO<sub>2</sub> AND NANO-Ag NANOPARTICLES ON STAPHYLOCOCCOUS AUREUS

Merve Özkaleli<sup>1</sup>, Ayça Erdem<sup>1</sup>

1. Akdeniz Üniversitesi, Mühendislik Fakültesi, Çevre Mühendisliği Bölümü, Antalya  
a. Corresponding author(ayerdem@akdeniz.edu.tr)

The use of conventional disinfection methods has ended the waterborne epidemics in the developed world more than a century ago. However, research in the past few decades have revealed a dilemma between effective disinfection and formation of harmful disinfection byproducts (DBPs). In order to overcome the DBPs issue and to apply more efficient disinfection methods, nanoparticles (NPs) have being as novel antimicrobial agents. used due to their unique chemical and physical properties.

Staphylococcus aureus, a well-known pathogenic gram positive bacteria, was selected as model organism in this study. In order to evaluate the antibacterial effects of NPs (TiO<sub>2</sub>, SiO<sub>2</sub> and nano- Ag) on S. aureus, different NP concentrations (0-100-500-1000 mg/L) and ionic strengths (0-10-50-100 mM) were tested under both light (0,2mW/cm<sup>2</sup>) and dark conditions. Serially diluted bacteria+NP aliquats were incubated onto LB-agar for 24 hours at 37°C. The number of bacteria was recorded as CFU/mL and % inhibition values were calculated.

According to the results, when NP concentrations were increased from 10 to 1000 mg/L, an increase in bacterial inhibition was observed. Particularly, antibacterial effect reached to a maximum of 90±2.5% inhibition when 1000 mg/L of Ag NP concentration was applied at 10 mM ionic strength under light condition.

## **SYNTHESIS AND CHARACTERIZATION OF SiC / Al MMCs BY POWDER METALLURGY**

Onur Fevzi KEVENLIK<sup>a</sup>, Hanifi ÇINIÇI, Recep ÇALIN  
a. Corresponding author (kevenlik@gmail.com)

In this study, SiC powder and Al2014 alloy were used as reinforcement and matrix respectively. Al-SiC reinforced metal matrix composites (MMCs) of 5%, 10%, 15%, and 20% reinforcement volume ratios produced by powder metallurgy method. MMC under same production condition. Hardness and porosity of composites were measured and microstructure of composite was investigated. It has been found that the hardness and porosity of composites were increased with increasing SiC volume fraction.

## **SYNERGISTIC EFFECTS OF HPC AND SDS ON FAST REDISPERSION AND DISSOLUTION OF FLUIDIZED BED AND SPRAY DRIED DRUG NANO-COMPOSITE POWDERS**

Rajesh Dave<sup>a</sup>, Anagha Bhakay, Ecevit Bilgili  
a. Corresponding author (dave@njit.edu)

Dissolution rate improvement of poorly water-soluble drugs, for example, Griseofulvin (GF) and azodicarbonamide (AZD), is considered by examining the influence of additives on the stabilization and recovery of the nano size upon drying. The drugs were nanomilled to produce nanosuspensions with median particle size of 160–250 nm. Stable nanosuspensions of both the drugs were produced with sodium dodecylsulfate (SDS) in combination with hydroxypropyl cellulose (HPC). HPC alone stabilized the AZD nanoparticles better while GF nanoparticles aggregated in the absence of SDS. The suspensions were dried by coating onto Pharmatose in a fluidized bed dryer or by spray-drying with/without mannitol. GF and AZD particles dried by both methods and formulated without SDS did not redisperse back into nanoparticles in water. Poor redispersibility resulted into a low dissolution rate for GF, but not for AZD due to its higher aqueous solubility. On the other hand, dissolution of dried GF and AZD was enhanced in presence of SDS in the formulation. In conclusion, formation of a stable drug nanosuspension achieved using the same formulation was a prerequisite for enhanced dissolution of the two drugs irrespective of the method of drying.

## **ATMOSPHERIC PRESSURE SYNTHESIS OF MESOPOROUS SILICA (MCM-41 AND HMS) FOR CATALYTIC APPLICATION IN BIODIESEL PRODUCTION**

Tahereh Mohammad Panah<sup>1,a</sup>, Mahmood Kazemzad<sup>1</sup>

1. Dept. of Energy, Materials and energy research center, P.O. Box 14155-477, Tehran -Iran  
a. Corresponding author (t.mohamadpanah@yahoo.com )

In this research, atmospheric pressure synthesis of mesoporous silica as well as its surface modification is reported for catalytic application of them in preparation of methyl esters of long chain fatty acids (biodiesel). Methanolysis of glycerin triacetate as a model showed that hybrid material obtained by mesoporous compound modification with basic organic molecules could be applied as an appropriate catalyst for 100% conversion of this compound in 4 hours. According to importance of transesterification reaction, catalytic performance of samples was also investigated in conversion of edible oil to methyl esters and glycerol. HMS's applied in this research were prepared using hexadecylamine as template whereas cetyltrimethyl ammonium bromide (CTAB) were used in preparation of MCM-41; Tetraethylorthosilicate (TEOS) was used as silica source in both cases. The organic components were removed through calcination in furnace. All samples were functionalized with NH<sub>2</sub> functional group before their application as catalyst. Samples were characterized by SAXS, BET-BJH, SEM, FT-IR and GC. This silica exhibited a uniform size and spherical morphology. Uniform sized highly porous silica compounds functionalized with amine groups showed very well catalytic performance in 100% conversion of edible oil as well as glycerine triacetate in the presence of methanol confirmed by GC-MS analysis.

## **GROWTH OF CARBON NANOTUBE ON THE Ni-MESOPOROUS ALUMINA CATALYSTS FOR USE AS A ADSORPTION**

Pariya shahbazi<sup>1,a</sup>, Mahmood kazemzad<sup>1</sup>, Amirali youzbashi<sup>1</sup>

1. Dept. of Energy, Materials and energy research center, P.O. Box 14155-477, Tehran -Iran  
a. Corresponding author (pariya\_shahbazi@yahoo.com )

Ordered mesoporous materials with high specific surface area and large pore volume have high potential for commercial applications in adsorption and catalysis. In this study, ordered mesoporous alumina ( $\gamma$ -alumina) with high thermal and chemical resistance was synthesized by the sol-gel method using various organic compounds, i.e. aminoacids and carboxylic acids as template. The obtained data showed that  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> produced in the presence of carboxylic acids as template results in very well catalytic activities for CNT growth. The best results obtained using Ni catalysts supported on alumina at a temperature of 900°C. Since the method and amount of the catalyst deposited on a porous support affects its efficiency in CVD growth of CNT, the above parameters have been also optimized in this work. Alumina supported CNT's were applied as adsorbent for removal of some organic compounds from aqueous samples. The microstructure, morphology, and chemical composition of the adsorbents were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). Efficiency of synthesized samples for adsorption organic compounds was investigated by high performance liquid chromatography (HPLC) analysis of filtrate. This work showed that, although mesoporous alumina supported CNT can be applied as a good adsorbent for removal of trace amounts of organic compounds from drinking water efficiency of the adsorbents are extremely dependent on the porous adsorbent syntheses condition..

## BIODEGRADATION OF PHENOL BY A PSEUDOMONAS SP

Hamitouche, A. <sup>1,2</sup>, Amrane, A. <sup>3,4,a</sup>, Bendjama, Z. <sup>1</sup> and Kaouah, F. <sup>1</sup>

1. Laboratoire des Sciences du Génie des Procédés Industriels, Faculté de Génie Mécanique et de Génie des Procédés, Université des Sciences et de la Technologie Houari Boumediene, BP 32, El-Alia, 16111, Bab ezzouar, Alger, Algeria
  2. Centre de Recherche scientifique et technique en Analyses Physico-Chimiques, BP 248, CRAPC, Alger, Algeria
  3. Ecole Nationale Supérieure de Chimie de Rennes, Université Rennes 1, CNRS, UMR 6226, Avenue du Général Leclerc, CS 50837, 35708 Rennes Cedex 7, France
  4. Université européenne de Bretagne, 35000 Rennes, France
- a. Corresponding author (zbendjama@yahoo.fr)

Phenols are toxic to several biochemical reactions. However biological transformation of phenols to non-toxic entities exists in specialized microbes, owing to enzymatic potential involving enzymes of aromatic catabolic pathways. In this study, a series of experiments were performed to examine the effects of the mineral medium composition and the pH on phenol removal. In this purpose, phenol biodegradation was carried out in a batch reactor containing mixed bacteria; the temperature (30°C), the stirring velocity (200 r /min), the  $\text{KH}_2\text{PO}_4$  concentration (1.5 g/L), the  $\text{K}_2\text{HPO}_4$  concentration (2 g/L) and phenol concentration (125 mg/L) were kept constants. The initial pH was varied in the range 5 – 9 and the mineral components were tested in the following concentration ranges: 0 – 2 g/L for Nitrogen sources ( $\text{NH}_4\text{Cl}$ ,  $\text{KNO}_3$  and  $\text{NH}_4\text{NO}_3$ ), 0 – 0.5 g/L for NaCl and 0 – 0.2 g/L for  $\text{MgSO}_4$ . Their effects on phenol biodegradation and specific growth rate were examined. The shorter biodegradation time of phenol was 20.6 h for  $\text{NH}_4\text{Cl}$ , NaCl and  $\text{MgSO}_4$  concentrations of 1, 0.3 and 0.1 g/L respectively. Maximum specific growth rate ( $0.35 \text{ h}^{-1}$ ) and total phenol removal (99.99 %) were recorded for an optimal pH value of 8.

## ELECTRODEPOSITION OF LAYERED MANGANESE OXIDES UNDER HYDROTHERMAL CONDITIONS

F.Eylül Saraç<sup>1</sup>, Uğur Ünal<sup>1,2,3,a</sup>

1. Koç University, Graduate School of Science and Engineering, Istanbul, Turkey
  2. Koç University, Dept. of Chemistry, Istanbul, Turkey
  3. Koç University Surface Science and Technology Center, Istanbul, Turkey
- a. Corresponding author (ugunal@ku.edu.tr)

Efficient and low-cost energy storage has become the leading problem today. Electrochemical capacitors (EC) are the promising materials with combining high energy and high power density. Among various materials, manganese oxides are one of the most researched ones as ECs because of their abundance, low-cost, and environmentally friendliness. We have synthesized manganese oxides with or without surfactants onto different substrates by electrodeposition under hydrothermal conditions to achieve enhanced pseudocapacitance. This possible electrodes for electrochemical capacitors showed excellent pseudocapacitive behavior in cyclic voltammetry measurements. They reached up-to 620F/g in the potential range of 0.9V and scan rate of 20mV/s.

## **BIOCATALYTIC MEMBRANE REACTORS: ADVANCES IN BIOTECHNOLOGY**

Sudip Chakraborty<sup>a</sup>, Arijit Nath, Chiranjib Bhattacharjee  
a. Corresponding author (zsudip.c@gmail.com)

Biocatalytic membrane reactors are membrane reactors whose catalytic properties are brought by a catalyst from biological origin. Compared to ordinary chemical catalysts, biocatalysts exhibit higher selectivity and efficiency, they show higher reaction rate, milder reaction conditions, greater stereospecificity. Usually they are labile macromolecules and they may represent technological limit to overcome productive applications. The heterogeneization of such catalysts in microstructured porous membrane systems represents a suitable strategy to develop biocatalytic processes and devices with improved stability, selectivity and catalytic performance. Enzyme immobilization in artificial membranes is considered a useful method to stabilize biocatalysts, enhance their biocatalytic availability, facilitate their recovery and achieve continuous operation. Lipase enzymes are well known phase transfer biocatalysts for stereoselective hydrolysis and esterification reactions. For this reason, they have been largely studied to develop membrane reactors for the production of high value component for biomedical, pharmaceutical and food applications. Two-separate phase enzyme membrane reactors show remarkable advantages over conventional system. If the reaction products are soluble in an aqueous phase, this membrane reactor also acts as a separator and can reduce the down-stream processing. In this paper, an analysis of the development stage of this technology will be illustrated, and in particular, case studies in biotechnology and pharmaceutical fields will be discussed.

## **EFFECT OF FLOW FIELD AND GEOMETRY OF REGULAR SCAFFOLDS IN CELL CULTURE PARAMETERS**

Javad Etedadi<sup>a</sup>, Hanieh Niroomand-oscuui  
a. Corresponding author (jetedadi@hotmail.com)

Tissue engineering scaffolds as non-rotating bioreactors are one of the developing methods for cell culturing. Mechanical stimulations such as shear stress can be one of the cells surviving and proliferation functions, because with regard to living cell properties it can endure specified shear stress, and this shear stress can be affected by scaffold geometry, pore size and flow field. The present study compares the impression of different geometries and pore sizes on cell culturing. COMSOL Multiphysics 4.3 was used to set up and solve the flow field in specified scaffolds and to analyze the results. Then, optimized conditions were discussed to prepare suitable conditions for cell proliferation.

## **SYNTHESIS OF MANDELIC ACID FROM BENZALDEHYDE USING THIRD-LIQUID PHASE SYSTEM WITH IMMOBILIZED PEG PHASE TRANSFER CATALYZED UNDER ULTRASONIC IRRADIATION COMBINATION**

Elif Ödeş AKBAY<sup>1a</sup>, Nilüfer ÖZ<sup>2</sup>, Didar YAZHANOV<sup>3</sup>

1. Anadolu University, Dept. of Chemical Engineering, Eskişehir, Turkey
2. Anadolu University, Dept. of Chemical Engineering, Eskişehir, Turkey
3. Anadolu University, Dept. of Chemical Engineering, Eskişehir, Turkey  
a. Corresponding author (eodes@anadolu.edu.tr)

Mandelic acid has cosmetic, pharmaceutical, and antibacterial activities and is used in urinary antiseptic medicines. The present work focuses on synthesis of mandelic acid by L–L–L PTC reaction of chloroform with benzaldehyde in the presence of PEG and PEG supported with silica gel. The effects of parameters such as amount of PTC and sodium hydroxide, temperature, without and with ultrasonic irradiation and stirring combinations, reactant mole ratio on the reaction rate will be study.

## **MICROPOROUS POLYMER NETWORKS (MPNS) MADE IN METAL-FREE REGIMES – SYSTEMATIC OPTIMIZATION OF A SYNTHETIC PROTOCOL TOWARDS N-ARYLCARBAZOLE-BASED MPNS**

Eduard Preis, Christian Widling, Ullrich Scherf, Gunther Brunklaus, Johannes Schmidt, Arne Thomas  
a. Corresponding author (preis@uni-wuppertal.de)

Self-condensation of 2,7-bis(N-carbazolyl)-9-fluorenone **1** under acidic conditions successfully resulted in formation of microporous networks (MPNs) of the N-arylcarbazole type where careful optimization of the reaction conditions (trifluoromethylsulfonic acid or methane sulfonic acid / phosphorus pentoxide in dichlorobenzene at 140 °C) allowed for the generation of novel MPNs with high BET surface areas  $S_{\text{BET}}$  of up to 2250 m<sup>2</sup>/g and hydrogen storage capacities of up to 1.7% (at 1 bar) in a fully metal-free condensation regime.

## **THERMAL RESPONSE TESTING: A NEW METHOD FOR THE RAPID CHARACTERIZATION OF POROUS MATERIALS**

Nicole Klein<sup>a</sup>, Matthias Leistner, Wulf Grählert, Stefan Kaskel  
a. Corresponding author (nicole.klein@iws.fraunhofer.de)

Nitrogen physisorption at 77 K is a common and versatile method for the characterization of porous materials. But a drawback is the usually long measurement time that is needed for a single experiment. For a rapid characterization of porous materials, the thermal response method is presented. Thereby a porous sample is exposed to a test gas and its temperature change caused by the release of the heat of adsorption is measured in real-time using an optical temperature sensor. The obtained thermal response curve is analyzed and information on adsorption capacity, adsorption kinetics, pore structure and the isotherm characteristics of the investigated sample are accessible within some minutes. Experimental results using different porous materials and different test gases are presented and the potentials and limitations of the method will be discussed.

## **METAL-ORGANIC FRAMEWORKS AS SENSOR MATERIALS FOR SELECTIVE DETECTION OF GUEST MOLECULES**

Nicole Klein, Irena Senkovska, Ronny Grünker, Wulf Grählert, Stefan Kaskel,  
a. Corresponding author (nicole.klein@iws.fraunhofer.de)

Metal-Organic Frameworks (MOFs) are a novel class of porous materials attracting interest as adsorbents, as catalysts, for separation processes and sensor materials. MOFs are formed by coordinative bonds of multidentate ligands to metal atoms or metal clusters. Using the modular concept for designing new MOF materials specific properties for a particular application can be introduced. The potential selectivity of MOF materials for specific analytes, or classes of analytes, is substantial. In principle, any MOF property that changes depending on the guest could be measured as a sensing signal. Recently, examples of MOFs capable to reversible structural transformation have been reported. This flexibility leads in particular to application in separation processes but also as sensor materials. External stimuli like temperature, pressure or guest molecules can lead to a detectable change of the MOF properties. The post-synthetic integration of functional molecules into more or less rigid but highly porous MOF structures as well as MOF materials with open metal sites make those structures especially interesting for the use as optical sensor. This contribution will give some examples of MOFs showing high potential for serving as a sensor material.

## **SYNTHESIS AND CHARACTERIZATION OF ACIDIC CESIUM SALT OF 12-TUNGSTOPHOSPHORIC ACID**

Elif Ödeş AKBAY<sup>1a</sup>, Gülberk DEMIRKILIÇ<sup>1</sup>

1. Anadolu Univ., Dept. of Chemical Eng., Eskişehir, Turkey  
a. Corresponding author (eodes@anadolu.edu.tr)

Acidic Cs salt,  $\text{Cs}_{2.5}\text{H}_{0.5}\text{PW}_{12}\text{O}_{40}$ , exhibits high catalytic activity for various kinds of acid-catalyzed reactions. This excellent catalysis of  $\text{Cs}_{2.5}\text{H}_{0.5}\text{PW}_{12}\text{O}_{40}$  is attributed to the strong acidity, hydrophobicity, unique pore structure, etc. In this study, acidic cesium salts,  $\text{Cs}_{2.5}\text{H}_{0.5}\text{PW}_{12}\text{O}_{40}$ , were prepared by the impregnation method. Then obtained acidic cesium salts have been characterized by X-ray powder diffraction (XRD), Fourier transform Infrared spectroscopy (FT-IR) and BET analysis.

## **CHARACTERIZATION AND MODIFICATION OF KAOLINITE WITH PYRIDINE AND 2,6-DIAMINO PYRIDINE**

Berna Koçer<sup>a</sup>, Yasemin Turhan, Mahir Alkan, Mehmet Doğan  
a. Corresponding author (berna\_kocer@hotmail.com)

Modification can be explained as changing the properties of a clay surface by using various methods. Surface modification is carried out with thermal, hydrothermal and chemical methods. Change in chemical compound of clay surface is defined as chemical modification. Intercalation, on the other hand, is the process of expanding the interlayer distance of varved clays by making use of variety of methods and organic substances. In this study, samples of kaolinite were ground under 25 submicron size by milling, sieved and samples obtained were characterized by FTIR-ATR, XRD, BET and TGA. In order to expand the interlayer basal spacing, kaolinite was initially intercalated with dimethyl sulfoxide and this modified kaolinite was labelled as KD. KD, which has slightly increased the interlayer distance, has been modified with pyridine and 2,6-diamino pyridine, in order to further increase in interlayer distance. Characterization of these modified samples were carried out with FTIR-ATR, XRD, TGA, BET and TEM. As a result; we aimed at using kaolinite as a filler especially on the polymer/clay nanocomposites by modifying with pyridine and 2,6-diamino pyridine, reasoning from its worldwide usage based on properties like homogeneity, ease of workability, capability of being used as a filler, and being highly absorbent.

## **PRODUCTION AND CHARACTERIZATION OF CHITOSAN/PEO POLYMER NANOFIBERS USING ELECTROSPINNING TECHNIQUE**

Nihan Tuğçe Nergiz<sup>1,a</sup>, Hande Çelebi<sup>2</sup>

1. Advanced Technologies Research Unit, Program in Nanotechnology, Anadolu Univ., Eskişehir, Turkey
2. Dept. of Chemical Eng., Anadolu University, Eskişehir, Turkey  
a. Corresponding author ( nnergiz@anadolu.edu.tr)

Chitosan (CS) is a biodegradable natural polymer that is soluble in concentrated acid solutions. It is difficult to obtain nanofibers from pure chitosan solution, therefore synthetic polymers and surfactants are used in order to improve pure chitosan nanofiber morphology. In this study, poly(ethylene oxide) (PEO) was chosen as a co-spinning agent due to its positive properties such as water-solubility, linear structure, biocompatibility etc. A surfactant and a co-solvent was added to improve the morphology of nanofibers. The effect of CS/PEO blend ratio, applied voltage and flow rate on the morphology of nanofibers was investigated. The electrospun nanofibers were characterized by using SEM (Scanning Electron Microscopy), DSC (Differential Scanning Calorimetry) and TGA (Thermo Gravimetric Analysis).

## **MONODISPERSE POROUS POLYMER PARTICLES CONTAINING N-METHYL-D-GLUCAMINE GROUPS FOR BORON REMOVAL FROM GEOTHERMAL WATER BY HYBRID METHOD**

Saba Samatya<sup>1</sup>, Pelin Köseoğlu<sup>2</sup>, Ali Tuncel<sup>3</sup>, Nalan Kabay<sup>4</sup>, Mithat Yüksel<sup>4</sup>

1. Siirt Univ., Dept. of Chemical Eng., Siirt, Turkey
2. Istanbul Univ., Faculty of Pharmaceutical Sciences, Istanbul, Turkey
3. Hacettepe Univ., Dept. of Chemical Eng., Ankara, Turkey
4. Ege Univ., Dept. of Chemical Eng., Izmir, Turkey  
a. Corresponding author (nalan.kabay@ege.edu.tr)

It was reported that hybrid processes coupling sorption process with membrane filtration offered some advantages compared with conventionally used fixed-bed systems. In hybrid processes, the sorbents can be used as very fine particles that increase the surface area. Consequently, sorbents show higher uptakes and enhance the kinetic rate of the process.

In this study, monodisperse porous poly (GMA-co-EDM) and poly(VBC-co-DVB) particles with a particle size range of 5-20 micrometer were synthesized using modified seeded polymerization method. These particles were then functionalized with N-Methyl-D-Glucamine to obtain boron selective resins. The efficiency of these particles for boron removal from geothermal water was investigated by a hybrid process coupling sorption with ultrafiltration (UF) using a submerged hollow fiber type UF membrane module. It was possible to lower the concentration of boron in geothermal water from 11.0 mg/L to around 1.0 mg/L in 20 min when the concentration of boron selective resins is 4 g/L, speeds of replacement of fresh and saturated resins 6 mL/min and flow rates of feed and permeate 5 mL/min.

## PHOTOVOLTAICS BASED ON SEMICONDUCTOR POWDERS

D. Meissner<sup>1,a</sup>

1. Tallinn Univ. of Technology, Dpt. of Material Science, Ehitajate tee 5, 19086 Tallinn, Estonia,  
a. Corresponding author (dm@crystalsol.com)

More than 50 years ago a first patent was granted to utilize powder materials for solar cell production submitted by Hoffman Electronics Ltd., the very first company ever selling photovoltaic modules. Different approaches mainly focusing on silicon crystals or spheres have been tried in the past of which as yet only Philips/Volvo's CdS Monograin Membrane Photoconductors (in the 1980's and 1990's) and Kyosemi's Sphelar (Mini) Modules (recently) made it to the market. Our own groups in Germany/Austria and in Tallinn have been working with Monograin Membrane Solar Cells based on Philips company's technology also already since more than 30 years, first using CdS, CdSe and CdTe, CIGS, and since about 6 years with the copper zinc tin sulfo-selenide CZTS. Currently crystalsol GmbH in Austria and its daughter company crystalsol OÜ in Estonia, our spin-off company of TTU, are developing a solar module production process based on CZTS monograins, currently the most promising new material in photovoltaics.

The talk will review the history of and current technologies based on semiconductor powders or spheres such as those of Texas Instruments, ATS, CV 21, Sphelar Power, FujiPream, Kyocera, Kyosemi, and Ball Semiconductor, before focusing on our own activities and those of crystalsol GmbH.

## HIGH TEMPERATURE MECHANICAL PROPERTIES OF CEMENT PREPARED BY ADDITION OF WASTE FOUNDRY SAND

Sinem Çevik Üzgür<sup>a</sup>, Tuğba Işıtan, Başak Mesci, Erhan Tüfenk

- Ondokuz Mayıs Univ., Materials Sci. and Eng., Samsun, Turkey  
a. Corresponding author (sinemu@omu.edu.tr)

Globally improving industrial technology has severely caused the environmental problems like increasing amount of waste materials. Since there is a serious need to reuse by-products and waste materials generated from industry, solid waste management has become the important concern all over the world. Foundry sand can be used in the foundries several times and it can also be used in cement based materials after it can be no longer used in molds. So spent foundry sand is a by-product of ferrous and non-ferrous metal casting industries. Fly ash, a byproduct of thermal power plants has been reported to improve the mechanical properties and durability of cement. In the present study the influence of fly ash, and spent foundry sand as partial replacement of sand on the elevated temperature mechanical properties of cement is investigated.

## **MOLECULAR DYNAMICS SIMULATION OF GRAPHENE LIKE BORON CARBIDE NANORIBBONS UNDER STRAIN**

Yusuf Şimşek<sup>a</sup>, Şakir Erkoç  
a. Corresponding author (yusufsimsek@gazi.edu.tr)

Structural properties of graphene like boron carbide nanoribbon systems with various sizes have been studied by performing classical molecular dynamics simulations using empirical atomistic potentials. Two different strain rates were applied along the ribbon directions at various temperatures. It has been found that the graphene like boron carbide nanoribbons show structural deformations after a few steps of strain. Furthermore, at some temperature values, uncoiling mechanism along the ribbon directions have been observed.

## **DEVELOPMENT OF A NEW NONDESTRUCTIVE METHOD FOR MONITORING THE HOMOGENEITY OF PHARMACEUTICAL POWDERS**

Nadjet Guemras<sup>a</sup>, Lilia Mouhi, Amel Abdelhamid, Stephane Veessler, Kamel Daoud  
a. Corresponding author (nguemras@usthb.dz)

The aim of our work is to develop a methodology to control the homogeneity of powder blends online through a non-destructive method. This method is characterized by processing images taken from the mixture, with the help of two software "MATLAB 7.0" and "ImageJ". The implementation and validation of the method of image analysis to measure the quality of the mixture allowed to monitor the kinetics of binary mixtures, the first mixture consists of two free flowing powders and the second mixture a free-flowing powder and one cohesive. We studied the influence of the stirring speed, the position of insertion of the active substance (tracer) and the size of the powders to be mixed on the mixing time in two types of mixers (cubic and V). The homogeneity was characterized by a statistical parameter "coefficient of variation". This study allowed us to characterize two types of mixers, define operating procedures to be used depending on the properties of powders in order to obtain efficient mixing both in terms of mixing time (shortest) and power consumption ( the lowest). The developed method was used to determine the number of particles of active ingredient and the powder particle size distribution.

## **THE PRODUCTION OF HARD PORCELAIN IN LOW TEMPERATURES**

Başak Mesci<sup>1</sup>, Sinem Çevik Üzgür<sup>1,a</sup>, Tuğba İşitan<sup>1</sup>

1. Ondokuz Mayıs Univ., Materials Sci. and Eng., Samsun, Turkey

a. Corresponding author (sinemu@omu.edu.tr)

Hard porcelains are that fired in 1380-1400°C have high energy cost due to high production cost. Porcelains typically have a triaxial composition comprised of about 50% clay, 25% flux and 25% filler. Fired bodies containing these three components result in a grain and bond microstructure, which has large grains or filler (usually quartz) held together by a finer bond or matrix comprised of mullite crystals and a glassy phase. In relation to its raw material composition (clay, quartz and feldspar), porcelain stoneware is considered to be a triaxial porcelain material. In porcelain production, using waste materials can decrease the raw material cost. Using spodumen in hard porcelain body provide the decreasing of the firing temperature without unchanging physical properties of the body. In the present study, the research is mainly about the production of the hard porcelain, the effect of the spodumen on the low temperature production of the porcelain and the waste materials usage in the production of porcelain. Literature review gives the last improvements, which types of waste materials can be used in the porcelain production and how these materials affect the properties of the porcelain and provide the cost savings on the raw material usage.

## **STEAM-STABLE SILICA-BASED MEMBRANES**

Vittorio Boffa, Yuanzheng Yue, Giuliana Magnacca

a. Corresponding author (vb@bio.aau.dk)

Inorganic membranes are emerging as energy-efficient technology for novel molecular separation systems. The sol-gel method allows fabricating amorphous silica membranes with pore size smaller than 1 nm, which can be applied to hydrogen purification, carbon dioxide capture, and alcohol dehydration. Despite the use of silica membranes in substitution of traditional adsorption and distillation units is expected leading to vast energy savings the poor steam-stability of these devices still hampers their practical application. Pure silica and doped silica nanosols were synthesized and used for preparing unsupported and supported membranes, which were characterized before and after steam-exposure. Our results support the hypothesis that Nb(V), Ti(IV), and Zr(IV) ions act as network formers in silica-based membranes and stabilize their porous structure by enhancing their network connectivity.

## **THE EFFECT OF COOLING RATE ON THE CHARACTERISTICS OF UNIDIRECTIONALLY FREEZE-CASTED GELATIN SCAFFOLD**

Neda Arabi<sup>1</sup>, Ali Zamanian<sup>1,a</sup>

1. Nanotechnology and Advance Materials Dept., Materials and Energy Research Center, Karaj, Iran  
a. Corresponding author (a-zamanian@merc.ac.ir)

In the current study, controlled unidirectional freeze-casting was employed to fabricate highly porous gelatin scaffold for use in tissue engineering. In the first step, 3wt% of gelatin was dissolved in distilled water and 0.5 %wt. glutaraldehyd was added as crosslink agent. Then, the solution was poured into a PTFE mold, located on a cold finger, and freeze-casted at different cooling rates of 1-6 °C/min using liquid nitrogen. Consequently, the freeze-casted specimens were moved to a freeze-dryer under the pressure and temperature of 60 Pa and -55 °C, respectively. Finally, the water absorption, microstructure (by SEM), and mechanical characteristics of scaffolds were assessed. The compressive strengths of the scaffolds increased as a function of cooling rate, varied from 270 KPa to 600 KPa. The value of water absorption and pore sizes was in the range of 550-1360 wt% and 40-120 µm, respectively, and decreased as a function of cooling rate. Results showed that by controlling the freeze casting parameters pore size, mechanical properties and water absorption of gelatin scaffolds can be tailored for using in tissue engineering.

## **OPTIMIZATION OF PROCESS PARAMETERS FOR ARSENIC ADSORPTION ONTO ACTIVATED CARBON**

Dilek Duranoğlu, Canan Bakkal Gula, Ülker Beker  
a. Corresponding author (dilekdur@gmail.com)

Efficient usage of existing sources and treatment of contaminated water have been mandatory due to the increasing demand for clean water along with the population growth and industrial activities. Arsenic occurs naturally in the environment and as a by-product of some agricultural and industrial activities. Arsenic in excess of determined limit in drinking water can cause skin damage and problems on circulatory system, and may increase risk of getting cancer. Arsenic removal by steam activated carbon, which was derived from a food industry waste, peach stone, has been investigated. 3-factor 3-level 2k full factorial design technique has been employed to investigate the effects of pH, concentration and temperature variables. The regression analysis and statistical significance have been obtained to find the most suitable combination of independent variables resulting in maximum As(V) adsorption capacity of activated carbon. The statistical significance of variables has been evaluated by using the analysis of variance (ANOVA). Design Expert Software for Design of Experiments (DOE) has been used for developing model and regression analysis. According to optimization results, pH is very important and adsorption capacity decreases with temperature for As(V) removal by peach stone based activated carbon.

## **ANNEALING OF CO-CR DENTAL ALLOY: EFFECTS ON NANOSTRUCTURE AND ROCKWELL HARDNESS**

Simel Ayyildiz<sup>a</sup>, Elif Hilal Soylu, Hasan Suat Gokce, Semra Ide, Selim Kılıc, Bulent Piskin  
a. Corresponding author (simelayyildiz@gmail.com)

The aim of this study was to evaluate the effect of annealing on the nanostructure and hardness of Co-Cr metal ceramic samples that were fabricated with a direct metal laser sintering (DMLS) technique. Samples fabricated by a conventional casting technique (Group I) and prefabricated milling blanks (Group II) were examined as controls. The DMLS samples were randomly divided into three groups of samples that were not annealed (Group III), annealed in argon atmosphere (Group IV), or annealed in oxygen atmosphere (Group V). The nanostructure was examined with the small-angle X-ray scattering (SAXS) method. The Rockwell hardness test was used to measure the hardness changes in each group, and the means and standard deviations were analyzed statistically. All groups displayed different hardness values depending on the manufacturing technique. The annealing procedure and environment directly affected both the nanostructure and hardness of the Co-Cr alloy. Annealing in oxygen atmosphere relieved the inner stress, but the hardness increased. However, annealing in argon atmosphere not only relieved the inner stresses but also decreased the hardness, and a homogeneous product was obtained. For this reason, after the manufacturing with DMLS technique, annealing in argon atmosphere is an essential process for Co-Cr metal ceramic substructures.

## **EFFECTS OF B<sub>4</sub>C ON ALUMINA-BASED CERAMIC FOAM FILTERS**

**Kerim Emre ÖKSÜZ<sup>1,a</sup>, Ebru Şahin YILDIRIM<sup>2</sup>**

1. Cumhuriyet Univ., Metallurgical and Material Eng. Dept., Sivas 58140, Turkey
2. Cumhuriyet Univ., Faculty of Arts and Sciences, Dept. of Chemistry, Sivas 58140, Turkey

a. Corresponding author (kerimemreoksuz@gmail.com)

Ceramic foams have many potential advantages, such as high temperature strength, high resistance to chemical attack, high refractories and good insulating characteristics. In this experimental study alumina-based foam ceramic filters were fabricated by using alumina, and B<sub>4</sub>C powder as major materials. The slurry prepared by stirring 45min has a high viscosity and thixotropic behavior, which makes it uniformly coat the sponge substrate, resulting in the production of a ceramic with a uniform macrostructure. The polymer foams were then dipped into the ceramic slurry, which then later were squeezed with the help of a handroll, leaving only a thin layer of slurry on the polymer scaffold. After the shaping operation, the samples were dried at room temperature for at least 24 h. The samples were then placed in a drying oven under 120°C for at least 12 h. The samples were first heated at 1°C/min to 600°C to burn out the polyurethane support without collapsing the deposited ceramic powder. Subsequently, the samples were heated to 1550°C at 5°C/min with a 1-h soaking for sintering of the ceramic powder. The end products obtained after sintering were characterized by physical and mechanical tests.

## **BIOSORPTION OF REACTIVE RED 2 BY CTAB-MODIFIED POWDERED BIOMASS: ISOTHERM STUDIES**

Tamer Akar<sup>1</sup>, Melike Divriklioglu<sup>2,a</sup>

1. Dept. of Chemistry, Faculty of Arts and Science, Eskisehir Osmangazi Univ., 26480 Eskisehir, Turkey
  2. Dept. of Chemistry, Graduate School of Natural and Applied Sciences, Eskisehir Osmangazi Univ., 26480 Eskisehir, Turkey
- a. Corresponding Author (melikedivriklioglu@hotmail.com)

Recently researchers have studied on the improvement of the biosorption performance of different porous and powder biomaterials. The main objective of this work was to investigate the biosorption performance of CTAB-modified biomass of *Agaricus bisporus* at different concentrations of Reactive Red 2 (RR2) dye. Because isotherm studies are important applications for the understanding of the biosorption mechanism. The effect of initial dye concentration on the dye biosorption capacity of CTAB-modified biosorbents was explored between 100-400 mg L<sup>-1</sup> dye concentration. Langmuir and Freundlich Isotherm models were tested to evaluate the equilibrium biosorption data. The monolayer biosorption capacity of modified biosorbent was found to be 141.53 mg g<sup>-1</sup>. The results revealed that this new biosorbent was a promising alternative for eliminating RR2 from contaminated aquatic environment.

## **ABSORPTION OF GASES IN POROUS SOLIDS: A COMPUTATIONAL MOD**

Hector Dominguez<sup>a</sup>, Omar Lopez  
a. Corresponding Author (hectordc@unam.mx)

In this work we constructed a computational model to study retention of gases, such as CO<sub>2</sub>, in solid surfaces, i.e. using the Reactive Monte Carlo Method we studied gas absorption in a slit-like porous. The solid porous was constructed with a crystal structure whereas for the gas we used a simple model composed of Lennard Jones particles with appropriate parameters to simulated CO<sub>2</sub>. Then, simulations were conducted by changing the temperature and the gas-solid interaction to study how gas retention was changed as function of those thermodynamics and interaction parameters. We compared our results with experimental data and we found similar tendencies to those reported, for instance, in absorption of CO<sub>2</sub> in Li<sub>2</sub>O (lithium oxide).

## INVESTIGATION OF SOLUBILITY AND TRANSPORT OF BORIC ACID IN ETHANOL AT SUBCRITICAL AND SUPERCRITICAL CONDITIONS

Ayşe BUDAK<sup>1</sup>, Mehmet GÖNEN<sup>2,a</sup>

1. Süleyman Demirel Univ., Eng. Faculty, Dept. Of Environmental Eng., Batı Yerleşkesi, Isparta, 32260, Turkey
2. Süleyman Demirel Univ., Eng. Faculty, Dept. Of Chemical Eng., Batı Yerleşkesi, Isparta, 32260, Turkey
  - a. Corresponding Author (gonen19@gmail.com)

In this study, the solubility of boric acid was investigated in ethanol at supercritical and subcritical conditions. Experiments were carried out in stainless steel reactor under mixing rate of 800rpm, in the temperature range of 150°C-250°C and corresponding pressures between 0.9-7.1MPa. A certain amount of the ethanol-boric acid mixture in the expansion vessel was dried at room temperature in petri dish. The powder obtained from ethanol phase was characterized by fourier transform infrared spectroscopy (FTIR), x-ray diffraction (XRD) and thermal gravimetric (TG) analyses. It was determined that there is neither interaction between ethanol and boric acid nor any change in the its structure during the extraction. Between 52%-82% of boric acid initially placed in the reactor was transported into the second vessel at subcritical and supercritical conditions. It was found that the transport of boric acid in supercritical ethanol was increased with temperature. The solubility of boric acid in ethanol was calculated using the transported amounts as 3.0-8.3g B(OH)<sub>3</sub> /100 mL ethanol under those conditions. The transportation of boric acid with ethanol at subcritical and supercritical conditions can be used in its extraction from boron minerals, such as ulexite and tincal.

## FABRICATION OF BULK YTTRIA STABILIZED ZIRCONIA-ALUMINA COMPOSITE FILTERS BY DIFFERENT FOAMING METHODS

Burcu Nilgün Çetiner<sup>a</sup>, Özgür Çınar

Univ. of Marmara, Faculty of Eng., Dept. Of Metallurgical and Materials Eng., Istanbul,Turkey  
a. Corresponding author (niigun.cetiner@marmara.edu.tr)

Macro and microporous yttria stabilized zirconia-alumina composite filters are developed to decrease the casting flaw in order to obtain more purified and less turbulent liquid flow in molten metals. These composites are intended to have light weight, high mechanical strength, large specific surface areas, high porosity, excellent thermal shock resistance, chemical corrosion resistance and high temperature stability in molten metal. In our research we tried several ways of foam production; foaming agents such as H<sub>2</sub>O<sub>2</sub>, porogens such as PVA (Poly vinyl alcohol) and finally polyurethane foams using like pore templates. After each procedure, samples were sintered at the same temperature (1650 °C). The XRD analysis was performed after the sintering process. The sintered zirconia-alumina composites are characterised by microstructural analysis using SEM and the EDS analysis. The thermal and mechanical behaviours of the zirconia-alumina ceramic filter were decided to be mentioned in another study.

## **FABRICATION AND CHARACTERIZATION OF POROUS BIOGLASS CERAMIC**

Kerim Emre ÖKSÜZ<sup>a</sup>, Hanlar BAĞIROV, Hasan YILMAZ,  
Buket SILAŞOR and Vedat YILDIRIM

Cumhuriyet Univ., Metallurgical & Materials Eng. Dept., 58140, Sivas, Turkey.  
a. Corresponding author (kerimemreoksuz@gmail.com)

Many kind of bioactive materials including bioglasses, bioglass–ceramics, and calcium phosphate ceramics, have been developed and some of them are now applied to repair and reconstruct diseased or damaged bones or tissues. Much attention has recently been devoted to investigation of these materials since they expand the range of bioresorbability and mechanical properties of bioceramics. The aim of this study is to explain the manufacturing process of bioceramics with controlled porosity by a simple method.  $Al_2O_3$  and  $ZrO_2$  were added to the matrix in order to increase the hardness and strength. Sodium-free bioglass material is derived from reagent grade chemicals. Wood flour with a grain diameter of 100  $\mu m$  is used as a filling material. Composites were sintered in a furnace at 850°C for 3h. The samples were characterized from a microstructural point of view, in order to evaluate the pore morphology, dimension and degree of interconnectivity.

## **THE EFFECT OF WASTE MARBLE POWDER ON THE FRESH STATE AND MECHANICAL PROPERTIES OF SELF-COMPACTING MORTARS**

Çağlar Yalçinkaya<sup>a</sup>, Ahsanollah Beglarigale and Halit Yazıcı

Dokuz Eylül Univ., Dept. of Civil Eng., Izmir, Turkey  
a. Corresponding author (caglar.yalcinkaya@deu.edu.tr)

Self-Compacting Mortar (SCM) is a relatively new repair material. This type of mortar may be preferred for narrow sections of reinforced concrete structures due to lack of coarse aggregate and its self-compacting behavior. However, it needs higher cementitious and fine materials to enhance segregation resistance. Marble powder (MP) as an industrial solid waste can be utilized in concrete products. The main goal of this study is to demonstrate the possibility of using waste marble powder as a substitute rather than crushed aggregates in SCM production. For this purpose, crushed limestone sand was replaced with MP up to 30%. Mini slump-flow and V-funnel experiments were performed at fresh state. Moreover, rheology of mixtures has been investigated. Compressive and flexural strengths were determined under standard and steam curing conditions. Results showed that MP can be used up to 20% volume of fine aggregate without remarkable workability loss. Moreover, mechanical properties were not significantly affected by MP substitution. In addition, water curing provided higher strengths compared to steam curing.

## **KINETIC MONTE CARLO SIMULATION OF SEMICONDUCTOR HETEROEPITAXY ON FEATURED SUBSTRATES**

Hassan KASSEM<sup>1,a</sup>

1. Lebanese Univ., Fac. of engineering, Al Hadat, Lebanon
  - a. Corresponding author (has\_kas@hotmail.com)

We investigate by a Kinetic Monte Carlo simulation the intermixing mechanisms during the growth of mismatched thin films on featured substrates. The Monte Carlo scheme is associated with an elastic energy term based on the valence force field approximation which is used to describe the strain effect on the lattice mismatched film. The stress is relaxed along “atomic chain” at each step of the simulation. It has been shown that using featured substrates enhance the interdiffusion due to the presence of the step boundaries. The effect of various experimental conditions: growth temperature, growth rate and the characteristics of deposited film: lattice mismatch, force constants, chemical binding energy on the intermixing are reported.

## **THE EFFECT OF COMPOSITION AND COOLING RATE ON MICROSTRUCTURE OF CHITOSAN/SILK-FIBROIN MICROTUBULAR ICE-TAMPLATED POROUS SCAFFOLD**

A. Zamanian<sup>1\*</sup>, Z.Nematollahi<sup>2</sup>, M. Tafazzoli-Shadpour<sup>2</sup>

<sup>1</sup>Nanotechnology and Advance Materials Dept., Materials and Energy Research Center, Karaj, Alborz, Iran

<sup>2</sup>Biomaterials Faculty, Amirkabir Univ. of Technology, Tehran, Iran  
a. Corresponding author (a-zamanian@merc.ac.ir)

Microtubular porous scaffolds are very promising physical guidance substrates for regenerating injured nerves. Recently chitosan(CH)/silk-fibroin(SF) based materials extremely have been used as nerve tissue engineering scaffolds. In this study, we investigate the effect of composition and cooling rate on microstructure of these scaffolds. In the first step, two ratio of CH/SF (3:1 and 1:1) as 3wt % solution was prepared. Then, the solutions were poured into a PTFE mold, located on a cold finger of the freeze casting set-up, and freeze-casted at different cooling rates of 1 and 4 °C/min. Consequently, the freeze-casted specimens were moved to a freeze-dryer for 24 hours. Finally, the microstructure of scaffolds were assessed by scanning electron microscopy. Results showed that by increasing the cooling rate and CH concentration the amounts of microfibers distributed between tubular layers of scaffolds go up and the distance between layers decrease when cooling rate increase. Base on previous studies schwann cells axons needs anchor for longitudinal growth. There for expected that scaffolds prepared by higher concentration of CH and cooling rate are the proper candidates for nerve tissue engineering scaffolds.

## **PREPARING FE/PD BIMETALLIC NANOPARTICLES FOR AN EFFICIENT AZO DYE (REACTIVE BLACK 5) REMOVAL FROM AQUEOUS SOLUTIONS**

Elaheh Goharshadi, Sara Samiee, Paul Nancarrow  
a. Corresponding author (gohari@ferdowsi.um.ac.ir)

Removal of azo dyes from colored effluents due to their complex composition, toxicity, poor degradability, and high solubility is an important and vital topic in aqueous systems. Herein, the ability of Fe/Pd bimetallic nanoparticles for removal of an azo dye, namely Reactive Black 5 (RB5), was investigated. To achieve this purpose, first Fe/Pd bimetallic nanoparticles were synthesized by a simple reduction method. X-ray diffraction, transmission electron microscopy, high resolution transmission electron microscopy, X-ray fluorescence, X-ray photoelectron spectroscopy, energy dispersive X-ray spectroscopy, magnetic hysteresis, scanning tunneling microscopy, and BET surface area analysis were used to characterize Fe/Pd bimetallic nanoparticles. The influence of Fe/Pd dosage, pH, temperature, and initial dye concentration on the dye removal process was studied. The maximum dye removal was achieved at 20 mg Fe/Pd, pH=3.0, 25 oC, and dye concentration of 20 ppm. Kinetic studies showed that the RB5 removal using Fe/Pd bimetallic nanoparticles obeys the pseudo-first order kinetic model. The Langmuir and Freundlich adsorption isotherms were studied and the experimental results revealed conformity with Freundlich model. The Freundlich constants illustrate that this process is favorable. Also, thermodynamic studies confirm that the RB5 removal was spontaneous ( $\Delta G=-8.32$  kJ mol<sup>-1</sup>) and exothermic ( $\Delta H=-4.06$  kJ mol<sup>-1</sup>).

## **MANUFACTURING OF STAINLESS STEEL FOAM USING POWDER METALLURGY TECHNIQUE**

Didem Serim, Rasim Ipek  
a. Corresponding author (dserim@totomak.com.tr)

In this study, 316L grade stainless steel foam produced by using powder metallurgy technique. Carbamide was used as a space holder in various sizes and content ratios. In order to analyze location effects of carbamide particles in stainless steel powder, different mechanical methods has been used and results of studies has been observed. Space holder capability of carbamide in samples and removal of carbamide from stucture after pressing process has been evaluated by observing microstructure. Mechanical tests has been done to review all effects of carbamide location results in structure. Experiments of this study still continues.

## **MODELING OF THE HYDRATION AND DEHYDRATION RATES OF CALCIUM AND MAGNESIUM OXIDES UNDER DIFFERENT CONTROLLING REGIMES SUCH AS MASS TRANSFER AND KINETICS CONTROLLED REGIMES**

Philipp Waldherr <sup>a,c</sup>, Figen Kayar Aynalı <sup>b,c</sup>, Kurtul Küçükada <sup>c</sup>

<sup>a</sup> Technical Univ. Berlin, Faculty of Process Sciences, Dept. of Chemical and Process Eng., Fraunhoferstr. 33-36 –FH 6-1, 10587 Berlin, Germany

<sup>b</sup> Yüzüncü Yıl Univ., Faculty of Eng. and Architecture, Dept. of Chemical Eng., 65 080 Van, Turkey

<sup>c</sup> Marmara Univ., Faculty of Eng., Dept. of Chemical Eng., Göztepe Campus, Kadıköy, 34 722 Istanbul, Turkey

*a.* Corresponding author (kurtul.kucukada@marmara.edu.tr)

The use of calcium and magnesium oxides as heat storage materials is attracting the interest as they can supply elevated temperatures during hydration. It is necessary to know the hydration rates of calcium and magnesium oxides in order to define the optimal operating conditions such as the flow rate, partial pressure and temperature of water vapor in addition to the particle diameter and porosity. The hydration reactions take place in porous media where simultaneous diffusion and hydration determine the overall rate of reaction. In the present work, hydration rates of those oxides were calculated and presented using different approaches such as mass transfer and reaction kinetics controlled rates for the aforementioned parameters. The results were compared to the data collected from the previously published works. Correlations were proposed to predict the optimal hydration trajectory based on the optimal operating conditions and thus optimal duration of hydration. In addition the optimization of the hydration rate was done for different parameters of the materials to be used such as the particle diameter, porosity and pore size.

## **EFFECT OF THE VARIOUS TYPES OF POROSITY ON MECHANICAL STRENGTH AND PURE WATER PERMEABILITY OF POLYSULFONE HOLLOW-FIBER MEMBRANES**

N. Attari<sup>1,2</sup>, R. Yegani<sup>1,2\*</sup>, P. Amirabedi<sup>1,2</sup>

1 Faculty of Chemical Eng., Sahand Univ. of Technology, Sahand New Town, Tabriz, Iran

2 Membrane Technology Research Centre, Sahand Univ. of Technology, Sahand New Town, Tabriz, Iran

*a.* Corresponding author (Nasrin4139@gmail.com)

Polysulfone (PSf) is a popular polymer for fabricating membrane. Hollow-fiber polysulfone membranes were prepared by phase inversion method. 1-methyl-2-pyrrolidone (NMP) was used as solvent and water was used as coagulant. Polyethylene glycol (PEG) of different dosage of PEG20000 was added as an additive in polymeric solution. The morphology of membranes was analyzed by scanning electron microscope (SEM) and their performance was evaluated in terms of pure water permeability (PWP), porosity, tensile strength, protein adsorption and protein rejection. Obtained results demonstrate that, with increasing of NMP concentration in bore fluid the porosity of hollow-fiber's inside surface increases. This phenomenon contributes to both permeability and mechanical strength improvement of fabricated hollow-fibers. The impact of coagulation bath temperature on membrane micro structure as well as performance was also investigated in which by increasing of bath temperature, water permeation improves. However, a severe decline in mechanical strength is observed. The introduction of PEG additive can improve the hydrophilicity of membranes. Therefore PWP and porosity of hollow-fibers increase. It is important to note that, the surface porosity play more prominent role in permeation and mechanical strength improvement than bulk porosity.

## REMOVAL OF MERCURY FROM AQUEOUS SOLUTIONS USING COMPOSITE NANOMATERIALS OF GRAPHITE OXIDE WITH CHITOSAN

Eleni Deliyanni, George Kyzas, Nikolina Travlou

*a.* Corresponding author (lenadj@chem.auth.gr)

In the current work, two novel forms of graphite oxide composites were prepared having as substrate chitosan. The first composite (GO-Ch) is a complex between graphite oxide (GO) and cross-linked chitosan (Ch), while the other composite (GO-Chm) is consisted of GO and magnetic chitosan (Chm). The magnetism occurred in the second case can strongly influence the properties of two polymers. A full characterization was achieved in order to study the properties of the composites synthesized. X-ray diffraction patterns revealed the crystallinity and possible degree of order. The elemental analysis of materials evaluated using energy dispersive X-ray analysis (EDX), while their morphology was observed with SEM. Also, TG analysis was realized revealing a significant difference in thermal behavior between the composites and the separate parts (GO and Ch/Chm). FTIR spectroscopy was used in order to explain, via the shift of peaks, the new interactions occurred in the composites. Then, the composite materials prepared used in adsorption experiments to bind/remove Hg(II). The maximum adsorption capacity can reach 190 mg/g (GO-Ch) and 210 mg/g (GO-Chm) for the removal of mercury. Kinetics as well as desorption experiments were done. Five cycles of adsorption-desorption were carried out revealing the strong reuse potential of these materials.

## RECOVERY OF ISOAMYL ACETATE FROM AQUEOUS SOLUTION USING MACROPOROUS ADSORPTION RESINS

Murat YILMAZTEKIN<sup>1</sup> and Sevinç TAY<sup>2</sup>

<sup>1</sup>Inonu Univ., Faculty of Eng., Dept. of Food Eng., 44280, Malatya, Turkey

<sup>2</sup>Kilis 7 Aralık Univ., Faculty of Eng., Dept. of Food Eng., 79000, Kilis, Turkey

*a.* Corresponding author (murat.yilmaztekin@inonu.edu.tr)

Esters are commonly used flavouring agents for the fruity aromas they provide. They are used in fruit-flavoured products (i.e. beverages, candies, jellies, and jams), baked goods, wines, and dairy products. Isoamyl acetate (IAAc), the characteristic compound of banana flavour, is one of these flavouring agents which is produced with an amount of 74 tonnes per annum. Recent market surveys have shown that consumers prefer foodstuff which contain natural flavourings. One of the most effective strategies in natural IAAc production is biotransformation of isoamyl alcohol (IAAl) into IAAc using microorganisms. However product accumulation above the inhibitory level during biotransformation limits the final IAAc concentration. An in situ product removal (ISPR) technique using macroporous adsorption resins used in this study for recovery of IAAc from the medium. Nine types of resins with different polarities and surface areas were tested in a sugarcane molasses based medium containing IAAl and IAAc. The adsorption capacity, adsorption ratio and desorption recovery of resins were calculated. H103 resin had the best adsorption capacity because of its large and nonpolar surface area. The results obtained from the adsorption experiments showed the possibility of using macroporous adsorption resins to recover IAAc from aqueous solutions.

## USE OF MICROORGANISMS IMMOBILIZED ON GRAPHITE TO REMOVE LEAD FROM AQUEOUS SOLUTION

H. Mokaddem, Z. Sadaoui, , <sup>1</sup>F. Taguet, <sup>1</sup>N. Boukhelata, <sup>1</sup>Y. Kaci, N. Azouaou  
Laboratory of Genius of the Reaction, Faculty of Mechanical and Processes Genius;  
<sup>1</sup>Laboratory of Biology and Physiology of Organisms, Faculty of Biologics Sciences,  
Univ. of Sciences and Technology, Houari Boumediene, USTHB, BP No 32, El Alia Bab Ezzouar  
a. Corresponding author (mokaddemhassiba@gmail.com)

Immobilized microorganisms on graphite were prepared by cultivating the bacterium in a mixture of culture medium and graphite. The ability of a biofilm of *Paenibacillus polymyxa* and *Pseudomonas* sp separately supported on graphite to remove lead from aqueous solutions was investigated in batch assays. The equilibrium data were described by Langmuir, Freundlich and Dubinin –Radushkevich. The best fit was obtained with the Langmuir model for both bacteria. The maximum adsorption capacity of graphite/*Paenibacillus polymyxa* (29.67 mg/g) is better than that of graphite/*Pseudomonas* sp (18.14 mg/g) using the Langmuir model. SEM images of carrier without immobilized microorganisms and carrier with immobilized microorganisms shows many differences between the surfaces.

## CHARACTERIZATION AND INCREASING POROSITY OF LIMESTONES;KUFEKI

Sonmez Arslan, Mustafa Fatih Alpdoğan, Murat Bayazit  
a. Corresponding author (sonmez.arslan@batman.edu.tr)

Limestones;Kufeki taken from Marmara Region were used in many historical art-works as stones. Compressive strength in Limestones has increased as vacancy ratio increased. With the rise of water absorption capability in boiling water by volume, uniaxial compressive strength showed an increase in Limestones. As the hot water has filled the porosities, the capillaries have been stuffed causing a rise in pressure which has resulted in various changes in Limestones. Fragmentation became easier as the interior pressure increased in and as compressive strength increased in limestones. Uniaxial compressive strength increased as proportional to increase in porosity in Limestones. As the volume of porosity in limestones increased in 18% more by volume in quantity in addition to almost 30 % porosity already existed resulted in maximum compressive strength about 50 % porosity. They became this by drying-wetting about 35-45 years in their service life. The increase in salt-crystallization in limestones resulted in compressive strength after a certain point. SEM-EDX, HT-XRD, and FT-IR were used to characterize and to explain mineral structures, their appearance, porosity, and chemical properties of the Limestones;Kufekis and as a result magnesium, calcium and carbonate ions were found.

## **PREPARATION AND CHARACTERIZATION OF HIGHLY INTERCONNECT CHITOSAN SCAFFOLD VIA FREEZE CASTING METHOD FOR TISSUE ENGINEERING APPLICATION**

A. Zamanian\*, M. Pourhaghgouy

Nanotechnology and Advance Materials Dept., Materials and Energy Research Center, Iran

a. Corresponding author (a-zamanian@merc.ac.ir)

Chitosan is a biocompatible and bioresorbable biopolymer which recently has attracted researchers' attention due to its appropriate properties. Since chitosan possesses favourable biologic properties, it has vastly been utilized in scaffold fabrication. With regard to produce a scaffold with proper structure, control of percentage, distribution, direction and interconnectivity of porosities is necessitated. In this study, porous chitosan scaffolds were prepared employing freeze-casting method and they are characterized. Hence, solutions of 1.5 and 3 wt% of chitosan in acetic acid (2%) were prepared and freeze-casted with the gradient of -1 and -4 °C/Min. The structure characterization was conducted by SEM, water absorbance and mechanical strength. The results show that along with increase of concentration, the amount of porosities and mechanical strength has risen and inversely, water absorbance decreased. Also by increasing of cooling rate the pore size and water uptake decrease and mechanical strength rises. Results showed that scaffolds is highly porous and there are porosities in the walls of the structure which could be the best locations where cells could easily adhere and proliferate.

## **FORMULATION AND CHARACTERIZATION OF THE MICROPARTICLES CONTAINING THE ANTIHYPERTENSEURS FOR PHARMACEUTICAL USE**

Nadjet Guemras, Nawel Ouennoughi, Stephane Veessler, Kamel Daoud

a. Corresponding author (n\_guemras@hotmail.fr)

In the industry, microencapsulation is implemented to fill the following objectives: to ensure protection, the compatibility and the stabilization of an active matter in a formulation, to carry out an adapted working, to improve the presentation of a product, to mask a taste, to modify and control the profile of release of an active matter to obtain, for example, prolonged release we focus ourselves on the encapsulation of the antihypertenseurs in order to improve profile them fect dissolution. Our choice was made on the technique of encapsulation by complex coacervation with two types of polymers (gelatin and the gum arabic) which is a physico-chemical process. Several parameters were studied at the time of the formulation of the microparticules and the nanoparticules: temperature, pH, ratio of polymers... etc. The microparticules obtained were characterized by microscopy, laser granulometry and UV-visible spectrophotometry. The profile of dissolution obtained for the microparticules showed an improvement of the kinetics of dissolution compared to that obtained for the active ingredient.

## **IMPROVEMENT OF HA BIOCERAMICS WITH ADDITION OF AW GLASS-CERAMIC**

Fatih Çalışkan<sup>a</sup>, Zafer Tatlı

Metallurgical and Materials Eng., Faculty of Technology, Sakarya Univ., Sakarya, TURKEY  
a. Corresponding author ( fcaliskan@sakarya.edu.tr)

Bioceramics used for the repair and reconstruction of damaged/diseased parts of the body system may be bioinert (Al<sub>2</sub>O<sub>3</sub>) or bioactive (HA, AW). HA is a material with excellent biocompatibility. In the recent times, many attempts have been made to obtain the HAp with increased strength.

The aim of this study was to evaluate the effect of AW glass ceramic additive in particulate form to hydroxyapatite in terms of both density and mechanical properties. Various types of HAp–AW composites were prepared through the use of powder metallurgy process. To improve mechanical properties, the HAp was mixed with AW glass ceramics which have higher bending strength (~200MPa) than that of the human bone (50-150MPa). The mechanical properties were evaluated by microhardness testing and measurement of fracture toughness. Microstructural analysis was carried out by optical microscopy and SEM. Density measurements took place via Archimedes method. All investigations showed that grain size, green density, sintering parameters like sintering temperature and dwelling times had significance effects on density and mechanical properties.

## **POROUS POLYLACTIDE AS MEDICAL SCAFFOLD**

Marek Kozłowski<sup>1a</sup>, Joanna Macyszyn<sup>1</sup>

1. Wrocław Univ. of Technology, Faculty of Environmental Eng., Wrocław, Poland  
a. Corresponding author (marek.a.kozlowski@pwr.wroc.pl)

Cellular structure formation in polylactide (PLA) has been described. Different methods of foaming have been tested and the porous morphology has been evaluated by means of the optical and scanning electron microscopy. Polymer foaming parameters have been correlated with the morphology details. Pore size and pore density as well as the connectivity of cells have been evaluated. Polylactide was characterized in respect of its viscoelastic properties in a molten state, by thermomechanical characteristics and differential scanning calorimetry. Mechanical properties of the porous polylactide at compression and bending stress have been described.

## CHARACTERIZATION OF NATURAL ALGERIAN GREEN CLAY AND ITS PERFORMANCE ON CADMIUM (II) REMOVAL FROM AQUEOUS SOLUTION

Latifa Bentchikou<sup>a,\*</sup>, Abdelhamid Mellah<sup>b</sup>, Chabha Berrached<sup>a</sup>, Bouchra Dahmoune<sup>a</sup>

<sup>a</sup> Laboratoire des Ecosystèmes Marins et Littoraux, ENSSMAL, B.P.19 Bois des Cars, Campus Universitaire, Dely-Ibrahim, Algiers, Algeria

<sup>b</sup> Centre de Recherche Nucléaire d'Alger, 2 Bd. Frantz Fanon B.P.399 Algiers, Algeria

*a.* Corresponding author (lati\_bentchikou3@yahoo.fr)

Among several porous adsorbent materials used in water treatment, clays have been extensively studied for the removal of various aquatic pollutants due to their low cost and significant adsorption's capacity. In this work, a natural algerian green clay was applied as for removal of cadmium from aqueous solution by batch mode. The characterization of the natural clay was performed by SEM, X-ray diffraction (XRD) and FT-IR which highlight the chemical constitution of the adsorbent.

The kinetic study presented that cadmium removal by green clay mainly followed the pseudo-second order model. Adsorption isotherms showed that the uptake of cadmium could be described by Temkin model at 293K.

The results showed that natural green clay is effective to remove cadmium(II) above 95%.

## KINETICS AND THERMODYNAMICS OF ADSORPTION OF AN AZO DYE BY GRAPHENE

Sara Samiee<sup>a</sup>, Elaheh Goharshadi, Monireh Barati Moghadam

*a.* Corresponding author (ssamiee11@yahoo.com)

Graphene nanosheets were synthesized by burning Mg ribbons in dry ice and the adsorption of Reactive Black 5 (RB5) on graphene nanosheets was investigated. To the best of our knowledge, this is the first report for adsorption of an azo dye, RB5, on graphene nanosheets. The effects of different parameters including adsorbent dosage, pH, temperature, and dye concentration on the dye removal efficiency were studied. The experimental data were fitted with the pseudo-second order kinetic model ( $R^2=0.997$ ). The activation energy of the RB5 adsorption on graphene was estimated to be 25.80 kJ mol<sup>-1</sup>. The adsorption isotherm was described well by Freundlich isotherm. The high values of Freundlich constant (191.9 mg g<sup>-1</sup>) showed the high capacity of graphene for the RB5 adsorption from aqueous solutions. The thermodynamic parameters revealed that the adsorption reaction was spontaneous and endothermic. Among the significant features of graphene as an adsorbent for RB5 removal are: the fast rate removal, low mass ratio of graphene to dye, and frequent usage of graphene with no loss of efficiency.

## **THERMAL INVESTIGATIONS OF MECHANICALLY ALLOYED MILL SCALE – COAL MIXTURE**

S.Osman YILMAZ<sup>1</sup>, Yusuf DONAT<sup>1</sup>, Selçuk KARATAŞ<sup>1</sup>,

<sup>1</sup>Firat Univ., Material and Metallurgical Eng. Faculty, 23119 Elazig, Turkey.

*a.* Corresponding author (osyilmaz@firat.edu.tr)

Fundamental mechanisms for reduction of coal-scale mixtures have been investigated by using mechanical alloying (MA) technique. The coal-scale mixtures were mechanically alloyed, and then sintered for 700-1000 °C temperatures. Several exothermic and endothermic peaks were observed which were related to the decomposition reactions and reduction. The X-ray diffraction (XRD) and the iron phase analytical techniques were applied to identify the reduction of scale with the temperature. It has been found that coal devolatilisation and scale reduction occur simultaneously during the heating of the mixture. H<sub>2</sub> and CO gases produced from coal devolatilisation and the reduction temperature of mill was decreased to 750 °C temperature by 1 hr MA. The mechanical alloying was responsible for the reduction of iron oxides at these temperatures, and iron oxides undergo step-wise reduction over the whole process. The results in this work provide production of iron from mill scale at 750-850 °C temperature for the mechanical alloying in direct reduced iron making processes.

## **EFFECT OF M<sub>7</sub>C<sub>3</sub> NANO PARTICULATES ON WEAR RESISTANCE OF NI BASED MMCS**

S.Osman YILMAZ<sup>1</sup>, Fatih DEMIR, Selçuk KARATAŞ<sup>1</sup>, Yusuf DONAT

<sup>1</sup>Firat Univ., Material and Metallurgical Eng. Faculty, 23119 Elazig, Turkey.

*a.* Corresponding author (osyilmaz@firat.edu.tr)

The metal matrix composites of Ni-Al-M<sub>7</sub>C<sub>3</sub> were fabricated by mechanical alloying process (1-4 h). Pure nickel, aluminum and FeCrC powders were mixed, mechanical alloyed and sintered in an atmosphere controlled furnace for 800-1100 °C temperature and 1-3 hr time. The synthesis of the FeCrC added NiAl was attempted to improve the wear resistance of the Ni based MMCs composite. The initially added FeCrC particles were unstable and decomposed partially within the matrix during sintering, and the carbides formed as nano sized. The microhardness, XRD, SEM, EDS, optical micrographs and dry sliding wear mechanism of the samples were investigated. It was confirmed that the mechanical alloying time decreased sintering time, formed nano sized reinforcements and improved the wear resistance of Ni based M<sub>7</sub>C<sub>3</sub> reinforced MMCs.

## COOLING BEHAVIOR OF FE-TI-C ALLOYS, PHASE DIAGRAM

F. SI AHMED, S.E. AMARA, F. HADDAD and R. KESRI

Laboratoire d'électrochimie, Corrosion, Métallurgie et Chimie Minérale.

Chemistry faculty, USTHB BP 32 El Alia Algiers, Algeria.

a. Corresponding author (samara@usthb.dz )

The presence of the titanium in steels has a very important role. So, it is necessary to well know the equilibrium diagram of the ternary Fe-Ti-C system to better understand the behavior of these materials. This is why the ternary Fe-Ti-C system has been the subject of several experimental or theoretical studies that led to plot the liquidus projection of this system and several isotherms sections. However, the bibliographic studies showed a great disparity in the results, including those concerning the liquidus projection.

In this work we propose to reinvest experimentally this system. The cooling paths were followed using a differential thermal analysis apparatus. The optic microscopy, the scanning electronic microcopy, the electronic microprobe and the transmission electron microscopy allowed us to identify the different phases formed during cooling.

Our research has led us to identify the primary phases. Liquid-solid equilibriums, in particular the invariant reactions, could be compared to the results of previous work. However we propose a new liquidus projection of the Fe-Ti-C system in the Fe rich corner.

## EXAMINATION OF ABRASIVE WEAR BEHAVIOUR IN Al 2014-SiC COMPOSITES

Niyazi Selçuk CILASUN<sup>1a</sup>, Recep ÇALIN<sup>2</sup>, Osman BICAN<sup>2</sup>, Muharrem PUL<sup>2</sup>

<sup>1</sup>Kırıkkale Univ., Dept. of Mechanical Eng., Kırıkkale, TURKEY

<sup>2</sup>Kırıkkale Univ., Dept. of Metallurgical and Materials Eng., Kırıkkale, TURKEY

a. Corresponding author (niyazicilasun\_s@hotmail.com)

In this study, the effects of reinforcement volume fractions on abrasive wear behaviour were examined in Al-SiC reinforced metal matrix composites (MMCs) of 3%, 6% and 12% reinforcement – volume (R-V) produced by melt stirring. Abrasive wear tests were carried out by 320 mesh sized Al<sub>2</sub>O<sub>3</sub> abrasive papers and pin-on-disc wear test apparatus under 10 N, 20 N and 30 N loads at 0.2 m/s<sup>-1</sup> sliding speed. The mechanical properties of composite specimens such as hardness and fracture strength were determined. Subsequent to the wear tests, the microstructures of worn surfaces were examined by Scanning Electron Microscope (SEM) and EDS analyses. While increased SiC reinforcement volume fraction in the composite resulted increased hardness, fracture strength was determined to decrease. Additionally, it was found that increased SiC reinforcement volume fraction in the composite was accompanied with increased wear loss and porosity as well as R-V were identified to be significant determinants of abrasive wear behaviour.

## **AN OVERVIEW OF THE USE OF CLINOPTILOLITE IN DOMESTIC WASTEWATER MANAGEMENT: TREATMENT, UPGRADING AND RECOVERY OF FERTILIZERS**

Bilsen BELER BAYKAL

a. Corresponding author (baykalb@itu.edu.tr)

Natural zeolite clinoptilolite can not only be useful for the removal of primary water pollutants, nitrogen and phosphorus from domestic wastewater, and upgrading effluent quality, but also can be used for reevaluating domestic wastewater through recovery of plant nutrients which may further be used as fertilizer. It had been reported that fertilizer needed for production of over 200 kg of cereals may potentially be obtained from the excreta (urine&feces) of each person on a yearly basis. Recovery of N&P may be accomplished both from conventional single stream collection of domestic wastewater and from yellow water, i.e. separately collected urine. Efficiencies exceeding 90% were observed upon adsorption/ion exchange with Turkish clinoptilolites followed by the release of the plant nutrients upon contacting with water to make them available to plants. Preliminary pot trials revealed that the results with the fertilizer obtained were as successful as synthetic fertilizers. Removal efficiencies of N&P from domestic wastewater with clinoptilolite were also over 90%, reaching complete removal at initial phases of operation, both for constant and with peak loads of ammonium. This paper provides an overview of work focusing upon the use of clinoptilolite for removal and recovery of nutrients within the context of wastewater management.

## **NATURAL GAS STORAGE ON SILICON, CARBON, AND SILICON CARBIDE NANOTUBES: A COMBINED QUANTUM MECHANICS AND GRAND CANONICAL MONTE CARLO SIMULATION STUDY**

Sayyed Jalil Mahdizadeh<sup>1</sup> and Eleheh K. Goharshadi<sup>1,2</sup>

<sup>1</sup>Dept. of Chemistry, Ferdowsi Univ. of Mashhad, Mashhad 91779, Iran

<sup>2</sup>Center of Nano Research, Ferdowsi Univ. of Mashhad, Mashhad 91779, Iran

a. Corresponding author (saja.mahdizadeh@gmail.com )

Grand canonical Monte Carlo (GCMC) simulation combined with ab initio quantum mechanics calculations were employed to study methane storage in homogeneous armchair open-ended single-walled silicon nanotubes (SWSiNTs), single-walled carbon nanotubes (SWCNTs), and single-walled silicon carbide nanotubes (SWSiCNTs) in triangular arrays. Two different groups of nanotubes were studied: the first were (12,12) SiNTs, (19,19) CNTs, and (15,15) SiCNTs and the second were (7,7) SiNTs, (11,11) CNTs, and (9,9) SiCNTs with the diameters of 26 and 15 Å for the first and second groups, respectively. The potential energy functions were calculated using ab initio quantum mechanics and then fitted with (12,6) Lennard–Jones potential model as a bridge between first-principles calculations and GCMC simulations. The absolute, excess, and delivery adsorption isotherms of methane were calculated for both groups. The specific surface area and the isosteric heat of adsorption were computed. The radial distribution functions for the adsorbed molecules on different nanotubes were also calculated. According to the results, the excess uptake value of methane adsorption in (11,11) CNT array exceeded the US Dept. of Energy target (180 V/V at 298 K and 35 bar). The results indicate that SiNTs and SiCNTs are not desirable materials compared with corresponding CNTs for natural gas storage.

## **STRUCTURAL AND ELECTRICAL PROPERTIES OF PALLADIUM/SILVER BIMETALLIC NANOPARTICLES PREPARED BY CONVENTIONAL AND ULTRASONIC-ASSISTED REDUCTION METHODS**

Hossein Azizi toupkanloo, Elaheh K. Goharshadi, Paul Nancarrow

*a.* Corresponding author (ho\_azizi60@yahoo.com)

Polyvinylpyrrolidone (PVP)-stabilized Pd/Ag bimetallic nanoparticles (NPs) with the average particle sizes of 9 and 6 nm were synthesized by simultaneous reduction in the presence and absence of ultrasound waves, respectively. The prepared NPs were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), high resolution-TEM (HRTEM), UV-vis spectroscopy, scanning tunneling microscopy (STM), and energy dispersive X-ray (EDX) analysis. The XRD and HRTEM analyses showed Pd/Ag NPs are in the alloy structure. The electrical conductivity of nanofluids of Pd/Ag bimetallic NPs in distilled water at different mass fractions and temperatures was measured. The temperature dependence of electrical conductivity of the nanofluids is much less than that of mass fraction of NPs. 3041% increase in electrical conductivity of distilled water was observed when 1% Pd/Ag NPs was added at 25 °C.

## **RHEOLOGICAL PROPERTIES OF GRAPHENE-GLYCEROL NANOFUIDS**

Monireh Barati Moghaddam<sup>a</sup>, Elaheh Goharshadi

*a.* Corresponding auhtor (monirehbarati@yahoo.com)

Due to the excellent properties of graphen, it has been received considerable scientific and technological attention. The rheology of suspensions and colloidal dispersions is critical to product performance in many industrial applications and process efficiency. Rheology based measurements can help to predict which formulations might exhibit flocculation or coagulation, resulting in undesired effects such as settling, separation, etc. A number of factors influence the rheology of a suspension including particle size, particle distribution, shear rate, the mass fraction of solids present, etc. To the best of our knowledge, the rheological properties of nanofluids of graphene-glycerol as functions of shear rate, mass fraction, and temperature were studied for the first time. The experimental results, showed that although the base fluid, glycerol, acts a Newtonian fluid, the nanofluid of graphene-glycerol behaves as non-Newtonian fluid at low shear rates. Our results showed that increasing temperature decreases viscosity since the intermolecular interactions between graphene-glycerol and between the molecules of glycerol weaken. The effect of change of mass fraction of graphene on the viscosity of graphene-glycerol was also investigated. As the mass fraction increases, the distance between particles decreases and the fluid becomes less mobilized and hence the viscosity increases.

## **RHEOLOGICAL PROPERTIES OF FABRICATED TUNGSTEN OXIDE NANOPARTICLE DISPERSED IN ETHYLENE GLYCOL**

Mahdi. Karimi <sup>1,a</sup> and Elaheh. K. Goharshadi <sup>1,2</sup>

<sup>1</sup>Dep. of Chemistry, Faculty of Sciences, Ferdowsi Univ. of Mashhad, Mashhad 91779, Iran

<sup>2</sup>Center of Nano Research, Ferdowsi Univ. of Mashhad, Mashhad, Iran

a. Corresponding author (me\_karimi@yahoo.com)

Tungsten oxide nanoparticles, WO<sub>3</sub>, with the average particle size of 19 nm were prepared by hydrothermal method. Prepared tungsten oxide NPs were dispersed in ethylene glycol (EG) as base fluid by ultrasonic waves. The rheological properties of the nanofluids of tungsten oxide nanoparticles in ethylene glycol were studied as functions of mass fraction, temperature, and shear rate. The resulting nanofluids showed either Newtonian or non-Newtonian behavior depending on their shear rate. The experimental results showed that the viscosity of nanofluid increases with increasing the mass fraction and decreases with increasing temperature as exponentially.

## **THE SYNTHESIS AND CHARACTERIZATION OF COPPER-BASED METAL-ORGANIC FRAMEWORKS AND ZINC-BASED ZEOLITIC-IMIDAZOLE FRAMEWORKS**

Elif Macunlar, Sennur Deniz\*

Yıldız Technical Univ., Chemical-Metallurgical Faculty, Chemical Eng. Dept.,

Davutpaşa cd. Nr: 127, 34210, Esenler-Istanbul, Turkey

a. Corresponding author (deniz@yildiz.edu.tr)

The synthesis of metal-organic frameworks (MOFs) has attracted immense attention during the last two decades due to the possibility to obtain a large variety of esthetically interesting structures that could also be of great interest for applications in a number of fields related to porous materials. This includes the more traditional areas of storage, separation, and catalysis, which are based on the pore size and shape as well as the host guest interactions involved. In addition, biomedical applications or the use as sensor materials are currently intensively investigated. At the same time, chemists with a background in the synthesis of zeolites and zeolite-related materials started to look at the use of organic molecules not only as structure-directing agents but also as reactants to be incorporated in as a part of the framework structure. Coordination chemistry has accounted for introducing electrochemical and mechanochemical synthesis as well as concepts like the precursor approach or in situ linker synthesis. On the other hand, from zeolite chemistry the concepts of solvothermal reaction conditions, structure-directing agents, mineralizers, as well as microwave-assisted synthesis or steam-assisted conversion have been also introduced. Starting from the same reaction mixtures, they can lead to different MOFs. They may have a strong impact on reaction time, yields, or particle size and morphology, or may be differently well suited for the implementation in large-scale processes. In addition to the crystal size or shape, thin films, membranes, and various other shapes made of MOFs have been reported, which require the application of different synthesis methods. The interest in porous coordination polymers and MOFs started only around 1990. In 1989 and 1990, the seminal work by Hoskins and Robson set the basis for the future of MOFs. In their paper, they already envisioned what has been subsequently shown by many scientists around the world: the formation of a large range of crystalline, microporous, stable solids, possibly using structure-directing agents, with ion-exchange, gas sorption, or catalytic properties.

The term of MOF was popularized by Yaghi et al. around 1995 for a layered Co-trimesate that showed reversible sorption properties. In 1997, a 3D MOF was reported by Kitagawa et al. that exhibited gas sorption properties at room temperature. In 1999, the synthesis of MOF-5 and HKUST-1 were reported that in the following years and up to now are among the most studied MOFs. Starting in 2002, Ferey et al. reported on nonflexible as well as flexible porous MOFs, i.e., MIL-47 and MIL-53/MIL-88, respectively [5,6,7,8]. In 2002, the family of MOFs was extended to imidazolate-based compounds that are nowadays known as zeolitic imidazole frameworks (ZIFs) [9].

In this study, the synthesis of copper-based metal-organic frameworks (MOFs) and zinc-based zeolitic-imidazole frameworks (ZIFs) with various organic ligands, metal sources and solvents were studied to obtain the different nanoporous structures. The properties of synthesized MOFs and ZIFs were characterized by using the scanning electron microscopy (SEM), X-Ray diffraction (XRD), thermogravimetric analysis (TGA), Fourier transform infrared spectroscopy (FTIR). In the future work, the polymeric nanocomposite membranes for gas separation will be prepared using the varying amounts of the synthesized MOFs and ZIFs.

## **SYNTHESIS OF HIGH PURITY SiO<sub>2</sub> AND Ta<sub>2</sub>O<sub>5</sub> POWDERS AND THEIR USES IN ANTIREFLECTING COATINGS**

A.M. Avci<sup>1,a</sup>, O. Uysal<sup>1</sup>, B.Yazgan<sup>2</sup>, C.D. Ozturk Selcuk<sup>2</sup>, A.E.S. Özhan<sup>2</sup>, E. Suvaci<sup>3</sup>, E. Ozel<sup>3</sup>, Y. Sahin<sup>4</sup>,

<sup>1</sup> ENTEKNO Ltd., Anadolu Teknopark, Eskisehir.

<sup>2</sup> ASELSAN Inc., Akyurt Tesisleri, Etlik, Ankara.

<sup>3</sup>Anadolu Univ., Dept. of Materials Sci. and Eng., Iki Eylul Campus, Eskişehir.

<sup>4</sup> Anadolu Univ., Dept. of Chemistry, Faculty of Science, Eskisehir.

a. Corresponding author (amuratavci@gmail.com)

Antireflecting coatings reduce reflections of the optical lenses or optical devices. Low and / or high refractive index materials with high purity levels (e.g 99.99%) can be used for eliminating reflections for specific wavelengths. These materials with desired chemical and physical properties are synthesized by improved techniques such as sol-gel, hydrothermal, precipitation etc. In this study, SiO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> coating materials were synthesized via such techniques and analysed to prove their properties by characterization techniques such as SEM, XRD, XRF, GD-MS etc. Synthesized materials were used to obtain single layers of thin films which were deposited on glass substrates via plasma assisted e-beam evaporation. Spectral performance of the films over the visible range was investigated using a UV-Vis spectrophotometer. Results of the spectrophotometric measurements were used to determine the optical constants of the thin films. Durability of the coatings in the under salt fog and humid environments as well as their adhesion properties were characterized according to military standards. Our results show that SiO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> coatings manufactured using the evaporation materials synthesized using the aforementioned powder synthesis methods can be suitable for design and manufacturing of electro-optical components such as filters, all dielectric mirrors and AR coatings.

## **SWELLING BEHAVIOR IN MICROWAVE SINTERING OF FE-AL MIXTURES**

Mehmet ÇAKMAKKAYA<sup>1</sup>, Şükrü TALAŞ<sup>2</sup>

1. Afyon Kocatepe Univ. Technology Faculty, Dept. of Automotive Eng., Afyonkarahisar.

2. Afyon Kocatepe Univ. Technology Faculty, Dept. of Metallurgy and Materials Eng., Afyonkarahisar

a. Corresponding author (cakmakkaya@aku.edu.tr)

Iron aluminides are intermetallics composites that are potentially suitable for applications such as high temperature corrosion. There are different manufacturing methods which can be applied for this composite. From these, P/M could be remarked as a highly effective and economic method compared with other alternatives. Sintering of elemental powders of Fe and Al can be an alternative manufacturing method for Fe aluminides. Nevertheless, the swelling problem is always observed in a stress-free reactive sintering of iron-aluminum elemental powder mixtures, even in a microwave sintering of iron-aluminum elemental powder mixtures. Present study on the stress-free vacuum quartz tube sintering of Fe-26at. % Al compacts showed that the eliminating swelling behavior is possible under vacuum.

## ADSORPTIVE REMOVAL OF CI BASIC YELLOW 28 AND CI BASIC GREEN 4 BY PRETREATED GARLIC PEEL FROM SINGLE AND BINARY DYE SOLUTIONS

Atmani Fatima<sup>1,2</sup>, Yeddou Mezenner Nacera<sup>2,a</sup>, Sadaoui Zahra<sup>2</sup>, Belmedani Mohamed<sup>2</sup>

<sup>1</sup> Saad Dahlab Univ., Blida, Faculty of Eng. Sciences

<sup>2</sup>Laboratory of Chemical Eng., Faculty of Mechanical and Chemical Eng.  
Univ. of Sciences and Technology Houari-Boumediene, USTHB, BP 32 El Alia,  
Bab Ezzouar 16111, Algiers, Algeria

a. Corresponding author (yeddouna@yahoo.fr)

The adsorption of two basic dyes, CI Basic Yellow 28 and CI Basic Green 4, was studied in single and binary solute systems using pretreated garlic peel as sorbent (250–350  $\mu\text{m}$ ). Adsorption rate data indicates that CI Basic Green 4 adsorbs more rapidly than BY 28 and a pseudo-second-order model was found to fit the kinetic curves, with regression coefficients above 0.99. Adsorption isotherms in single solute systems at pH 7 and pH8, 5 were respectively analysed according to the Freundlich and Langmuir models using non-linear regression. Best fits were obtained with the Freundlich model. In binary dye systems the adsorption at three molar ratios (1:5, 1:2 and 5:1) demonstrated that the adsorption of BG 4 was greater than that of BY 28, this was in agreement with the results obtained for single solute systems. Equilibrium adsorption of CI Basic Yellow 28 and CI Basic Green 4 in binary solutions has been quite well predicted by the extended Freundlich and the Sheindorf-Rebuhn-Sheintuch (SRS) models. The isotherm curves constructed in the temperature range of 293–313 K, show that the optimum temperature is 293 K for the two dyes.

## EFFECT OF HEAVY METALS ( $\text{Cr}^{6+}$ , $\text{Cd}^{2+}$ , $\text{Pb}^{2+}$ ) ON BIOSORPTION OF BASIC RED 46 ONTO DEAD PLEUROTUS MUTILUS

F. Atmani<sup>1</sup>, N. Yeddou- Mezenner<sup>2</sup>, H. Kais<sup>2</sup>, Z. Sadaoui<sup>2</sup>, M. Belmedani<sup>2</sup>

<sup>1</sup> Saad Dahlab Univ., Blida, Faculty of Eng. Sciences

<sup>2</sup>Laboratory of Chemical Eng., Faculty of Mechanical and Chemical Eng.  
Univ. of Sciences and Technology Houari-Boumediene, USTHB, BP 32 El Alia,  
Bab Ezzouar 16111, Algiers, Algeria

a. Corresponding autor (yeddouna@yahoo.fr)

The paper studies the effect of chromium, cadmium and lead on the removal efficiency of basic red 46 onto dead *Pleurotus mutilus*. Series of batch studies was carried out to identify the optimum biosorption conditions such as pH, biosorbent dosage, initial dye concentration and equilibrium time. An equilibrium time of 45 min was achieved for basic red 46 in mono-component system as well as in binary one. It was determined that dead *pleurotus mutilus* shows better biosorption performance towards basic red 46 in binary adsorption systems at higher pH. The addition of Chromium, Lead and cadmium caused a 10.23 %, 8.12% and 5% increase in basic red 46 biosorption, respectively.

The rate of kinetic processes of single and binary systems onto dead *Pleurotus mutilus* was described by using three kinetics adsorption models : the pseudo-first order, pseudo-second order and intraparticle diffusion. The pseudo-second-order model was the best choice among the kinetic models to describe the biosorption behaviour of single and binary system onto dead *Pleurotus mutilus* and the biosorption is diffusion process with two stages.

The experimental data were modeled by Langmuir and Freundlich models.

## **PHTES MODIFIED SILICA COATINGS BY SINGLE STEP SOL-GEL PROCESS**

Merve Metin, Sennur Deniz<sup>a</sup>

Yıldız Technical Univ., Chemical-Metallurgical Faculty, Chemical Eng. Dept.,  
Davutpaşa cd. Nr: 127, 34210, Esenler-Istanbul, Turkey  
a. Corresponding author (deniz@yildiz.edu.tr)

Hydrophobic effect was prepared on the alumina and glass surfaces via sol-gel method at this study. The aim was to achieve hydrophobic surfaces. This study was targeted Al surfaces and achieved hydrophobic Al surfaces. To enhance nanoroughness of the surface, chemical etching method was applied to the aluminum substrates before coating by using an acidic solution.

Wetting phenomena of water droplets on solid surface are of crucial concern in our daily life as well as in engineering and science (Latthe, vd., 2009). This work describes the room temperature synthesis of superhydrophobic silica films on glass and alumina substrates using phenyltriethoxysilane (PhTES) as a co-precursor. The coating sol was prepared by keeping the molar ratio of tetramethoxysilane (TMOS) precursor, methanol (MeOH), water (H<sub>2</sub>O) constant with 3 M HCl for all experiments and the PhTES/TMOS molar ratio (M) was varied. It was found that with an increase in M value, the hydrophobicity of the films decreased. The hydrophobic silica films were characterized by Atomic Force Microscopy (AFM), static water contact angle (WCA) measurements and the highest WCA value was found at Al surface as  $\theta=103^\circ$  for M=1.57.

## **IN-VITRO RELEASE OF THEOPHYLLINE THROUGH CELLULOSE ACETATE MEMBRANES MODIFIED BY n-SiO<sub>2</sub>**

Gülşen Asman<sup>a</sup>, Mürvet Taşkın

Gazi Univ., Faculty of Science, Dept. of Chemistry, Ankara, TURKEY  
a. Corresponding author (gulsen@gazi.edu.tr)

Release characteristics of theophylline from n-SiO<sub>2</sub> modified cellulose acetate membranes (n-SiO<sub>2</sub>-CA) were investigated at in-vitro conditions. The effect of the thickness of the membrane, pH of donor and receiver solutions, concentration of theophylline and temperature on the release performances of theophylline from membranes was studied. As the thickness of the membrane increased the transfer of theophylline decreased in accordance with Fick's first law. It was concluded that the permeation of theophylline through the membranes is high for the pH's at which theophylline has high solubility. Increase in theophylline concentration and temperature increased the amount of theophylline transferred from the membranes. The activation energy for the transfer at theophylline from n-SiO<sub>2</sub>-CA membranes was found as 12.17 J/mol.

## **PREPARATION AND CHARACTERIZATION of CELLULOSE ACETATE MEMBRANES MODIFIED BY n-SiO<sub>2</sub>**

Gülşen ASMAN<sup>1,a</sup>, Mürvet TAŞKIN<sup>1</sup>, Nursel PEKEL BAYRAMGİL<sup>2</sup>

1. Gazi Univ., Faculty of Science, Dept. of Chemistry/ Ankara-TURKEY
2. Hacettepe Univ., Faculty of Science, Dept. of Chemistry/ Ankara-TURKEY  
a. Corresponding author ( gulşena@gazi.edu.tr)

Cellulose acetate (CA) is a biologically compatible polymeric additive for drugs as a pharmaceuticals dosage forms. CA is used in osmotic release systems [1-3], transdermal release systems [4-5], used as a covering material of drug-cores [6-8] and also in the polymeric matrix systems [9]. In this study, CA membranes were modified by nano-silicon dioxide (n-SiO<sub>2</sub>) and Theophylline was preferred as a model drug; the effects of preparation parameters on the permeation of theophylline through the membranes were studied. Thermal and morphological analysis of the membranes was done by DSC, AFM, SEM analysis. Surface characteristics of the films toward water were studied by contact angle measurements and hydrophilic character and the free volume suitable for permeation were investigated by swelling behaviors of the membranes. As a result of the study it was determined that modification of CA membranes by using n-SiO<sub>2</sub> increased the amount of theophylline transfer.

## **INFLUENCE OF NI CATALYST FILM STRUCTURE ON NUMBERS OF GRAPHENE LAYERS GROWN BY CVD**

Elif Ozceri<sup>a</sup> and Yusuf Selamet

Dept. of Physics, Izmir Inst. of Technology, Urla Izmir 35430, Turkey  
a. Corresponding author (elifozceri@iyte.edu.tr)

Graphene is a wonder material due to unmatched excellent properties and great number of potential applications. One of the compelling techniques to synthesize graphene is Chemical Vapor Deposition (CVD) over few hundred nm thick films.

In this work, some of the parameters which effect the number of graphene layers such as thickness and surface structure of Ni catalyst films were examined. By using magnetron sputtering technique several samples of various thickness polycrystal Ni catalyst films were grown on buffer/Si substrates. These catalysts films were annealed at 900 °C. Their crystal structures, surface roughness and morphology were studied by X-ray Diffraction, Atomic Force Microscopy and cross sectional Scanning Electron Microscopy. The CVD growth of graphene was carried out using Ar, H<sub>2</sub> and CH<sub>4</sub> gases exactly at annealing temperature. The Raman spectroscopy was utilized in order to determine the number of the layers, the size and quality of graphene. The strong effect of buffer layers on Ni catalyst surface roughness and as a result of that the change in the number of graphene layers were observed.

## **ANALYSIS OF MULTIPHASE TRANSPORT PROCESSES AND FLUID DISPERSION IN SINTERED POROUS STRUCTURES**

Nils Hornig<sup>a</sup>, Udo Fritsching

Univ. of Bremen, Particle and Process Eng., Badgasteinerstr. 3, 28359 Bremen, Germany  
a. Corresponding author (hornig@iwt.uni-bremen.de)

This work focusses on the simulation and experimental study of multiphase transport processes and fluid dispersion in porous structures, as they occur for the generation of mono dispersed droplet sizes in membrane emulsification processes. The internal fluid dispersion of two non-miscible fluids in premix membrane emulsification processes is investigated to understand the connection between the internal fluid dispersion and the structural properties of the membrane. Therefore, CFD methods are implemented for a prediction of resulting droplet sizes and distributions under a certain energy input for fluid dispersion to occur. As models of sintered porous structures, randomly generated sphere packings under predetermined structural parameters are investigated as well as computer tomogram models of sintered glass particle structures of different porosity classes. The model validation has been achieved through single phase simulations of momentum transport related to experimental pressure drop measurements and analytical pressure drop correlations. In addition, ceramic membrane structures were fabricated, characterized and the generated product emulsion droplet sizes compared to such generated with sintered glass structures.

## **CHALLENGES IN MIXING OF IRON OXIDE AND CARBON BLACK WITH POROUS LYCOPODIUM SPORES FOR FINGERPRINT POWDER PRODUCTION**

Merve GÜRTEKİN SEDEN, Tuğba IPEKSAÇ, Serkan GÜRBÜZ, Bahar ÖZMEN MONKUL and Melek EROL

a. Corresponding author (merve.gurtekin@tubitak.gov.tr)

Fingerprint powders are highly used for criminal investigation worldwide. Some commercial black latent print powders contain carbon black or iron oxide as colorant, and lycopodium spores as carriers of the inorganic pigment particles onto the fingerprint residue. Carrier lycopodium powders are spores of the clubmoss *Lycopodium Clavatum*. Each lycopodium spore is roughly isodiametric and approximately 25  $\mu\text{m}$  in diameter with regularly distributed pores of 6- $\mu\text{m}$ -aperture-size. Particle size of carbon black and iron oxide used for this study was about 200 nm and 2  $\mu\text{m}$ , respectively. These inorganic particles need to fill the lycopodium pore apertures homogeneously during the mixing process for the fingerprint powder to develop latent fingerprints successfully. However, this mixing process is quite challenging.

In this work laboratory scale mixing procedures for high quality fingerprint powders for crime scene investigation were developed. For this aim three different mixing devices- a Spex SamplePrep 8000D Dual Mixer/Mill high energy ball mill, a Fritsch Planetary Mono Mill Pulverisette6 ball mill and a Turbula T2F Shaker Mixer- were used. For the obtainment of a homogeneously mixed fingerprint powder, the effects of mixing parameters such as fill level, rotation speed, mixing time and presence of mixing aids will be discussed.

## ALDEHYDE SUBSTITUTED PHTHALOCYANINES FOR SCHIFF BASE METAL COMPLEX FORMATION

Pinar Sen<sup>a</sup>, Salih Zeki YILDIZ<sup>a</sup>

Sakarya Univ., Faculty of Arts and Sciences, Dept. of Chemistry, 54187 Serdivan-SAKARYA

a. Corresponding author (sen\_pinar@hotmail.com, szy@sakarya.edu.tr)

Organic materials for chemical sensors are typically based on functional groups, especially the crown ethers and amines having rich electron-donor units. Phthalocyanines containing reactive functional groups have been interesting target for chemists due to bind metal ions for the development of new molecular materials. Architectural flexibility, high thermal, chemical and photochemical stabilities of phthalocyanines provide them to be used in different industrial applications due to bind metal ions for the development of new molecular materials.

Because of the synthetic difficulties, there have been only a few examples with the appended ligating group containing heteroatoms (N, S, O) for sensing to metal ions as advanced materials.

In this study, we synthesized and characterized metal-free and metallo phthalocyanines bearing tetra(2-formylphenoxy) substituents as functionalized materials. We have also studied the chemical reactivity and the selectivity of tetra(2-formylphenoxy) substituted Zn-Pc(9), via the monitoring Uv-vis spectroscopic changes when Schiff base and its metal complex occurred on their periphery by the addition of o-aminophenol and nickel (II) ions, respectively.

## EXPERIMENTAL STUDY ON WORKABILITY OF WARM MIX ASPHALT WITH NATURAL ZEOLITES

Sevil Köfteci\* Niyazi Uğur Koçkal\*\*

a. Corresponding author (skofteci@akdeniz.edu.tr)

Zeolite is a natural volcanic porous tuff having remarkable absorption ability, large specific surface area and lightness. Thus, it provides also catalytic abilities. Natural zeolite is abundantly available in our country. Therefore, seeking the utilisation possibilities of this porous material in asphalt mixes at lower temperatures by means of evaluating the workability would be a realistic approach. The main purpose of using zeolite in warm mix asphalt is to produce hot mix asphalt for road construction at lower temperatures. The reduction of temperatures of hot mix asphalt means a significant environmental effect such as reduction in burning fuel uses, fumes and odors etc. In this study, asphalt mixes containing different amounts of zeolite and ordinary asphalt mix (control mix) were compared. As a result, this material with these properties can be used as filler in warm mix asphalt production.

## PREPARATION AND CHARACTERIZATION OF BIOCOMPOSITE POLYSTYRENE NANOFIBERS FOR FOOD PACKAGING

Eyüp Karaca<sup>1</sup>, Özgün Arslan<sup>1</sup>, Fatma Özge Gökmen<sup>2</sup>, Nursel Pekel Bayramgil<sup>1</sup>

<sup>1</sup> Hacettepe Univ., Faculty of Science, Dept. of Chemistry, 06800, Beytepe-Ankara, Turkey

<sup>2</sup> Bilecik Şeyh Edebali Univ., Central Laboratory, Bilecik, Turkey

a. Corresponding author (nursel@hacettepe.edu.tr)

Composites are materials made from two or more constituent materials with significantly different physical or chemical properties. When combined, these constituents produce a material showing superior characteristics that differ from those of individual components. Light-weight, dimensional stability, high mechanical properties, high chemical resistance, high heat resistance and tailoring electrical properties as desired can be considered among the excellent properties of composite materials. When dispersed phase is of biological origin, composite is referred to as biocomposite. Polystyrene is a thermoplastic amorphous, stiff polymer with limited flexibility. It is considered to be one of the most versatile, easily fabricated, and cost-effective plastics. It is used in many different applications including packaging for food, disposable cutlery, plastic models, packing materials, insulation, and disposable beverage cups. The major disadvantage of polystyrene is its brittleness; in tension the strain at break is only few percentages. On the other side, polycaprolactone can be easily processed due to the low melting temperature. Mechanical properties and biodegradation through hydrolysis can be arranged by the crystalline structure of polycaprolactone. However, polycaprolactone is a neutral polymer and have some drawbacks as limited bioactivity and high hydrophobicity. The aim of this study is to obtain nanofiber mats comprising polystyrene and polycaprolactone for food applications. Nanofiber mats were produced by electrospinning. Long nanofibers with a diameter of 150 to 200 nm range were obtained. Thermal and mechanical properties of biocomposite nanofiber mats were investigated using simultaneous thermal analysis system and universal testing machine. Biodegradation test were conducted by gravimetric methods using Lipase enzyme. Mechanical properties of polystyrene were improved by adding polycaprolactone. Biodegradation of biocomposite polystyrene nanofiber mats was successfully achieved at laboratory conditions.

## REMOVAL OF $Zn^{2+}$ FROM AQUEOUS SOLUTION BY CHELATING ION EXCHANGE RESINS

Ceren Okuyucu, Ayça Aksoy, Özgür Arar, Müşerref Arda<sup>a</sup>, Ümran Yüksel

Ege Univ. Faculty of Science Dept. of Chemistry 35100 IZMIR, TURKEY

a. Corresponding author (muserref.arda@ege.edu.tr)

Heavy metals such as zinc, mercury, copper, cadmium as one of the important pollutants in water from a multitude of sources such as metal plating, mining, painting, batteries manufacturer. They can cause some health problem. Zinc as a trace element is essential for nutrition but if it is taken in high doses it may become toxic. So, it poses a risk of water resources when it is considered that it is not biodegradable and tends to accumulate in living organisms, causing depressions, lethargy, neurologic sings. Therefore it is necessary to eliminate Zn (II) from the source water, in order to prevent the deleterious impact of Zn (II) on ecosystem and public health.

In this study removal of Zn(II) from aqueous solution by chelating ion exchange resins was investigated. For this, two types of chelating ion exchange resins have been used for batch experiments. The analysis of Zn(II) was performed by spectrophotometrically.

The obtained results shows that the kinetic of iminodiacetic acid containing resin (Lewatit TP 207) is faster than the resin bearing aminomethylphosphonic acid groups (Lewatit TP 260). The solution pH has an important effect on Zn(II) removal. When the  $pH \geq 4$ , the concentration of Zn (II) in the aqueous solution decreased from 50 mg/L to 0.2 mg/L with about % 99 of Zn (II) removal for two type of resins. The experimental equilibrium data were tested for the Langmuir and Freundlich isotherms. Correlation coefficients indicate that Langmuir isotherm fit better than Freundlich isotherm for both resins.

## GENETIC DETERMINANTS OF THE STRUCTURAL AND MATERIAL PROPERTIES OF ADULT BONES

Engin Ozcivici

a. Corresponding author (enginozcivici@iyte.edu.tr)

Bone has many physiological and anatomical functions, and among those weight-bearing is essential for human posture and locomotion. Bone mass decreases during aging (osteopenia) and this trend increases individual risk of fractures. Adult bone mass is a strong indicator of bone mass in later life, therefore high mass during adulthood is considered to be protective from osteoporotic fractures. Also, structure and mass of adult bones is variable among humans, suggesting potential genetic effects. Here, we used female adult mice of a genetically heterogeneous population. Structural and material properties of trabecular bone from distal femoral metaphysis were evaluated using microCT. Trabecular bone volume fraction (BV/TV) showed normal distribution similar to humans. QTL analysis, which correlates variations in the observed phenotype to variations in the genome of individual mice, revealed 4 different spots on genome that explains 15% of variability observed in BV/TV. Similarly, 4 partially different QTL explained 27% of the variability of trabecular bone mineral density, which is representative for material properties of bone. Genomic locations indicated by the results may contain genes that regulate structural and material properties of adult bones. Identification of such genes is important in development of personalized biomedicine to protect individuals from aging related fractures.

## STUDY OF PRECIPITATION PROCESS IN TWO AL-MG-SI SHEETS

Y. Aouabdia<sup>1,a</sup>, A. Boubertakh<sup>2,b</sup>, F. Delaunois<sup>3,c</sup>, S. Hamamda<sup>b</sup>, M. N. Aventtand- FENOEL<sup>4,d</sup>

<sup>a</sup>Ecole Normale Supérieure de Constantine, Plateau du Mansourah, Constantine 25000, Algeria.

<sup>d</sup>Département de Physique, Université Montouri-Constantine 25000, Algeria.

<sup>c</sup>Faculté Polytechnique Service de Métallurgie, Rue de l'Épargne 56 B- 7000, Mons, Belgique.

<sup>d</sup>Unité Matériaux et Transformations, Bât. C6 Université Lille1, 59655 Villeneuve d'Ascq, France.

a. Corresponding author (youcefaouabdia@yahoo.fr)

The precipitation process in two Al-Mg-Si alloys elaborated by Direct Chill Casting has been investigated using differential scanning calorimetry (DSC), X ray diffraction, scanning electronic microscopy (SEM) fitted with X ray energy dispersive (EDX) and hardness measurements. The results indicate that the excess of Si accelerate the precipitation reaction. The activation energy of  $\beta'$  phase formation is determinate by Ozawa's method. The obtained values suggest that the  $\beta'$  phase formation in the first alloy is easier than that in the second alloy. X ray diffraction study showed that the intensity reflection of the corresponding to the formed precipitates is very weak. Moreover, this technique revealed the presence of anisotropy in both alloys. SEM micrographic showed clearly the existence of precipitates dispersed randomly in the  $\alpha$ -aluminum matrix. Two types of precipitate have been identified by EDX chemical analysis. They mainly contain in additions to Si, two transitions Mn and Fe. Compared to weak and literature data these latest precipitates can be attributed to the  $\alpha$ -AlFeSi phase and/or the cubic phase  $\alpha$ -Al (Mn,Fe)Si.

## **MICROWAVE ABSORPTION PROPERTIES OF CO,MN SPINEL FERRITE–ACRYLATED EPOXY NANOCOMPOSITES**

Harun Bayrakdar

a. Corresponding autor (h.bayrakdar@comu.edu.tr)

We have investigated the electromagnetic (EM) characteristics of  $\text{Co}_x\text{Mn}_{1-x}\text{Fe}_2\text{O}_4$  spinel ferrite (where  $x = 0.0, 0.5$  and  $1.0$ ) nanoparticles (NPs) / acrylated epoxy nanocomposite material at 8-20 GHz.  $\text{Co}_x\text{Mn}_{1-x}\text{Fe}_2\text{O}_4$  NPs. have been synthesized by cetyltrimethylammonium (CTAB) assisted hydrothermal route using NaOH. A variation of complex dielectric permittivity and magnetic permeability at room temperature with frequency in the range 8 GHz – 20 GHz has been studied. Particles showed phase purity and crystallinity in powder x-ray diffraction (XRD) analysis. At the same time,  $\text{Co}_x\text{Mn}_{1-x}\text{Fe}_2\text{O}_4$  NPs demonstrated a spinel cubic structure from XRD results. A reflection loss (RL) of  $-59.60$  dB was found at 12 GHz for an absorber thickness of 2 mm.  $\text{Co}_x\text{Mn}_{1-x}\text{Fe}_2\text{O}_4$  may be attractive candidates for EM wave absorption materials.

## **DIELECTRIC AND MAGNETIC PROPERTIES OF CO-MN SPINEL FERRITES**

HarunBayrakdar<sup>a</sup>

ÇanakkaleOnsekiz Mart Univ., Faculty of Eng., Dept. of Materials Sci. and Eng., Çanakkale, Turkey  
a. Corresponding author (h.bayrakdar@comu.edu.tr)

We have synthesis ferrite nanoparticles and ferrite-polymer nanocomposite structures, theoretically and experimentally investigated magnetic and dielectric behavior of ferrite nanoparticles. Variation of complex dielectric permittivity at room temperature with frequency in the range 1MHz–3GHz has been studied. Magnetization measurements showed that coercivity increasing with decreasing temperature and with increasing some particles.

## **SYNTHESIS AND PROPERTIES OF SUPERABSORBENT POLYMER COMPOSITES BASED ON CHITOSAN-GRAFT-POLYACRYLAMIDE AND CARBOXYMETHYLCELLULOSE**

Hafida Ferfera-Harrar<sup>1</sup>, Nacera Aiouaz<sup>1</sup>, Nassima Dairi<sup>1</sup>

<sup>1</sup>Materials Polymer Laboratory, Chemistry Faculty, Univ. of Sciences and Technology  
Houari Boumediene USTHB, Algiers, Algeria  
a. Corresponding author (harrarhafida@yahoo.fr)

Material's biodegradability has been widely focused on owing to environmental protection issues. The graft polymerization of hydrophilic monomers onto polysaccharides is convenient to prepare superabsorbents with improved biodegradability and bioactive functions.

In this study, superabsorbent polymer composites CTS-g-PAAm/CMC were synthesized via radical graft copolymerization of acrylamide (AAm) onto chitosan backbone in absence and presence of carboxymethylcellulose (CMC) using potassium persulfate as an initiator and N,N'-methylenebisacrylamide as crosslinker. The grafting reaction was confirmed by Fourier Transform Infrared Spectroscopy and Thermogravimetric Analysis. The Scanning Electron Microscopy showed porous structures. The composites were also hydrolyzed to achieve anionic superabsorbents with uppermost swelling capacity. The effects of CTS and CMC contents on swelling capacity of these superabsorbents were investigated in deionized water and NaCl 0.9 wt% solution. Regardless the swelling medium, the water absorbency was decreased upon increasing the CTS content and was enhanced by adding CMC into network. Also, the hydrolysis has not only greatly optimized the absorption capacity but also improved the salt-resistivity. Besides, thermal stabilities of these composites were improved compared to that of PAAm and CTS but slightly affected by the added CMC. The antibacterial tests against *S. aureus* and *E. coli* bacteria showed moderate inhibition of their growth.

## **ATOMIC LAYER DEPOSITION OF ALUMINIUM OXIDE ON SILICON CARBIDE NANOPOWDER**

TAIVO JÖGIAAS<sup>1</sup>, LAURI KOLLO<sup>2</sup>, JEKATERINA KOZLOVA<sup>1</sup>, AILE TAMM<sup>1</sup>, IRINA HUSSAINOVA<sup>2</sup> KAUPU KUKLI<sup>1,3</sup>

<sup>1</sup> Univ. of Tartu, Inst. of Physics, Dept. of Materials Science, Riia 142, EE-51014 Tartu, Estonia, <sup>2</sup> Tallinn Univ. of Technology, Dept. of Materials Eng., Ehitajate tee 5, EE-19086 Tallinn, Estonia, <sup>3</sup> Univ. of Helsinki, Dept. of Chemistry, P.O. Box 55, FI-00014, Univ. Helsinki, Finland  
a. Corresponding author (taivo.jogiaas@ut.ee)

Atomic layer deposition (ALD) is one of the most applicable methods for the conformal growth over three-dimensional substrates [1] and can be used for deposition of films onto porous objects. SiC tablets of 40 nm powder were pressed in a 20x20 mm die at 96 MPa. Consolidated green bodies were coated by about 10 nm thick Al<sub>2</sub>O<sub>3</sub> at 300 °C, using Al(CH<sub>3</sub>)<sub>3</sub>-H<sub>2</sub>O based ALD process. A 100 cycles (10s/10s/10s/30s pulse times of Al(CH<sub>3</sub>)<sub>3</sub>, N<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub>, respectively) of alumina deposition was conducted. Acquired structures were characterized and gained information is considered for designing of nanocomposites using ALD.

## ULTRASONIC-TREATED MCM-41: A TAILORED ADSORBENT

M.A. Zanjanchi, E. Sedighi

Dept. of Chemistry, Faculty of Science, Univ. of Guilan, Rasht, 41335-1914, Iran  
a. Corresponding author (zanjanchi@guilan.ac.ir)

MCM-41 is a mesoporous powder material and can be easily synthesized at room temperature in the presence of surfactant cations as structure-directing template. Our XRD analysis showed that MCM-41 preserve its structural order upon ultrasound irradiation. The as-synthesized MCM-41 were treated in ultrasonic bath for different time (1-30 min). The sonicated samples loss parts of their template according to the time of sonication. We used methyl orange as a reagent to estimate amount of the template (cetyltrimethylammonium bromide : CTAB) in the structure of MCM-41 samples. The results show that the amount of CTAB remained in the pores of MCM-41 varies at different sonication time. According to the obtained data longer time of the treatment leads to less amount of CTAB in the structure. These samples were used for examining the adsorption of organic compounds. Different conditions were tried to find out the highest amount of adsorption for phenol and 4-chlorophenol. . Our inspection showed that eliminating higher amount of the CTAB molecules out of MCM-41 will provide increased adsorption capacity of the mesoporous MCM-41 for removal of organics.

## SYNTHESIS, CHARACTERIZATION AND THE USE OF NOVEL POROUS SUPERABSORBENT P(ACRYLAMIDE) HYDROGELS AS TEMPLATE FOR HYDROGEN PRODUCTION

Fahriye Seven<sup>1</sup>, Nurettin Sahiner<sup>1,2</sup>

<sup>1</sup>Canakkale Onsekiz Mart Univ., Faculty of Sciences and Arts, Chemistry Dept., <sup>2</sup>Nanoscience and Technology Research and Application Center (NANORAC), Terzioglu Campus, 17100, Canakkale-Turkey.

a. Corresponding author (sahiner71@gmail.com)

P(AAm) hydrogels were synthesized via photo polymerization technique by use of acrylamide as monomer, N,N'-methylenebisacrylamide (MBA) as crosslinker and 2,2'-azobis(2-methylpropionamide) as UV-initiator. The obtained p(AAm) hydrogel were reacted with NaOH to develop highly swellable, porous and high metal ion metal absorbing network. The chemical modification induce changes were confirmed by swelling experiments, TGA, FT-IR and surface area analysis. The modified p(AAm) hydrogel were loaded with Co, Ni and Cu metal ions from their aqueous solutions and treated with aqueous NaBH<sub>4</sub> for in situ corresponding metal nanoparticles formation. The modified p(AAm)-M (M:Co, Ni or Cu) composites were used as catalyst in the hydrolysis of NaBH<sub>4</sub> for hydrogen generation, and catalytic performances were investigated. The amounts of metal ion within p(AAm) were determined by Atomic Absorption Spectroscopy (AAS). Various parameters effecting the catalytic performances of p(AAm)-M such as the amounts and the type of metal nanoparticles, the temperature, the extent of NaOH and etc were investigated. It was demonstrated the development of novel porous p(AAm) can be readily prepared and used template material for in situ metal nanoparticle preparation and as catalysts systems in hydrogen production.

## PHOTOCHROMIC BEHAVIOR OF SILVER NANOPARTICLE INCORPORATED TITANOSILICATE ETS-10 FILMS

Sezin Galioglu<sup>a,c</sup>, Melda İşler<sup>a,c</sup>, Zeynep Demircioğlu<sup>b,c</sup>, Raşit Turan<sup>b,c</sup>, Burcu Akata<sup>a,c,e,\*</sup>

<sup>a</sup> Micro and Nanotechnology Dept., Middle East Technical Univ., Ankara, Turkey

<sup>b</sup> Dept. of Physics, Middle East Technical Univ., Ankara, Turkey

<sup>c</sup> The Center for Solar Energy Research and Applications, Middle East Technical Univ., Ankara, Turkey

<sup>e</sup> Central Laboratory, Middle East Technical Univ., Ankara, Turkey

a. Corresponding author (sezingalioglu@gmail.com)

Photochromism is defined as a light-induced reversible change of color. The partially reversible photochromic behavior of silver(0) nanoparticle incorporated titanosilicate ETS-10 films was achieved for the first time. Silver(I) ions were incorporated into ETS-10 matrix by ion-exchange. Reduction/Oxidation process; as a result, colored form of the photochromic system (activated state)/colorless form of the photochromic system (bleached state) of silver(0) nanoparticle incorporated ETS-10 films was achieved through thermal reduction of the films and exposure of them to visible laser at wavelength of 532 nm, respectively.

The resulting samples characterized by ICP-OES, XRD, XPS, FE-SEM, UV-vis spectroscopies. XPS studies revealed that ionic form of silver was achieved instead of oxide form of silver (i.e., AgO and Ag<sub>2</sub>O), which could be attributed to smaller size of the silver(0) nanoparticles ( $\leq 2$  nm) formed in the pores of ETS-10. Partial restoration of color was achieved after second thermal treatment. Furthermore, the bandgap energy of the ETS-10 was calculated to be 3.37 eV by using Density Functional Theory. The Fermi level of the silver nanoparticles consisting of 20 atoms matches with bandgap energy of ETS-10, which enables electron transfer in redox reactions. Accordingly, the photochromic behavior observed can be ascribed to the -Ti-O-Ti-O-Ti- quantum wire.

## PREPARATION OF MESOPOROUS SILICAS FROM BAGASSE ASH USING POLYETHYLENE GLYCOL TEMPLATING

Heru Setyawan<sup>a</sup>, Nanik Astuti Rahman, Ika Widhiana, Sri Rachmania Juliastuti, Samsudin Affandi

a. Corresponding author (sheru@chem-its.ac.id)

Bagasse ash (BA) is a solid waste resulting from the burning of bagasse in boilers in sugar cane mills. BA is rich in silica (~51 wt.%). In this work, BA was used as raw material for the preparation of mesoporous silicas using polyethylene glycol (PEG) templating. Silica in BA was extracted by NaOH solution at its boiling point to produce sodium silicate solution. The sodium silicate solution was then added dropwise into acid PEG solution. The gel was aged at 80 °C for 2 h and at 90 °C for 16 h. Then, the PEG template was removed by either calcination at 550 °C or solvothermal extraction using dimethyl sulfoxide (DMSO) solution. The results showed that the method of template removal influenced the surface area of silica gels. The surface area of silica gels prepared by solvothermal extraction takes the value of about twice than that of prepared by calcination. The surface area using solvothermal extraction was about 652 m<sup>2</sup>/g at pH 3 and it decreased by increasing the pH and reached 150 m<sup>2</sup>/g at pH 7. The surface area tended to increase by increasing the PEG concentration and then constant.

## **SYNTHESIS OF ORDERED MESOPOROUS CARBON WITH LARGE PORE SIZE IN ORDER TO BE USED IN PEM FUEL CELLS**

F. Çiğdem GÜLDÜR<sup>1</sup>, Silver GÜNEŞ<sup>2</sup>

<sup>1</sup>Gazi Univ., Eng. Faculty, Chemical engineering Dept., Maltepe, ANKARA

<sup>2</sup>Gazi Univ., Inst. of Science and Technology, Besevler, ANKARA

a. Corresponding author (cguldur@gazi.edu.tr)

Ordered Mesoporous Carbons (OMC's) are a relatively new family of materials with many potential engineering applications. One of such applications is the fuel cells, for which they can serve as catalyst support materials. In particular, PEM fuel cells need the use of carbon supports with large and ordered pores for an effective distribution of the platinum catalyst and a rapid gas diffusion rate. Classical OMC synthesis methods fail to obtain ordered structures with large pores, however, recently developed self-assembly methods enable a better control of the textural properties.

In this study, it was aimed to develop an OMC carbon with a large and ordered pore texture. To increase the pore size, an inorganic-organic self assembly strategy was employed in which tetraorthosilicate (TEOS) was added to the reaction mixture to form silica chains and increase the pore size. The synthesis procedure consists of the polymerization reaction of resorcinol and formaldehyde in the presence of micelle forming surfactant (pluronic f127) and addition of TEOS. The resultant polymer phase was carbonized at 850 °C to remove the organic constituents and finally etched by HF to remove the siliceous agents. The carbon sample was analyzed by nitrogen physisorption, x-ray diffraction spectroscopy, thermogravimetric analysis and energy dispersive spectroscopy. Results showed that an ordered structure was successfully obtained, having a pore diameter of 9,5 nm and a surface area of 711 m<sup>2</sup>/g. The ordered structure was also confirmed by x-ray spectroscopy analysis. EDS results showed that the final structure was carbonaceous and nearly all the silica has been removed after etching. It was

## **RESEARCH AND DEVELOPMENT OF SURFACE-ACTIVE POWDER COMPOSITE MATERIAL BASED ON VISCOUS-FLOW WASTE**

Komila Negmatova<sup>1</sup>, Sayibjon Negmatov<sup>1</sup>, Akrom Rajabov<sup>1</sup>, Gappor Rahmonberdiev<sup>1</sup>, Jahongir Negmatov<sup>1</sup>, Gulom Sharifov<sup>1</sup>, Shodil Isakov<sup>1</sup>

1. State Unitary Enterprise "Fan va Taraqqiyot", Tashkent State Technical Univ., Uzbekistan  
a. Corresponding author (polycomft2005@rambler.ru)

First time it was developed and scientifically proved the possibility of creating an effective surface-powder formulations of composite gossypol resin to stabilize the drilling fluids and their production technology, using local raw materials, wastes of oil and fat production, gossypol resins, non-ferrous metals - alyumak.

We developed the optimum compositions of modified powder composite gossypol resin type PCGR to stabilize drilling fluids and found that they have surface-active properties.

Shown the closeness of their surface activity at concentrations in drilling fluids more than 0.05% to the activity sulphanol, as compared to OP-10 is much higher, which suggests the possibility of their use as surfactants instead of expensive sulphanol and OP-10. Studies show that emulsifying properties of developed modified powder composite formulations of gossypol resin indicate that, due to their high surface activity, they are adsorbed on the alyumak surface, which is consistent with the theory of mono-molecular adsorption of American scientists Langmuir.

## **RESEARCH AND DEVELOPMENT OF COMPOSITE POWDER MATERIALS BASED INDUSTRIAL WASTES FOR USE IN DRILLING OF OIL AND GAS WELLS**

Komila Negmatova<sup>1</sup>, Soyibjon Negmatov<sup>1</sup>, Bakhrom Mamanov<sup>1</sup>, Gappor Rahmonberdiev<sup>1</sup>, Jakhongir Negmatov<sup>1</sup>, Nodir Kobilov<sup>1</sup>, Malika Negmatova<sup>1</sup>

1. State Unitary Enterprise "Fan va Taraqqiyot", Tashkent State Technical Univ., Uzbekistan  
*a.* Corresponding author (polycomft2005@rambler.ru)

First time it was developed and scientifically substantiated the possibility of creating of effective composite powder formulations of chemicals reagents for drilling fluids and production their technology, using local raw materials and waste production of nitric acid – “nedopal”, non-ferrous metals – “alyumak” and modified powder gossypol resin - CPGR.

We discovered the pattern of the influence of ingredients of composite compositions of chemical reagents on the physical and chemical processes, which lead to an increase of technological and operational characteristics of drilling fluids, and allow perform the drilling operations in complicated geological and technical conditions.

We developed optimum composition of composite chemical reagents type CCR for drilling fluids and found that they exhibit surface-active properties. The expediency of using the developed new composite chemicals in drilling muds instead of expensive imported was shown, both in fresh and in high mineral formation water. It increases the possibility of drilling operations without complications and accidents.

## **MICROBIAL HEAT SHOCK PROTEIN GROEL TRIGGERS HUMAN T CELL APOPTOSIS**

Ayten Nalbant

- a.* Corresponding author (aytennalbant@iyte.edu.tr)

Modulation of apoptosis could be a critical factor in defining the outcome of an infection. The purpose of the present study was to investigate the ability of endogenous GroEL protein of *Actinobacillus actinomycetemcomitans* (Aa) to induce human T cells apoptosis. One of the GroEL (Hsp60) expressing bacteria is periodontal pathogens *A. actinomycetemcomitans*. It is a Gram-negative bacterium which lives in oral cavity and often associated with localized aggressive periodontitis. In this study, peripheral blood T cells were treated with endogenous GroEL. Apoptosis was measured by phosphatidylserine exposure, caspase-3 activation and DNA fragmentation. Data showed that GroEL induces T cell apoptosis. Plasma membrane changes in GroEL-treated T cells were dose- and time-dependent. Active caspase-3 was also detected in apoptotic T cells. Addition of caspase inhibitor Z-VAD-FMK to the cultures decreased T cell apoptosis. There was also significant level of DNA fragmentation. Interestingly, other bacterial Hsp's did not induce apoptosis including *E. coli* Hsp60, *M. tuberculosis* Hsp71 and *M. bovis* Hsp65. Overall, we demonstrated first time that endogenous GroEL of this oral bacterium has a capacity to induce T cell apoptosis. Therefore, it possible that endogenous GroEL protein can utilize apoptosis process to shape the outcome of infection in inflammatory diseases.

## **PREPARATION OF CHEMICALLY-MODIFIED ACTIVATED CARBON FROM OLIVE STONES AND INVESTIGATION OF ITS ADSORPTION CAPACITY**

Duygu OVA<sup>1,a</sup>, Bikem ÖVEZ<sup>2</sup>

<sup>1,2</sup> Ege Univ., Chemical Eng. Dept., Bornova, Izmir/TURKEY, 35100

a. Corresponding author (duygu.ova@ege.edu.tr)

Due to the usage of commercial activated carbon with high associated costs, attempts have been made to find inexpensive alternative activated carbon precursors as waste materials. Olive stone is among the most widely preferred agricultural wastes for the economical production of activated carbon. In this study, olive stones obtained from an oil factory located in Kuyucak, Aydın was used as raw material for the production of activated carbon via chemical activation which reduced the formation of tar and other by-products, thereby increased the carbon yield. For this purpose, phosphoric acid, potassium hydroxide and zinc chloride were retained as dehydrating agents. The impregnation ratio, defined by the weight ratio of the impregnants to olive stones, was kept constant as 1:1.5. The samples were carbonized in a furnace heated to 600°C (2h) under a constant flowing nitrogen atmosphere. The chars obtained were cooled at room temperature and the weight losses due to pyrolysis were determined. Characteristics of the activated carbon were conducted and the adsorption capacity of each modified-sorbent was also determined separately. It is concluded that chemical agents enhances the quality and quantity of the activated carbon obtained.

## **INTERACTION OF SOME PESTICIDES WITH ZINC ORGANOMETALLIC COMPOUNDS**

<sup>1</sup>Assia Boucif, <sup>1,a</sup>Zakia Hank and <sup>1</sup>Sultana Boutamine

\*<sup>1</sup>Université des Sciences et de la Technologie Houari Boumediene (USTHB), Faculté de Chimie, Laboratoire d'Electrochimie, Corrosion, Métallurgie et Chimie Minérale, BP 32, El Alia, Bab-Ezzouar, 16111, Algiers Algeria.

a. Corresponding author (z\_hank@yahoo.fr)

Particular chemicals like pesticides which use, in agriculture, became inescapable are engendering an environmental pollution and more particularly that of soils.

It is urgent, for preservation of public health, to reduce at most our exposure to these substances and to operate everything to reduce and control these pollutants. Some conventional adsorbing product such carbon F400 are frequently used.

The adsorption on the synthesized metal organic complexes may be an alternate technique to disinfect soils and waters polluted by pesticides and other chemicals.

In this context, some coordination compounds of Zinc were tested in the adsorption of mitrobusin present in contaminated water. The retained organic molecules are natural products (flavonoids and purines)

The preliminary results seem encouraging and we report them here.

## INTERACTION OF PESTICIDES WITH MANGANESE-ORGANIC FRAMEWORKS

<sup>1</sup>Assa Boucif\*, <sup>1</sup>Zakia Hank and <sup>\*1,a</sup>Sultana Boutamine

\*Université des Sciences et de la Technologie Houari Boumediene (USTHB), Faculté de Chimie, Laboratoire d'Electrochimie, Corrosion, Métallurgie et Chimie Minérale, BP 32, El Alia, Bab-Ezzouar, 16111, Algiers Algeria.

a. Corresponding author (sultanadz@yahoo.fr)

Particular chemicals like pesticides which use, in agriculture, became inescapable are engendering an environmental pollution and more particularly that of the waters as well of surfaces as ground-water sheets.

It is urgent, for preservation of public health, to reduce at most our exposure to these substances and to operate everything to reduce and control these pollutants.

So, the presence of pesticides in drinkable waters is severely regulated and the producing companies of water, to conform to the established standards, are obliged to include in their networks of water treatment, processes to eliminate them.

The adsorption on the synthesized metal organic complexes may be a technique to disinfect waters polluted by pesticides and other chemicals.

In this context, some coordination compounds of manganese were tested in the adsorption of nitrobenzimidazole present in contaminated water. The retained organic molecules are natural products (flavonoids and purines)

The preliminary results seem encouraging and we report them here. They are compared to those obtained with a conventional adsorbing agent, namely powdered activated carbon F400.

## TREATMENT OF PAINT CONTAINING EFFLUENTS BY ELECTROCOAGULATION

<sup>\*1</sup>Nassila. Sabba, <sup>2</sup>Malika Taleb-Ahmed, <sup>2</sup>Toufik. Chaabane and <sup>3</sup>André Darchen

<sup>1</sup>Laboratoire d'Hydrométallurgie & de Chimie Inorganique Moléculaire. FC. Université des Sciences et de la Technologie Houari Boumedienne, BP 32 El Alia Bab Ezzouar; Alger, Algeria

<sup>2</sup>Laboratoire Génie de la Réaction. FGMGP. Université des Sciences et de la Technologie Houari Boumedienne, BP 32 El Alia Bab Ezzouar; Alger, Algeria

<sup>3</sup>UMR CNRS Sciences Chimiques de Rennes, ENSCR, Avenue du Général Leclerc, CS 14315, 35708 Rennes Cedex 7, France

a. Corresponding author (nassilasabba@yahoo.fr)

This investigation deals with the effect of electrocoagulation process on the treatment of synthetically wastewater that contains paint residues. Paintings are made up of film forming matters, solid matters and volatile matters. These substances can be of natural or artificial origin, generally of organic nature. The rejections of these paintings comprise agents of strongly harmful pollution to the environment. The objective of this study makes it possible to apply electrocoagulation for the effluents paintings process and to study the parameters influencing this process. Two types of paintings (water and oil paint) are considered in this study. The electrocoagulating reactor used is equipped with two electrodes plan out of aluminum. The electrocoagulation process in acid medium gives a better output of electrolysis making it possible to obtain a sufficient quantity in ionic coagulant ( $Al^{3+}$ ). The ionic coagulant will make it possible amongst other things to reduce in a considerable way the parameters of pollution turbidity. The process of depollution used for the various paintings under consideration in this study makes it possible to conclude that the method is promising on an industrial scale owing to the fact that mud obtained does not present a composition complexes is to recycle their rejection or the starting products of in nature.

## **CU/ZR BASED CATALYST DEVELOPMENT FOR METHANOL STEAM REFORMING PROCESS**

F.C. Guldur \* U. Y. H. Umar

\*Gazi Univ. Chemical Eng. Dep.06570Maltepe - Ankara, +903125823507  
a. Corresponding author (cguldur@gazi.edu.tr)

Using methanol as a hydrogen source for fuel-cell applications is a favorable solutions to supply hydrogen on board in comparison to other hydrocarbon fuels, because of the following reasons: low temperature (250 °C) in steam reforming of methanol (SRM), high hydrogen to carbon ratio, low CO formation, and zero emission of NO<sub>x</sub>, SO<sub>x</sub>. There are possible processes for hydrogen production from methanol for example decomposition, steam reforming, partial oxidation, and combined reforming (also called oxidative steam reforming) of methanol. A higher hydrogen yield is obtained in steam reforming compared to partial oxidation and oxidative steam reforming.

In order to improve the activity, long term stability, and reduced CO formation, catalyst consisting of copper supported on ZrO<sub>2</sub> was synthesized using three preparation method. The morphology and porosity of zirconia can be readily controlled and resulting material with high surface area. The small copper particles formed during reduction of the catalyst stay well separated by the ZrO<sub>2</sub> support, preventing sintering and loss of copper surface area with time on stream.

Catalytic production of hydrogen by steam reforming of methanol reaction developed on three types of copper based catalysts (Cu/ZrO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub>, Cu/ZrO<sub>2</sub>, Cu-ZrO<sub>2</sub>). These catalysts prepared by three different ways: Sol-Gel, Co-Precipitation and Microemulsion techniques. In each Method we changed the ratio of copper contain (5% Cu, 8%Cu & 11% Cu ) to also examine the copper ratio effect on the decomposition reaction of the methanol steam reforming. Structural characterization have been tested by means of X-ray powder diffraction (XRD) and specific surface area (BET),The catalysts were tested at atmospheric pressure in a fixed bed micro reactor. Effect of the preparation method and copper ratio were investigated.

## **COMPUTATIONAL SCREENING OF METAL-ORGANIC FRAMEWORKS FOR GAS SEPARATIONS**

Seda Keskin, Ilknur Erucar

a. Corresponding author (skeskin@ku.edu.tr)

Metal organic frameworks (MOFs) have been promising nanoporous materials for gas storage and gas separation applications due to their high porosity, large surface area, well-defined pores and a large variety of physical and chemical properties. Selecting appropriate MOFs for a specific application is challenging due to the very large number of available materials. In this study, we used molecular simulations to assess the adsorption-based and membrane-based separation performance of several MOFs in CH<sub>4</sub>/H<sub>2</sub>, CO<sub>2</sub>/H<sub>2</sub>, CO<sub>2</sub>/CH<sub>4</sub> and CO<sub>2</sub>/N<sub>2</sub> separation processes. We will shows that separation performance of MOFs are significantly better than that of traditional nanoporous materials such as zeolites. We also considered MOFs as filler particles in polymers to obtain high performance mixed matrix membranes (MMMs) for gas separations and predicted gas permeabilities and selectivities of various MOF-based MMMs combining atomic simulations and theoretical permeation models. We will show the good agreement between our theoretical predictions and experimental data and present several strategies to determine the appropriate MOF/polymer pairs for natural gas purification and hydrogen recovery. These results will be helpful to identify the best performing MOFs in gas separation applications and develop new MOFs for a target application.

## **AMINO ACIDS ADSORBED ONTO CELLULOSE AS A WAY TO INCREASES THE CELLULOSE'S OXIDATION BY SUPPORTED Y ZEOLITE TO COSTLY COMPOUNDS**

Enrique Lima<sup>1</sup>, Magali Hernández<sup>1</sup>, Ariel Guzmán-Vargas<sup>2,a</sup>

1. Instituto de Investigaciones en Materiales, Universidad Nacional Autónoma de México, Mexico

2. Instituto Politécnico Nacional – ESIQIE-LiMpCa-Qf, Zacatenco, Mexico

a. Corresponding author (aguzmanv@ipn.mx)

Phenylalanine was adsorbed onto the surface of microcrystalline cellulose, which caused changes in the morphology and texture at the cellulose surface. The amino acid grafting partially modified the hydrogen bonding network of the cellulose structure, leading to more reactive cellulose residues that were facily oxidised to gluconic acid by oxygen in the presence of gold zeolite supported catalysts.

## **SILVER AND ZINC OXIDE BASED NANO POWDERS AND THEIR POLYMER BASED NANOCOMPOSITES FOR ANTIBACTERIAL APPLICATION**

Tuğçe ÖZMEN<sup>1</sup>, Ezgi ABATAY<sup>1</sup>, Alper ARSLANOĞLU<sup>2</sup>, Berna NALBANT<sup>3</sup> and Metin TANOĞLU<sup>4,a</sup>

<sup>1</sup>Dept. of Biotechnology and Bioengineering , Faculty of Eng., Izmir Inst. of Technology, Gulbahce Campus, 35430 Urla, Izmir, Turkey

<sup>2</sup>Dept. of Molecular Biology and Genetics, Faculty of Science, Izmir Inst. of Technology, Gulbahce Campus, 35430 Urla, Izmir, Turkey

<sup>3</sup>AKG Yalıtım ve İnşaat Malzemeleri Sanayi ve Ticaret A.Ş., 35070 Işıkkent, Izmir, Turkey

<sup>4</sup>Dept. of Mechanical Eng., Faculty of Eng., Izmir Inst. of Technology, Gulbahce Campus, 35430 Urla, Izmir, Turkey

a. Corresponding author (metintanoglu@iyte.edu.tr)

There is a dramatic increase in exposure of humans to microorganisms which present in indoor and outdoor, with in environmental pollution. The technological development is increased to create steril areas by the improvement of antibacterial materials. The silver (Ag) and zinc oxide (ZnO) nanopowders are being used for the preparation of the polymer based antibacterial nanocomposite materials. In this study; the Ag and ZnO nanopowders obtained were characterized by means of dynamic light scattering (DLS), scanning electron microscopy (SEM) / EDX, thermogravimetric analysis (TGA), X-ray diffraction (XRD), and fourier transform infrared spectroscopy (FTIR). Nano-sized Ag/polyester and ZnO/polyester nanocomposites were prepared with different weight fractions. In addition, Ag coated ZnO particles were prepared using AgNO<sub>3</sub> solutions. Similarly, Ag/ZnO/polyester nanocomposites were prepared and tested. The antibacterial properties of Ag/polyester and ZnO/polyester nanocomposites are being analyzed against gram positive and gram negative bacteria.

## RESEARCH AND DEVELOPMENT OF NEW POWDER COLORIFIC COMPOSITIONS BASED ON SALTS OF POLYVALENT METALS FOR DYEING THE NATURAL AND SYNTHETIC FIBERS AND TEXTILE MATERIALS ON THEIR BASES

Sayibjan Negmatov<sup>1</sup>, Shokhista Rasulova<sup>1</sup>, Won Cheol Lee<sup>1</sup>, Valeriy Kim<sup>1</sup>,  
Jakhongir Negmatov<sup>1</sup>, Malika Negmatova<sup>1</sup>, Shirin Abed<sup>1</sup>

1. State Unitary Enterprise "Fan va Taraqqiyot", Tashkent State Technical Univ., Uzbekistan  
a. Corresponding author (polycomft2005@rambler.ru)

On the basis of comprehensive studies were designed the optimum compositions of powder colorific compositions based on salts of polyvalent metals for protein and polyamide and cellulosic fibers and fabric dyeing technology based on them. Powder colorific compositions for textiles based on protein, cellulose and polyamide fibers, due to their interaction with the fiber, help creating salt, coordination and covalent connections and creating the coloring on fibers, which has a high resistance to various physical and chemical effects.

Dyeing of protein, polyamide and cotton fibers with colorific composition is carried out in an acidic environ at pH 3-4. At the boiling temperature reaches its equilibrium in the case of dyeing textile materials based on protein fibers for 2-3 minutes, cotton fabrics - 6-7 minutes, polyamide for 35-40 minutes. The obtained colorings are characterized by high resistance to various physical and chemical factors: washing, dry cleaning, abrasion and light.

## DYNAMIC MECHANICAL PARAMETERS OF FUNCTIONAL POLYMER LAYERED SILICATE NANOCOMPOSITES AS FUNCTIONS OF IN SITU PROCESSING IN THE FORMATION OF NANOPOROUS NANOHYBRID STRUCTURES

Serap Kavlak<sup>a</sup>, Zakir M. O. Rzayev<sup>b</sup>, Ali Güner<sup>a</sup>

<sup>a</sup>Dept. of Chemistry, Faculty of Science, Hacettepe Univ., Beytepe, 06800 Ankara, Turkey

<sup>b</sup>Division of Nanotechnology & Nanomedicine, Inst. of Sci. and Eng., Hacettepe Univ., Beytepe, 06800 Ankara, Turkey

- a. Corresponding author (skavlak@hacettepe.edu.tr)

Dynamic mechanical analysis (DMA) method allows to determine a combination of the important parameters, such as storage modulus (SM), loss modulus (LM), loss  $\tan \delta$  (LM/SM), dynamic force (DF), complex modulus (CM), dynamic viscosity (DV) and complex viscosity (CV) as a function of temperature in the polymer nanosystems [1-2]. In this study, we used DMA technique to detect response of nanocomposites to oscillatory deformation as a function of temperature. Observed significant difference ( $\Delta$ ) between these parameters [ $\Delta = \text{DF (nanocomposite)} - \text{DF (copolymer)}$ ] or [ $\Delta = \text{CM (nanocomposite)} - \text{CM (graft copolymer)}$ ] above  $T_g$ , relating to copolymer and its nanocomposite, can be described as a function of the formation of nano-structural architecture in poly(MA-alt-1-OD)-g-PLA/organoclay multi-porous nanosystems (Figure1). The maximum values of  $\Delta$  were observed around 90-110°C for the nanosystem related to graft copolymer and its ODA-MMT nanoporous composite, and for the nanosystems around 110-130°C at middle and lower values of DF and CM parameters, respectively. Unlike known polymer/organoclay nanosystems, synthesized copolymer-g-PLA/organoclay nanocomposites and their  $\text{Ag}^+$ -carrying derivatives exhibit self-assembled core-shell morphology due to surfactant character of matrix copolymer which easily form the hydrophilic/hydrophobic balance in the reactive copolymer-g-PLA/organoclay systems, and therefore, occurrence of the self-organized in situ chemical and physical interfacial interactions in the chosen interlamellar graft copolymerization conditions.

## **SYNTHESIS OF SiO<sub>2</sub> VIA SINTERING POLY(SILYNE-CO-HYDRIDOCARBYNE)**

Yusuf Nur<sup>a</sup>, Yusuf Şimşek

a. Corresponding author (ynur2005@gmail.com)

The interface between polymers and ceramics is one of the most important in materials science. One aspect of this association is seen in pre-ceramic polymers. These are an important class of polymer which produces ceramic materials such as silicon carbide (SiC) and diamond upon heating. Poly(methyl silyne) (PMSi) forms silicon carbide (SiC) or SiO<sub>2</sub> and polyhydridocarbyne (PHC) produces diamond and diamond-like carbon (DLC). Among these polymers, poly(silyne-co-hydridocarbyne) (PSC) simply forms SiC without requiring the addition of more carbon species and a catalyst since it already contains silicon and organic carbon on its backbone. Another important feature of PSC is to produce crystalline or amorphous SiO<sub>2</sub>, which strongly depends on heating conditions. Here it is reported the synthesis of SiO<sub>2</sub> from a pre-ceramic polymer, poly(silyne-co-hydridocarbyne). The polymer was converted to ceramics upon heating at 500 (SiO<sub>1</sub>), 750 (SiO<sub>2</sub>) 1000°C (SiO<sub>3</sub>) and under air atmosphere. Ceramic materials were characterized with optical microscopy, SEM, X-Ray and Raman spectroscopies. While SiC<sub>3</sub> mostly includes crystals of “Coesite” (PDF (ICDD); 14-0654, 72-1601 and 73-1748), the samples produced at higher temperature, SiC<sub>1</sub> and SiC<sub>2</sub>, were crystalline, and their reflections were consistent with the mixture of Moganite”, “Tridymite-M,syn, “Tridymite” and “Coesite” (PDF (ICDD); 13-0026,18-1170,38-0360,72-1601, 75-1323 and 78-2315).

## **SILK FIBROIN COATED WITH POLY 2-HYDROXYETHYL METHACRYLATE IMPREGNATED WITH SILVER NANOPARTICLES COUPLED WITH CIPROFLOXACIN AS A BIOMATERIAL FOR BIOMEDICAL APPLICATIONS**

S. Sekar, A. Mandal, S.Sankar, V. Ramnath, T.P. Sastry<sup>a</sup> and A.B. Mandal<sup>a</sup>

Bioproducts Lab, Central Leather Research Inst.,  
Adyar, Chennai-20, Tamil Nadu, India.

a. Corresponding Authors (abhishek682@hotmail.com, sekarjuly30@gmail.com )

Nanoparticle based agents often applied as coatings on biomaterials have shown promise in providing improved sterility against variety of microbes. In the present study, silk fibers were coated with poly (2-hydroxyethyl methacrylate) (pHEMA), impregnated with silver nanoparticles and coupled with ciprofloxacin. The prepared composite material was characterized for its physico-chemical properties and in vitro cell proliferation tests were performed using 3T3 fibroblast cell lines. The infrared spectroscopy results confirmed the protein nature of the biomaterial. The surface morphology results of SEM images demonstrate silk fibroin coated with pHEMA along with impregnated silver nanoparticles. The biomaterial exhibits improved thermal stability, enhanced antimicrobial activity and better cell proliferation along with adhesion property, thereby making it ideal candidate as biomaterial for wound dressings. The efficacy of the biomaterial for wound dressing and as tendon reconstruction material could be further evaluated using small animals.

## **CHIRAL VOIV-SAL-INDANOL COMPLEX OVER MODIFIED SBA-15: AN EFFICIENT, REUSABLE ENANTIOSELECTIVE CATALYST FOR ASYMMETRIC SULFOXIDATION REACTION**

Anand Pal Singh, Anish Lazar, Priti Sharma

a. Corresponding author (ap.singh@ncl.res.in)

A reusable, mesoporous, heterogeneous vanadium complex, VOIV-Sal-Ind-SBA-15 has been synthesized by immobilizing asymmetric (1R,2S)-(+)-1-[N-(3-tertbutyl-5chloromethyl salicylidene) amino]-2-indanol (Sal-Indanol) ligand over mesoporous -OH protected amino functionalized SBA-15 and further complexation with VOIV(acac)<sub>2</sub> to get VOIV-Sal-Ind-SBA-15 [1]. The physico-chemical properties of the functionalized catalysts were analyzed by a series of characterization techniques like XRD, N<sub>2</sub> sorption measurement isotherm, SEM, TEM, FT-IR, TG-DTA, XPS, EPR, DRS UV-Visible, ICP-OES and solid and liquid state <sup>13</sup>C, <sup>29</sup>Si and <sup>51</sup>V NMR. Catalytic evaluation in asymmetric sulfoxidation [2] reaction of sulfides indicated that VOIV-Sal-Ind-SBA-15 exhibited higher catalytic activity, stability, reusability and comparative enantioselectivity than different synthesized catalysts. The effect of temperature, solvents and substrates on sulfoxidation reaction were examined in order to optimize the conversion and enantioselectivity of thioanisoles to sulfoxides. Moreover, recycling study of VOIV-Sal-Ind-SBA-15 shows no major deactivation of the catalyst. [1] A. Lazar, P. Sharma and A. P. Singh, Microporous and Mesoporous Materials, 170 (2013) 331-339. [2] C. Bolm, Coord. Chem. Rev., 2003, 237, 245-256.

## **RESEARCH AND DEVELOPMENT OF TECHNOLOGIES OF OBTAINING THE MECHANICALLY ACTIVATED POWDER BASED ON NATURAL INGREDIENTS AND DUNE SAND FOR PRODUCTION OF SEALING COMPOSITE CEMENTS AND COMPOSITE MATERIALS FOR VARIOUS PURPOSES**

Sayibjan Negmatov<sup>1</sup>, Kakhramon Inoytov<sup>1</sup>, Lochin Oblakulov<sup>1</sup>, Shukhrat Bozorboyev<sup>1</sup>, Bahodir Sobirov<sup>1</sup>, Jahongir Negmatov<sup>1</sup>, Dilshod Makhkamov<sup>1</sup>,  
Rustam Soliev<sup>1</sup>, Mahammadjon Tursunov<sup>1</sup>

1. SUE "Science and Progress" Toshkent State Technical Univ., Tashkent, Uzbekistan,  
a. Corresponding author (polycomft2005@rambler.ru)

Based on comprehensive research we developed mechanoactivated technology and created installation - dismembrator based on impact-splitting-abrasive method for dispersing and natural dune sand, providing reception of powdered ingredients with a high degree of dispersion - up to 30-90 microns, developed surface area and their use in production of non-hardened and vibration reducing mastics and sealants for building designs of windows, sealing cracks of asphalt roads, filling the joints of concrete roads, composite coating of asphalt roads, and other industries.

Study of the effect of mechanical activation and natural dune sand on the mechanical properties of composite cements and asphalt surfaces shows that when they are activated by dismembrator installation achieved increase in compressive strength and shear in half and according to their durability.

## **POZZOLANIC ACTIVITY OF CLINOPTILOLITE-RICH, MORDENITE AND ANALCIME-BEARING TUFFS FROM NEOGENE DEPOSITS, WESTERN TURKEY: THE CONTROLLING PARAMETERS**

Özen, Sevgi<sup>a</sup>, Göncüoğlu, M. Cemal<sup>b</sup>

<sup>a</sup>Middle East Technical University, Geological Eng. Dept., 06531, Ankara, Turkey

<sup>b</sup>Middle East Technical University, Geological Eng. Dept., 06531, Ankara, Turkey

a. Corresponding author (ozsevgi@metu.edu.tr)

In this study, the physical and chemical factors influencing the pozzolanic reaction by comparing the behavior of zeolites was investigated at six different times ranging from 3 to 180 days. For this purpose, the mineralogical, chemical and physical characterizations were performed on the zeolitic tuffs from western Turkey by quantitative XRPD, ICP-OES, quantitative electron microprobe analysis, BET specific surface area, grain-size and cation exchange capacity (CEC) measurements. Thermogravimetric analyses and Fratini's test were applied to three clinoptilolite-rich, one mordenite-bearing and one analcime-bearing tuff in order to evaluate and compare the pozzolanic activity. Experiments realized in this work showed that higher specific surface area enhances the pozzolanic activity at initial stage (less than 3 days) but it has no significant effect on reactions thereafter. The main effect of Si/Al ratio was observed at later stages, especially after 28 days. Clinoptilolite-rich tuffs exchanged with K<sup>+</sup> displays faster rate of reaction than Ca<sup>2+</sup> and Na<sup>+</sup>-exchanged ones at longer periods. Kinetic analyses showed that the reaction is mainly controlled by the diffusion of reactants through a layer of dense reaction products in accordance with modified Jander equation.

## **NANOFABRICATION AND CHARACTERIZATION OF NOVEL NANOPOROUS NANOFIBERS FROM PCL/ODA-MMT AND COPOLYMER-G-PLA/AG-MMT BLENDS BY ELECTROSPINNING METHOD**

Murat Şimşek, Zakir M. O. Rzayev

Inst. of Science & Eng., Division of Nanotechnology and Nanomedicine, Hacettepe Univ., 6800 Ankara, Turkey

a. Corresponding author (muratsimsek08@gmail.com)

Electrospinning is the most utilized method to fabricate polymer (or polymer blends) / nanoparticle nanofibers. Better fundamental understanding of the complex mechanisms in the formation of nanoporous nanostructural fibres incorporated with various organo-nanofillers, especially organo-montmorillonite (MMT) clays will lead to design and fabricate new generation of nanofibers with controlled morphology. In this study, we synthesized multi-nanoporous polymer nanofibers by electrospinning using blends of polycaprolactone/and poly(maleic anhydride-alt-1-octadecene)-g-poly(L-lactic acid) (copolymer-g-PLA, M<sub>n</sub> ~40.000 Da)/silver (Ag)-MMT biodegradable nanocomposites. In the formation of copolymer-g-PLA and nanofibers, octadecyl amine-MMT and Ag-MMT clays and their preintercalated LA...MMT complexes as reactive nanofillers were exhibited multi-function activities such as surfactant-stabilizer, self-catalyst and reinforcing agent. The electrospinning process was carried out in two solvent dimethyleneformamide/dichloromethane with optimum parameters. Result showed the formation of ultrafine multi-nanoporous nanofibers with hollow cross-section morphology (Kirkendall effect) depended on the parameters and loading second partner-nanocomposite. Better results (fine distribution and higher amount of nanofibers with length ≤ 100 nm) were observed for the fibers fabricated in 0.6:0.4 (v/v) polymer solution ratio at applied voltage 8.0 kV, collection distance 10-15 cm and flow rate 0.2-0.3 mL.h<sup>-1</sup>. Developed a new generation of polymer nanofibers can be widely utilized in medicine, various bioengineering and filtration-separation processing.

## SYNTHESIS OF PNIPAAm-BASED COMPOSITE HYDROGELS IN NaOH SOLUTION

Bestenur KURTULUŞ<sup>1</sup>, Candan ERBİL<sup>2</sup>

<sup>1</sup>Faculty of Arts and Sciences, Bahcesehir Univ., Besiktas, Istanbul, Turkey  
bestenur.kurtulus@bahcesehir.edu.tr

<sup>2</sup>Faculty of Science and Letters, Chemistry Dept., Istanbul Technical Univ., Maslak, Istanbul, Turkey.  
*a.* Corresponding author (erbil@itu.edu.tr)

Conventional hydrogels have weak and fragile structures resulting from the inverse relations between swelling and mechanical properties and depending on structural inhomogeneities. The combination of large swelling and high mechanical performance within the same hydrogel structure is important for their potential applications such as biotechnological devices, tissue engineering and drug delivery systems [1,2]. The indicated structural properties can be improved by synthesizing composite materials containing layered silicates in their network structures [3,4].

N-isopropyl acrylamide (NIPAAm) hydrogels are known as thermosensitive crosslinked polymer networks. In this work, the mechanical properties of NIPAAm / sodium montmorillonite ( NIPAAm / Na<sup>+</sup>MMT ), NIPAAm / organo-modified MMT and NIPAAm / Laponite (LP) composite hydrogels synthesized by free radical solution polymerization in the absence of accelerator, using two different clay content (3.0 and 10.0 wt % of total monomer concentration) at 25°C in both distilled-deionized water (DDW) and sodium hydroxide solution (NaOH) were investigated.

Uniaxial-compression measurements in the 30° – 45°C range ( Table 1. Young's moduli of composite-NIPAAm hydrogels, in Pa) showed that the concentration of hydroxyl ions is an important parameter affecting the mechanical strengths of Na<sup>+</sup>MMT/PNIPAAm hydrogels. In addition, the shapes and phase transitions of the hydrogels changed by depending on the composition of the polymerization media.

## WASTEWATER DISINFECTION BY HETEROGENEOUS PHOTO CATALYSIS: ROLE OF THE MEDIA USED

Majdi Kacem, Vincent Goetz, Gael Plantard

*a.* Corresponding author (majdi.kacem@promes.cnrs.fr)

This work is part of treated wastewater reuse and involves the disinfection of Escherichia coli DSM 3083 (selected as an indicator of treatment efficiency) by heterogeneous photocatalysis. Its main objective is to compare the disinfection efficiency of three different photo catalytic media. The used media were based dioxide titan and were the Aeroperl catalyst, the Degussa P25 (both in a powder form), with an average particle diameter respectively of 20µm and 20 nm and a cellulosic impregnated dioxide titan support from the Alstrom Company. As a first step, an identification of an optimal working configuration for each media (optimal concentration, UV light absorption capacity...) has been proposed tending to maximize their reactivities into the treated samples. In a second step, a series of photocatalytic disinfection tests were carried out in a lab pilot scale using the different media. The disinfection tests were undergone under different process working conditions. The aims was to identify key parameters that govern the photocatalytic disinfection, to establish disinfection kinetics and photonic yields assigned to each media and to draw disinfection kinetics constants as function of process working parameters. This will lead to the comparison of the used photocatalytic media in terms of bacterial degradation efficiency.

## **SYNTHESIS OF FE/WC-CO BI-LAYERED CARBIDE CUTTING MATERIALS BY POWDER METALLURGY**

Ayman Elsayed<sup>1,a</sup>

1. Central Metallurgical Research & Development Inst., Powder Technology lab., Cairo, Egypt  
a. Corresponding author (ayman\_elsayed\_11@yahoo.com)

The carbide cutting materials have been widely used in conventional and advanced machining operations. For a cutting tool, they require materials with superior characteristics including high wear resistance, high temperature stability and hardness. However, those properties are usually incorporated with low impact toughness. Therefore, attention was given to improving the toughness of cutting materials. The ability of powder technology to manufacture multi-layered materials has become the motivation for its use to overcome the problem. In this study, cutting materials with cemented carbide-iron based layers were manufactured by powder technology. Mixtures of Co-based tungsten carbide and iron powders were prepared by ball milling and then green-compacted and vacuum sintered into bi-layered tools. The integrity of the tools were then investigated. The microstructure and the mechanical properties have shown that the synthesis was successful to yield a good combination of wear resistance and toughness.

## **RAPID DIAZOTIZATION–CYANATION USING CROSS-LINKED POLY (4-VINYLPYRIDINE) SUPPORTED NITRITE ION**

Mohammad Ali Karimi Zarchi, Nahid Ebrahimi, Nahid Ebrahimi

- a. Corresponding author (makarimi@yazd.ac.ir)

Substituted benzonitriles are an integral part of dyes, natural products, herbicides, agrochemicals and pharmaceuticals. Recently the chemistry of functional polymers has received great attention and became a practical method for the efficient preparation of novel chemical libraries.<sup>1-3</sup> In this article an efficient, simple and effective method for one-pot synthesis of aryl nitriles from aromatic amines is described. Diazotization of aromatic amine was occurred by using cross-linked poly (4-vinylpyridine) supported nitrite ion, [P4-VP]NO<sub>2</sub> in the presence of concentrated H<sub>2</sub>SO<sub>4</sub> at 0–5 °C. Then cyanation was followed by decomposition of the in situ generated aryl diazonium salts using NaCN/CuCN (molar ratio of 2/1) in water at room temperature and consequently, the corresponding aryl nitrile was obtained by removing of the nitrogen gas (Sandmeyer-type reaction). A wide variety of primary aromatic amines were also subjected to diazotization-cyanation by using [P4-VP]NO<sub>2</sub>/H<sub>2</sub>SO<sub>4</sub>/NaCN/CuCN in water. The advantages of the present method over conventional classical methods are; safe handling, rapid, and very simple work-up. Also, the spent polymeric reagents can be regenerated and reused for several times without significant loss of their activity. In this paper we report the first procedure for facile and rapid diazotization–cyanation using cross-linked poly (4-vinylpyridine) supported nitrite ion.

## **LUMINESCENT MATERIALS FOR SOLID STATE LIGHT SOURCES WITH ULTIMATE EFFICIENCY**

Prof. Dr. Thomas Jüstel

Münster Univ. of Applied Sciences, D-48565 Steinfurt, Germany

a. Corresponding author (tj@fh-muenster.de)

Research and development efforts on luminescent materials started in the late 19<sup>th</sup> century. In the 20<sup>th</sup> century, activities concentrated on the search for luminescent materials for gas discharge lamps, cathode-ray tubes, and x-ray detectors. Suitable materials were rapidly found and presently applied materials have been developed to an impressive maturity level. Therefore, the search for new materials for these mature applications were stopped and current research concentrates on tailoring the particle morphology and surface of established materials to optimize device performance.

The advent of new lighting and display technologies, e.g. LC and plasma displays, Hg free discharge lamps, and solid state light sources, has revitalized research on luminescent materials worldwide, since luminescent powders with a high stability and efficiency under harsh excitation conditions, i.e. under high photon flux, high electrical field strength, and at elevated temperatures, are required. This demand for efficient and stable materials is presently the driving force for material research on rare-earth activated oxides, (oxy)nitrides, and sulfides.

In this contribution the basic physics and chemistry of luminescent materials will be elucidated. Additionally, the demands on suitable phosphors (blends) for solid state light sources will be presented. Finally, recent achievements on color converters for LEDs will be discussed.

## **DEVELOPING OF WETTING BEHAVIOR OF TITANIUM MATRIX COMPOSITE REINFORCED WITH CARBON NANOTUBES**

Topcu, H. Adanır and A. N. Güllüoğlu

Marmara Univ., Eng. Faculty, Metallurgy & Materials Eng. Dept., 34722, Goztepe, Istanbul/TURKEY.

a. Corresponding author( itopcu@marmara.edu.tr)

In this study, the effect of Carbon Nanotube (CNT) additions into Ti6Al4V alloy is investigated. The small amount (0.5-7%) of CNT is added to Ti6Al4V alloy. The mixed powders are pressed under 80 tons pressure with uniaxial hydraulic press. Then, green samples were sintered for one hour in a high level of vacuum ( $10^{-5}$  mbar) at 1300°C. After sintering, the wetting behaviors of the sample were characterized. Archimedes method is used to investigate the theoretical density, the Sessile-Drop test method is used to measure the contact angles and microhardness tester utilized for the samples hardness investigation. By the addition of CNT, the contact angle and hardness of the samples are increased.

## **ELECTRICAL PROPERTIES OF THE NATUREL ZEOLITE CLINOPTILOLITE**

Metin ÖZER<sup>a</sup>, Irmak KARADUMAN, Bahtiyar SALAMOV, Selim ACAR

Dept. of Physics, Faculty of Sciences, Gazi Univ., 06500 Ankara, Turkey  
a. Corresponding author( metinoz@gazi.edu.tr)

Zeolites are microporous crystalline aluminosilicates and they have more than 42 structural types. They nowadays are widely used in industrial applications such as ion exchange materials, in removal and purification of some radioisotope, in air enrichment, in catalysis, in soil beneficiation, in wastewater cleaning treatments. The structural properties of natural zeolite clinoptilolite, the phase stability and the phase changes during heating at ambient pressure and at different pressures have been discussed in the papers. However, there are only very few studies on the electrical conductivity measurements. The crystalline phase composition of the naturel zeolite clinoptilolite (Manisa-Gördes in Western Anatolia) used in this work was characterized by X-ray diffractometry (XRD). We measured current-voltage characteristics of natural zeolite clinoptilolite samples at different temperatures and the activation energy determined.

## **MONODISPERSED HOLLOW NANO CALCITE PRODUCTION**

Ekrem OZDEMIR, Gorkem TOPRAK, Sevgi KILIC OZDEMIR

a. Corresponding author (ekremozdemir@iyte.edu.tr)

Calcium carbonate ( $\text{CaCO}_3$ ) is one of the most abundant materials in nature and widely used as filling material in various industries in order to decrease the product costs and to improve some mechanical properties of the composite materials. Because commercial calcite sold in the market is in granular form, in micron size, and inhomogeneous size distribution, the required properties can only be obtained by the recrystallization method. Here, we have develop a method to produce hollow nano calcite particles with an homogenous size distribution of about 200 nm.

## **LARGE SCALE PRODUCTION OF MONODISPERSED CUBICAL NANO CALCITE**

Ekrem OZDEMIR, Sezen Duygu ALICI, Sevgi KILIC OZDEMIR

a. Corresponding author (ekremozdemir@iyte.edu.tr)

Calcium carbonate (CaCO<sub>3</sub>) is widely used as filling material in various industries in order to improve some of the mechanical properties and to decrease the product costs. Although calcite is present in nature in abundant amounts, the commercial calcite is generally in granular form, micron sizes, and inhomogeneous size distribution. The required properties can only be obtained by the recrystallization method. However, because the crystallization is an ionic reaction, there is not a standard procedure to obtain calcite in nano size, homogenous size distribution and different morphologies. In this study, we have developed a method to produce mono-dispersed cubical nano calcite particles of sizes about 200 nm in large scales.

## **METHOD DEVELOPMENT IN NANO CALCITE SYNTHESIS**

Ekrem OZDEMIR, Eda ULKERYILDIZ, Sevgi KILIC OZDEMIR

a. Corresponding author (ekremozdemir@iyte.edu.tr)

Calcium carbonate (CaCO<sub>3</sub>) is widely used as filling material in various industries in order to improve some of the mechanical properties and to decrease the product costs. Although calcite is present in nature in abundant amounts, the commercial calcite is generally in granular form, micron sizes, and inhomogeneous size distribution. The required properties can only be obtained by the recrystallization method. However, because the crystallization is an ionic reaction, there is not a standard procedure to obtain calcite in nano size, homogenous size distribution and different morphologies. Here, we have developed a method to produce nano calcite particles of sizes about 200 nm, in homogenous size distribution, and different morphologies.

## **BIOCATALYTIC ACTIVITY OF CARBONIC ANHYDRASE IMMOBILIZED WITHIN POROUS POLYURETHANE FOAM**

Ekrem OZDEMIR, Ilyas Umur AYAZ

a. Corresponding author (ekremozdemir@iyte.edu.tr)

Enzymes are benign biocatalysts for conversion of many chemicals in aqueous solution; however, their activities were almost completely lost in organic solvents. We have immobilized Carbonic Anhydrase (CA) within polyurethane (PU) foam and characterized for enzyme activity in organic solvents, i.e. acetonitrile. The catalytic activities for the free and immobilized CA were estimated by using p-Nitrophenyl Acetate (p-NPA) as the substrate. The CA enzyme activity in free form were decreased as the organic content were increased and the activity was completely lost at about 40% of acetonitrile-water liquid phase. When the acetonitrile content was increased, some enzyme activity was also seen up to 90% of acetonitrile in water mixture. When the CA was immobilized in porous polyurethane foam, the activity was significantly improved in organic solvents.

## **RUTHENIUM NANOPARTICLES ENCAPSULATED DISORDERED TITANOSILICATE ETS-10**

Melda İşler, Sezin Galioglu, Burcu Akata

a. Corresponding author (meldasler@gmail.com)

Engelhard Titanosilicate (ETS-10) is a member of crystalline microporous material consisting of corner sharing  $TiO_6$  octahedra and  $SiO_4$  tetrahedra forming 12-membered rings. Each negative charge due to an octahedra titania unit is balanced with exchangeable cations, which are  $Na^+$  and  $K^+$ . It is of great interest to encapsulate metal nanoclusters inside such microporous materials due to the metal containing porous structure's altered and unique optical, electronic and catalytic properties. However, the size of the metal nanoparticles inside this structure is limited with the pore size of that network and thus it can also be of interest to be able to alter the size of these nanoparticles, if possible, in the network. It was shown that post-synthesis treatments with aqueous solutions of  $H_2O_2$  for different times induced structural defects in ETS-10 by partial removal of the structural Ti atoms without a substantial degradation in the crystallinity. The micropore volume of ETS-10 was observed to increase slightly after hydrogen peroxide treatment. Ru nanoparticles were stabilized by ETS-10 and the effect of increasing micropore volume as a function of harshness of  $H_2O_2$  treatment was investigated to see whether any changes were induced during the formation of such metal nanoparticles.

## **OPEN CELL AL-SI FOAMS BY A SINTERING AND DISSOLUTION PROCESS**

Ioan Vida-Simiti, Gabriel Gherasim, Niculina Argentina Sechel, Gyorgy Thalmaier

a. Corresponding author (Vida.Simiti@stm.utcluj.ro)

Light metal foams are an interesting group of materials from a technological point of view due to their light weight, good energy absorption and low thermal conductivity. The aim of this study is to evaluate the morphological and mechanical properties and to optimize the process parameters of the Sintering and Dissolution Process (SDP). Open cell foams from Al-Si (12 wt.%) alloy were successfully fabricated by the Sintering and Dissolution Process using NaCl as space holder. The powder size range used for the aluminum alloy was <45  $\mu\text{m}$  and 315-500  $\mu\text{m}$ ; 630-800  $\mu\text{m}$  and 800-1250  $\mu\text{m}$  respectively. The appropriate quantities of alloy powder and salt were mixed then the mixture was cold pressed at 250MPa and sintered at 500°C, 525°C and 550°C in vacuum (10-5 torr) for 10 to 30 minutes. The effect of the process parameters on the mechanical and on the energy absorption properties was evidenced.

## **INVESTIGATION OF MULTIFUNCTIONAL ANHYDRIC CONTAINING NANOCOMPOSITES FORMED BY USING ORGANO-BENTONITE MATRIX BY INTERCALATION POLYMERIZATION**

Özlem ŞAHİN, Hatice KAPLAN CAN

Hacettepe Univ., Faculty of Science, Dept. of Chemistry, Beytepe, Ankara, Turkey

a. Corresponding author (ozlemsahin@hacettepe.edu.tr)

Development of nanoscience and new materials began to be studied like nanoparticles, porous materials that are formed by a network of nanoparticles, and nanocomposites. There are infinite possibilities of production of nanocomposites and one of them is the formation of nanoparticles inside porous matrices that can have their texture and morphology tailored by thermal treatment or templates.

For many applications, the textural properties, such as porosity and specific surface area, are as important as the chemical composition. Thus, the growing demand for porous materials in the industry of nanotechnology, especially for polymer-clay nanocomposites (PCN's) has led to the increase in the studies related to these properties. This work describes, bentonite was modified three alkyl ammonium salts and organo-bentonite used in preparation of poly(DHP-co-MA-co-VA) biologically active nanocomposites by in situ intercalation terpolymerization via charge transfer complex mechanism (CTC). The comparative analysis of structure-composition-property relationship of the pristine poly(DHP-co-MA-co-VA) and its nanocomposites with varying modification of quaternary ammonium cations were investigated by ATR-FTIR, XRD, Raman, NMR and TEM methods.

## SILICA BASED SHEAR THICKENING FLUIDS (STFs) FOR PERSONAL PROTECTION

Sema Yıldız<sup>1</sup>, Oylum Çolpankan<sup>1</sup>, Fikret Şenel<sup>2</sup>, Metin Tanoğlu<sup>3,a</sup>

1. Izmir Inst. of Technology, Materials Sci. and Eng. Dept., Urla-Izmir, Turkey
2. BARIŞ Electrical Industry Inc., Havaalanı Yolu 23. Km, Akyurt, 06750, Ankara, Turkey
3. Izmir Inst. of Technology, Mechanical Eng. Dept., Urla-Izmir, Turkey  
a. Corresponding author (metintanoglu@iyte.edu.tr)

Shear thickening phenomenon is a non-Newtonian fluid behavior which takes place in concentrated colloidal suspensions and described as the increase in viscosity with increasing applied shear stress or shear rate. Due to this unique property, shear thickening fluids (STFs) have attracted attention for using in impact resistance applications. In this study, fumed silica nanoparticles/Polyethylene glycol (PEG) suspensions were prepared by a sonochemical method with various concentrations of silica particles and containing PEG 200 and PEG 300 which are 200 and 300 g/mole molecular weight, respectively. Rheological behaviour of the prepared STFs were investigated by a (TA AR2000ex) rheometer to investigate the effect of silica concentration and PEG molecular weight on the behaviour of the liquids. Characterization of nano-sized silica particles were carried out by means of scanning electron microscopy (SEM) and X-ray diffraction (XRD) whereas PEG's were analyzed by differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and STFs by TGA and SEM.

## CO<sub>2</sub> ADSORPTION ON ZEOLITE X

Özgül Dere Özdemir<sup>1,a</sup>, Müge Sarı Yılmaz<sup>1</sup>, Nevin Karamahmut<sup>1</sup>, Prof. Dr. Sabriye Pişkin<sup>1</sup>

1. Yildiz Technical Univ., Dept. of Chemical Eng., Istanbul, Turkey  
a. Corresponding author (odere@yildiz.edu.tr)

Zeolites are crystalline aluminum-silicates, with group I or II elements as counterions. Their structure is made up of a framework of  $[\text{SiO}_4]^{4-}$  and  $[\text{AlO}_4]^{5-}$  tetrahedra linked to each other at the corners by sharing their oxygens (Querol et al., 2002). Zeolites represent one of the most innovative adsorbents for a wide range of applications including air separation, air drying, CO removal from reforming gas, and CO<sub>2</sub> removal from natural gas [1]. World CO<sub>2</sub> emissions are expected to increase by 1.9 percent annually between 2001 and 2025. Developing countries' emissions are expected to grow above the world average at 2.7 percent annually between 2001 and 2025; and surpass emissions of industrialized countries near 2018. Accumulation of CO<sub>2</sub> concentration has caused global warming. So it is a major problem all over the world (Mulgundmath et al. 2012). The aim of this study is to evaluate the CO<sub>2</sub> adsorption behavior of Zeolite 13X. A volumetric-type apparatus was used to measure the CO<sub>2</sub> adsorption at 19.8 °C. It was found that CO<sub>2</sub> adsorption amounts of Zeolite 13X at 19.8 °C 103.55 kPa was 4.72 mmol/g.

## **FLEXIBLE POLYURETHANE FOAMS INFUSED WITH CALCIUM CARBONATE PARTICLES AS FILLERS**

Sevgi Kilic Ozdemir, Melis Gezgin

a. Corresponding author (sevgikilic@iyte.edu.tr)

Flexible polyurethane foams are one of the most important classes of polymeric materials used in domestic and industrial applications. There has been a growing demand however for durable and compression resistant foams at low cost. For this purpose, industries that produce flexible polyurethane foams use fillers to modify the material properties. Fillers added to the polymeric matrix provide the tension applied to the polymer to be transferred to the filler phase, minimizing deformations in the polyurethane foam. Some fillers have been already used to improve the properties of polyurethane based foams. This study focuses on examination of thermal and mechanical properties of flexible polyurethane foams infused with different sizes, concentrations and morphologies of nano calcium carbonate particles.

## **SILICA SUPPORTED POLY(2-AMINOPHENOL) AND ITS ADSORPTION APPLICATION**

Hacı Ökkeş DEMİR<sup>1</sup>, Esin ISPIR<sup>1</sup> and Bilal ACEMIOĞLU<sup>2</sup>

<sup>1</sup>K.Maraş Sütçü Imam Univ., Faculty of Science and Arts, Dept. of Chemistry, 46100 Kahramanmaraş, Turkey

<sup>2</sup>Kilis 7 Aralık Univ., Faculty of Science and Arts, Dept. of Chemistry, Kilis, Turkey  
a. Corresponding author (okkesdemir@hotmail.com)

Polyphenols are a group of poly(arilene)s polymers. Polyphenols have got some useful properties like adsorption, paramagnetism, semiconduction, the usage in electrochemical cells and high energy effect.

Mesoporous materials are currently a field of intensive activity due to their potential in a very broad range of applications. Polymer/silica nanocomposites have been studied in order to obtain materials with thermal, mechanical and electrical characteristics. The mixing of polymers and nanoparticles provides opportunities to engineer flexible composites that exhibit advantageous electrical, mechanical, optical, or magnetic properties.

In this study a novel Silica Supported Poly(2-Aminophenol) (SSPA) was prepared by the immobilization of poly(2-aminophenol) to the activated silica (AS) with 3-aminopropyltriethoxysilane. The SSPA showed great affinity and high adsorption capacity against to the some dyes. As seen from the SEM images of AS and SSPA, the differences between morphologies of the synthesized compounds, confirm the immobilization.

## **THE EXPERIMENTAL INVESTIGATION OF WEAR RATE WITH TAGUCHI METHOD OF Cu COMPOSITE ADDITIVE B<sub>4</sub>C**

Ali Kaya GÜR, Necmettin YIGITTÜRK, Fevzi Ataman BILEN

Dep. of Metallurgy and Materials Eng., Faculty of Technology, Univ. of Firat 23119 Elazig/TURKEY  
a. Corresponding author (akgur@firat.edu.tr)

In study, the effect on the adhesive wear resistance of Cu-B<sub>4</sub>C<sub>p</sub> composites produced by powder metallurgy method. Cu/B<sub>4</sub>C<sub>p</sub> composite materials, cold pressing methods were made, reinforced with 3-6-9 and 12 vol B<sub>4</sub>C<sub>p</sub>. The wear tests were performed in different loads of the rotation speed of 90 rpm, the wear distance of 250, 500, 750 and 1000 m by block on ring test apparatus and the wear losses were calculated. Results were analysed with analysis of variance of ANOVA; and effects of parameters on wear rate were determined as percentage rate. Furthermore, error ratio statistically was revealed. The analysis of experimental results using analysis of means and analysis of variance has been discussed in detail.

## **CONVENTIONAL SINTERING OF DIAMOND CUTTING TOOL USED IN NATURAL STONE CUTTING**

Onur TAZEGUL, Ekin SELVI, Ferit TOPALOGLU

a. Corresponding author (tazegul@itu.edu.tr)

Diamond tools are used in drilling, polishing and grinding of natural stones such as concrete, marble and granite. Many diamond tools are used in the form of composite with diamond reinforced metal matrices. Diamond grains are impregnated into metal matrices in these composites. Diamond Tools, used in natural stone cutting, is produced commonly by powder metallurgy with Spark Plasma Sintering (SPS) and/or Conventional Sintering (CS). Co is generally used as metal matrices because of their bonding strength and optimum wear rate. However, because of cobalts' high prices, other alloying elements are also used to decrease the cost of diamond tools. Aim of this study is to compare mechanical, physical, microstructural properties of diamond cutting tools made of Co-Ni-Cu-Sn matrice, produced by Spark Plasma Sintering and Conventional Sintering. Spark Plasma Sintering performed at 800-8500C during 10 minutes, and Conventional Sintering performed at various temperatures (between 950 and 1150 oC) and times (1 to 4 hours). Then various properties (density, hardness, compression strength) of Conventional Sintered and Spark Plasma Sintered tools were investigated and compared. The experimental results showed that SPS tools have much better properties than CS tools.

## FORMATION OF AL-BASED COMPOSITE REINFORCED WITH NANO-ALUMINA PARTICLES USING A MECHANOCHEMICAL METHOD

S. Yazdani<sup>a</sup>, A. Fadavi Boostani<sup>a</sup>

<sup>a</sup> School of Materials Science, Faculty of Eng., Sahand Univ. of Technology (SUT), Tabriz, Iran  
a. Corresponding author (fadavi\_82@yahoo.com)

In this study, the reaction between recycled glass powders with aluminum powders during mechanical alloying in a planetary ball mill was evaluated using XRD patterns. The mixture of Al-10% wt. glass was milled to form Al-Si matrix with nano-alumina particles via in-situ reactions between the starting powders. The thermal analysis of mixed and milled powders using DSC indicated that milling of starting powders led to formation of mechanically activated powders and the exothermic reactions took place in lower temperatures with a higher intensity. The results of microstructural investigations using scanning electron microscopy and transmission electron microscopy have approved formation of nano-sized alumina with average size of 80nm in the matrix of aluminum after ball milling process. Additionally, these results demonstrated that the interface formed between reinforcements and matrix during this process is a clean interface meaning that there is a minimum amount of porosity inside the interface of alumina particles and aluminum matrix bringing about a higher mechanical properties for parts made by this process in comparison with ones produced by other conventional methods like stir casting.

## MICROWAVE DEPOSITION OF IRON OXIDE ON ACTIVATED CARBON AND ITS CHARACTERIZATION

Alp Yürüm<sup>a</sup>, Züleyha Özlem Kocabaş<sup>b</sup>, Meltem Sezen<sup>a</sup>, Raphael Semiat<sup>c</sup>, Yuda Yürüm<sup>b</sup>

<sup>a</sup> Sabanci Univ. Nanotechnology Research and Application Center, Tuzla, Istanbul, Turkey

<sup>b</sup> Faculty of Eng. and Natural Sciences, Sabanci Univ., Tuzla, Istanbul 34956, Turkey

<sup>c</sup> Faculty of Chemical Eng., Technion Inst. of Technology, Technion City, Haifa, Israel

a. Corresponding author (yyurum@sabanciuniv.edu)

Iron oxide is one of the materials, which is studied in areas like catalysis and environmental applications. Synthesizing iron oxides in nano dimensions show enhancements in the catalytic activity. In this study, pre-oxidized activated carbons impregnated with iron-based nanoparticles are prepared under hydrothermal conditions with microwave radiation. The hydrothermal treatment provides an important advantage by forming fine particles that can easily impregnate deep in to the porous support by the help of water. The synthesized nanomaterials with different iron oxide loadings were characterized by x-ray diffraction, scanning electron microscopy, and BET surface area analyzer. In addition to that the porosity of the material was characterized with focused-ion beam (FIB) by taking the cross section of the adsorbent. Microwave radiation provided much faster nano-sized iron oxide ( $\text{Fe}_2\text{O}_3$ ) impregnation on the active carbon surface. Further treatment with microwave increased the size of particles and the amount of surface coverage. Laboratory experiments were carried out to analyze As(V) removal capacities of the pure pre-oxidized activated carbon and iron impregnated adsorbents. The optimum pH values for each adsorbent were determined. According to kinetic sorption data, experimental data for fits pseudo-second order model.

# REMOVAL OF COPPER, CADMIUM AND NICKEL FROM AQUEOUS SOLUTIONS USING A NOVEL ADSORBENT PREPARED FROM RICE HUSK ASH AND $Fe_2O_3$ NANOPARTICLES

R. Demirci and G. Doner

Istanbul Technical Univ., , Faculty of Science and Letters, Dept. of Chemistry, Faculty of Maslak  
34469 Istanbul, Turkey

a. Corresponding author (doner@itu.edu.tr)

Rice husk is a major agricultural waste. Rice husk ash was prepared the ignition at 800 °C for 5 hours in a muffle furnace and successfully modified into a novel magnetic nano adsorbent by co-precipitating it with  $Fe_2O_3$  nanoparticles for the removal of copper, cadmium and nickel from aqueous solutions. The obtained nanocomposite sample was characterized by FTIR and XRD . The surface area of prepared magnetic composite was calculated by BET surface calculation method and found to be 69.58 m<sup>2</sup>/g , 156.34m<sup>2</sup>/g for rice husk ash (RHA) and magnetic composite material respectively. Batch adsorption studies were performed under different experimental parameters , such as pH, contact time, temperature, adsorbent mass, initial metal ion concentration and the effect of possible matrix ions. The adsorbent could be easily separated from the solution with a commercial magnet due to the magnetic property, which is very beneficial for their practical applications. Under optimum conditions (pH 7, 30 min shaking time at 200rpm and at 25°C) the maximum adsorption capacity was found to be 25.4mgCu<sup>2+</sup> /g, 20.3mgNi<sup>2+</sup>/g, 19.5mgCd<sup>2+</sup>/g adsorbent. RHA adsorption capacity for the studied elements was lower. The results showed that increasing the surface area increases the adsorption capacity.

## SYNTHESIS AND SURFACE PROPERTIES OF

### Ga-Te Co-DOPED ZnO NANORODS

Seçkin Akın<sup>1,a</sup> and Savaş Sönmezoğlu<sup>2</sup>

1. Dept. of Physics, Faculty of Kamil Özdağ Science, Karamanoğlu Mehmetbey Univ., Karaman,  
Turkey

2. Dept. of Materials Sci. and Eng., Faculty of Eng., Karamanoğlu Mehmetbey Univ., Karaman, Turkey

a. Corresponding author (seckinakin@kmu.edu.tr)

In this study, undoped ZnO and Ga-Te co-doped ZnO semiconductor thin films were grown on fluorine tin oxide (FTO) glass substrates by using sol-gel spin coating technique. The effects of Ga-Te dopants on the structural, optical and morphological properties of produced thin films were analyzed. Both thin films exhibit a high ZnO (002) diffraction peak indicating a strong c-axis orientation. Additionally, high-quality growth in the crystal structure of the films was seen in the surface images. SEM images also help us to draw a conclusion that the Ga-Te codoping has a strong effect on the ZnO morphology to obtain a nanorod based structures. The nanorods have diameters in the range of 50 - 80 nm and lengths of ~1 µm.

## NATURAL JUGLON DYE AS A PHOTSENSITIZER FOR DYE-SENSITIZED SOLAR CELLS

Seçkin Akın<sup>1,a</sup>, Cafer Akyürek<sup>2</sup>, Hasan Akış<sup>3</sup> and Savaş Sönmezoğlu<sup>4</sup>

1. Dept. of Physics, Faculty of Kamil Özdağ Science, Karamanoğlu Mehmetbey Univ., Karaman, Turkey
2. Karamanoğlu Mehmetbey Univ., Vocational High School of Technical Sciences, Dept. of Food Technology, Karaman, Turkey,
3. Karamanoğlu Mehmetbey Univ., Vocational High School of Technical Sciences, Dept. of Carpets and Kilims, Karaman, Turkey,
4. Dept. of Materials Sci. and Eng., Faculty of Eng., Karamanoğlu Mehmetbey Univ., Karaman, Turkey  
a. Corresponding author (seckinakin@kmu.edu.tr)

Juglon dye was obtained from the shell of walnut fruit using by hot extraction method, and used in the production of TiO<sub>2</sub> based dye-sensitized solar cell. When the obtained optical analysis measurements are examined, it is seen that TiO<sub>2</sub> absorbed with Juglon dye has a higher absorption coefficient than pure TiO<sub>2</sub>. It seems that these phenomena were related to electrical surface-state modifications induced by dye molecules. DSSC is formed with combining of FTO/TiO<sub>2</sub>/Juglon working electrode and FTO/Platinum counter-electrode layers in the form of a sandwich. The performance was for Juglon dye with a solar energy conversion efficiency of 0.945%, with a fill factor of 54.5% using an incident irradiation of 100 mW/cm<sup>2</sup> at room temperature. As a result, Juglon dye-sensitized solar cell produced in this study is also available in commercial potential due to having a simple and inexpensive production method.

## PRODUCTION OF ACTIVATED CARBON FROM ALMOND COCKLES : OPTIMIZATION USING SIMPLEX METHOD

T Chekakri<sup>a</sup>, T.Berama, Z Bendjama

Dept. of Environmental Eng., Inst. of Mechanical Eng. and Process Eng., Univ. of Sciences and Technology (USTHB), ALGERIA.

a. Corresponding author (s.hem@hotmail.fr )

In this study, the manufacture of an activated carbon from almond cockles has been investigated. Initially the experiments were designed and carried out according to 2<sup>4</sup> full factorial design. The variables chosen are the carbonization temperature, carbonization time, concentration of activating agent (HCl) and activation time. Elaborate coals were tested to adsorb aniline. The influence of the parameters mentioned on adsorption rate has been studied.

The data was statistically analyzed by using MODD.6 software. The established model allowed us to determine the approximate region of the optimum.

In addition to develop more efficient coal, both of activation and carbonization parameters were optimized according to simplex method with two variables. To do this, we proceeded in a sequential approach varying in each case two parameters.

The obtained results show that the removal efficiency increases with increasing concentration of HCl. Moreover, the increase in the duration of activation is unfavorable to the removal efficiency.

The maximum adsorption rate was obtained with high temperature and moderate concentration of HCl. Coal produced in an optimal way presents a specific surface about 773 m<sup>2</sup>.g<sup>-1</sup>, with a rate of micropores of 76.4%.

## SILVER-BASED METAL-ORGANIC HYBRID MOLECULES AND APPLICATION AREAS

Sevim HAMAMCI ALIŞIR, Hande MARULCUOĞLU

Ondokuz Mayıs Univ., Dept. of Materials Sci. and Eng., Faculty of Eng., 55200, Samsun, Turkey  
a. Corresponding author (sevimh@omu.edu.tr)

Crystal engineering of metal–organic networks via self-assembly of metal ions and multifunctional ligands has attracted considerable attention because of the structural diversity and their potential applications as functional materials. In principle, desired structural features and/or physicochemical properties greatly depend on the nature of the organic ligands and metal ions. Consequently, using appropriate organic ligands with functional groups that are capable of bridging metal centers to construct crystalline materials has shown to be a fast developing field of crystal engineering research. There has been some works on transition metal coordination polymers with pyridine dicarboxylates (pydc). However, coinage metals have received relatively little attention. Coordination polymers based on silver(I) are attraction, since the coordination sphere of silver(I) is very flexible and can adopt various coordination numbers. Furthermore, the flexibility of silver(I) may lead to different molecular architectures in the presence of chelating and bridging ligands.

In our ongoing investigation on the coordination chemistry of silver (I) complexes containing pydc, herein we report the synthesis, structure, thermal, luminescent properties and antibacterial activities of coordination polymer of Ag(I)- pydc.

## ORGANOFUNCTIONALIZED MESOPOROUS SILICA AS A SUBSTRATE FOR THE SYNTHESIS OF HIGHLY DISPERSED AU, PT AND PD NANOPARTICLES.

Natália Fattori<sup>a</sup> and Yoshitaka Gushikem

Inst. of Chemistry, State Univ. of Campinas (UNICAMP), PO Box 6154, 13083-970, Campinas-SP, Brazil

a. Corresponding author (nataliafattori@gmail.com)

The use of porous powder materials in widely different fields of science can be easily associated with the high level of scientific and technological development currently observed. The present work describes the use of functionalized porous matrices as supporting materials for the preparation and stabilization of metal nanoparticles (NPs). Metal nanoparticles dispersed in porous solids arouse great interest due to their unique properties, usually related to the quantum confinement effects and large surface-to-volume ratios, which drastically differ from the properties of the extended solid.

Mesoporous SBA-15 post-grafted with 1,4-diazabicyclo[2.2.2]octane (dabco) was used for the preparation and stabilization of Au, Pd and Pt NPs. The ion-exchange properties of the functionalized porous solid toward  $\text{AuCl}_4^-$ ,  $\text{PdCl}_6^{2-}$  and  $\text{PtCl}_6^{2-}$  ions allowed a controlled and effective uptake of anionic metal species throughout the porous structure. In a subsequent step, the retained ions were converted into supported metal nanoparticles by chemical reduction with  $\text{NaBH}_4$ . TEM investigation revealed that the supported NPs present a very high metal loading and high dispersion degree, while keeping very small particle sizes. The dabco grafted SBA-15 and proposed synthesis approach showed itself to be very efficient and convenient for the preparation of uniform and stable supported noble metal nanoparticles.

## THE ROLE OF POST-SYNTHETIC CATION EXCHANGE PROCESS IN TUNING METHANE STORAGE IN ANIONIC NANO-POROUS MOF MATERIALS

Kamran Akhbari and Ali Morsali<sup>a</sup>

Dept. of Chemistry, Faculty of Sciences, Tarbiat Modares Univ., P.O. Box 14115-175, Tehran, Islamic Republic of Iran

a. Corresponding author (morsali\_a@modares.ac.ir)

Methane is an attractive fuel due to its natural abundance and clean burning process.<sup>1</sup> Metal-Organic Frameworks (MOFs) represent a new class of coordination polymers<sup>2</sup> with permanent microporosity which make them good candidates for gas storage applications.<sup>3</sup> Thus exploring novel anionic frameworks under new synthetic conditions is very interesting.<sup>4</sup> Post-syntheses cation exchange process of  $[\text{HDMA}]_2[\text{Zn}_2(\text{BDC})_3(\text{DMA})_2].6\text{DMF}$  (**1**), (HDMA<sup>+</sup>: dimethylammonium, BDC<sup>2-</sup>: 1,4-benzenedicarboxylate, DMA: dimethylamine and DMF: N,N'-dimethylformamide) anionic MOF with Ni<sup>2+</sup>, Cu<sup>2+</sup>, Li<sup>+</sup>, Na<sup>+</sup> and K<sup>+</sup> ions was investigated by ICP, CHN, XRD, <sup>1</sup>H-NMR and TG analyses. Nitrogen adsorption isotherms of these MOF materials at 77K show type V adsorption curves. This strange behaviours are due to blocked channels or pores of the framework by the large, unremovable HDMA<sup>+</sup> cations (in **1**) or by aggregated KI (in exchanged sample with K<sup>+</sup>) and the weak interaction between N<sub>2</sub> molecules and the anionic framework (in other four samples). Replacement of the organic cation with smaller Li<sup>+</sup> ion in **1** leads to an increase in its internal surface area and methane sorption capacity. By the strategy developed here, we be able to prepare ion exchanged MOFs with higher surface area and methane sorption capacity capable of operating at more ambient temperature and pressure.

## $[\text{HDMA}]_2[\text{Zn}_2(\text{BDC})_3(\text{DMA})_2]$ : REUSABLE METAL ORGANIC FRAMEWORK AS AN EFFECTIVE SOLID BASE CATALYST FOR KNOEVENAGEL CONDENSATION REACTIONS

Saeideh Beheshti and Ali Morsali<sup>a</sup>

Dept. of Chemistry, Faculty of Sciences, Tarbiat Modares Univ., P.O. Box 14115-175, Tehran, Islamic Republic of Iran.

a. Corresponding author (morsali\_a@modares.ac.ir)

The structural nanoporosity of MOF materials places them at the frontier between zeolites and surface metal-organic catalysts. MOFs therefore appear to be excellent candidates for catalysis, with the understanding of their potential still largely in its infancy. The Knoevenagel condensation is one of the most fundamental condensation reactions in organic chemistry.<sup>1-3</sup> The  $\alpha,\beta$ -unsaturated products have been widely used as intermediates in the synthesis of fine chemicals, therapeutic drugs, natural products and functional polymers. However, most of the reported Knoevenagel condensations suffer from non-recoverable catalysts and use organic solvents and toxic metals. Current research is focused on the development of  $[\text{HDMA}]_2[\text{Zn}_2(\text{BDC})_3(\text{DMA})_2]$  metal organic framework as a heterogeneous catalyst to perform Knoevenagel condensations. This anionic MOF is found to be very efficient catalyst with reusability for a number of times with consistent activity.

## **THERMAL SHOCK RESISTANCE OF A SODA LIME GLASS ERODED BY SANDBLASTING: EXPERIMENTAL RESULTS AND MODELING**

Z. MALOU<sup>2</sup>, C. BOUSBAA<sup>1</sup>, N. BOUAOUADJA<sup>1</sup>, M. HAMIDOUCHE<sup>2</sup>, G. FANTOZZI<sup>3</sup>

1- Laboratoire des matériaux non métalliques, université Sétif 1, 19000 Algérie

2- Unité de recherche matériaux émergents (URMES), université Sétif 1, 19000 Algérie

3- MATEIS, UMR CNRS 5510, INSA de Lyon, 69621 Villeurbanne, France Laboratoire  
Mateis

a. Corresponding author ( zahramalou@yahoo.fr)

The purpose of this work is to study the thermal shock resistance of a soda lime glass eroded by sandblasting. First we exposed the samples to sandblasting by varying the mass of sand. The results show that, roughness increases rapidly up to 100 g of sand and tends thereafter to a landing up to a mass of 200g. Mass loss increases almost linearly and reaches a value of 3.76 mg for 200 g of sand projected. After, we submitted the samples sandblasted to thermal shock testing. We have found that the critical temperature is localized around 295 °C regardless of the surface state, while it is of the order of 305 °C for the as-received state. The simulation is in good agreement with the experimental results.

## **THE ALKENYLAMBER ACID ESTERS AS ANTIOXIDATIVE ADDITIONS TO FUELS**

M.A.Mamedyarov, F.Kh.Aliyeva

The Academician Y.H. Mamedaliyev Inst. of Petrochemical Processes,

Azerbaijan Republic, Baku - Az1025, 30, Khojaly ave.

a. Corresponding author (fatma-aliyeva@rambler.ru, fatma-aliyeva@mail.ru)

The alkenylamber esters (AAE) have been offered as a base and component of lubricant oils. The esters with different chemical structure have been received and its physical-chemical viscosity-temperature and also useful properties have been investigated. The correlative dependence between chemical structure and properties of these esters has been determined. By development of technology the demands to lubricants and also to fuels are raised. Execution of European standards Euro-4 and Euro-5 is impossible without use of substances, the small amount of which essentially change the useful properties of fuel. One of important demands to fuels are its thermo oxidative stability. On present time for rise of fuels chemical stability the antioxidative additions-stabilizer, for example VEMC are used, being composition of 2,6-di-tert-butyl-4-methylphenol, Mannikh hydroxide, alkyl phenol and etc, which are added in fuel in amount 0,05%. The alkenylamber acids esters of different structure have been researched as additions rising the fuel stability. By this purpose the diesel fuels samples by addition of alkenylamber acids esters in amount from 0,003 to 0,006% have been received. All the indices of diesel fuel quality and also the thermo oxidative stability have been studied. The thermo oxidative stability of received samples has been determined in apparatus LCART by temperature 120<sup>0</sup>C during 4 hours. It has been revealed that addition of esters in diesel fuel doesn't influence on its fraction composition; 95% is distilled in interval 357-361<sup>0</sup>C. The density of all samples is 852-853,3 kg/m<sup>3</sup> and solidification temperature change in interval from minus 22<sup>0</sup>C (turbidity temperature is minus 13<sup>0</sup>C) to minus 28<sup>0</sup>C (turbidity temperature is minus 18<sup>0</sup>C). The samples endure the corrosive aggression of copper (3 hours by 50<sup>0</sup>C). By addition of esters the thermo oxidative stability of all samples is rising, that is determined by decrease of amount of formed settlement. For example by addition of 0,004% of AAA esters of different structure in diesel fuel in some samples it is reduced to 2,4 and 2,8 mg/100 ml. In some samples the precipitate is absent. Thus, by received results some esters of AAA may be recommended as antioxidative additions to diesel fuels.

## **SURFACE-DECORATION OF ZINC OXIDE (ZNO) NANOPARTICLES OR NANOCOATINGS ONTO ELECTROSPUN POLYMERIC NANOFIBROUS MEMBRANES BY ATOMIC LAYER DEPOSITION**

Fatma Kayaci, Cagla Ozgit-Akgun, Necmi Biyikli and Tamer Uyar<sup>a</sup>

UNAM-Inst. of Materials Science and Nanotechnology, Bilkent Univ., Ankara, Turkey

a. Corresponding author (tamer@unam.bilkent.edu.tr)

The electrospinning is versatile and cost-effective for producing functional nanofibers. The design flexibility for surface modification is quite feasible for obtaining multi-functional electrospun nanofibers. Yet, the surface-decoration of electrospun polymeric nanofibers by metal oxides is challenging since the deposition of inorganic nanostructures sometimes requires high temperature or complex processes which can deform the polymeric nanofiber. However, atomic layer deposition (ALD) is a special type of low-temperature chemical vapor deposition which can be used for surface functionalization of electrospun polymeric nanofibers with inorganic nanostructures. In this study, the electrospun polymeric nanofibers were surface-decorated with zinc oxide (ZnO) nanoparticles (NP) or ZnO nanocoating by ALD. By altering the ALD parameters we tailored the ZnO morphology onto electrospun polymeric nanofibers and various nanostructures such as surface-decorated ZnO NP or a continuous ZnO nanocoating having uniform thickness were obtained. The resulting polymer/ZnO nanofibrous membranes were easily handled and folded as a free standing material due to the flexible polymeric component. These nanofibrous membrane surface-decorated with the highly dense ZnO NP exhibited the highest efficiency for the photocatalytic decomposition of Rh-B dye due to its high surface area. These functional nanofibrous membranes may find applications as filtering materials for water purification and organic waste treatment.

## **PROTEIN IDENTIFICATION WITH MALDI-TOF/TOF MS BY USING ON-SURFACE DIGESTION**

Melike Dinç

a. Corresponding author ( melikedinc@iyte.edu.tr)

Protein identification is predominantly carried out by searching tandem mass spectrometric data of peptide fragments in a protein database. For this reason, proteins are converted to peptides through a digestion process by using some certain endoproteinases. Whereas in-solution digestion method is applied for the proteins in solution, proteins trapped in the gel can be digested by using in-gel digestion technique. Alternative to these traditional digestion methods, it has been reported that proteins can be digested too while they were adsorbed onto solid surfaces.

In this study, digestion process of the adsorbed proteins, namely on-surface digestion is examined by using both hydrophobic and ionic adsorbents on different proteins. Results of the on-surface digestion were compared with in-solution digestion and in-gel digestion methods. As a conclusion, on-surface digestion is applicable for the protein identification by mass spectrometry; however, its yield may change from one experiment to another, depending on two separate but related processes: protein adsorption before the digestion and peptide recovery after the digestion. Nevertheless on-surface digestion has the advantages of protein enrichment and protein purification prior to mass spectrometry. These processes are necessary and significant especially for the samples containing minute amounts of protein and an effective enzymatic activity.

## **STUDY ABOUT THE INFLUENCE OF SOME SPECIAL POROSITY MATERIALS ON TREATMENT OF THE DANUBE WATER – USED IN TO IRRIGATION TASK**

Petre Savescu<sup>1,a</sup>, Ileana Cojocaru<sup>1</sup>, Teclu Codresi<sup>2</sup>

1 Univ. of Craiova, Faculty of Agriculture and Horticulture, Craiova, Romania

2 A.E.R. Foundations, Inst. of Applied Research in Systemic Ecology, Romania

a. Corresponding author (psavescu@gmail.com)

The work paper is a part of great research study under ECCO-IRRIGATION PROJECTS funded by Phare Romania-Bulgaria Cross-Border Cooperation Programme. The influence of some special material at different porosity used for filtering and neutralized tasks, prove different chemical composition and properties of vegetables crop. These crops were irrigated through two methods – direct, by Danube water and indirect, through waste water plant; the obtained results proved great differences on chemical composition of irrigated vegetable crop.

## **TRICHLOROPHENOL REMOVAL FROM AQUEOUS SOLUTIONS BY MODIFIED HALLOYSITE: KINETIC AND EQUILIBRIUM STUDIES**

Mokhtar Boutahala, Hassina Boudiaf

a. Corresponding author (mboutahala@yahoo.fr)

The Algerian halloysite was modified by thermal activation, acid activation and combined acid and thermal activation to obtain new materials. The changes were characterized by, MEB, X-ray diffraction (XRD), Fourier transform infrared (FTIR) and textural analysis by BET. The MEB image of raw halloysite shows nanotubular morphology. After the calcination of halloysite at 600°C, no XRD peaks were shown and a complete disappearance of the bands in the wavelength range 3700-3600 cm<sup>-1</sup> is observed. The treatment of halloysite by sulphuric acid increases the surface area from 185.4 to 321.0 m<sup>2</sup>/g. Halloysite is calcined then activated, its surface area increases from 74.3 to 538.6 m<sup>2</sup>/g. The effect of initial pH, adsorbent dose, contact time and temperature on the adsorption of 2, 4, 5-trichlorophenol (TCP) by modified halloysite samples were investigated. Kinetic experiments showed that the adsorption follows a pseudo-second order kinetic model and the isotherm equilibrium data were well described by the Freundlich model. The thermodynamic parameters revealed that adsorption reaction using the modified clays is spontaneous and exothermic.

## **BIOGAS PRODUCTION FROM FRUIT JUICE WASTEWATER**

S. Zerrouki<sup>a</sup>, R. Rihani<sup>a</sup>, F. Bentahar<sup>a</sup>

<sup>a</sup> Laboratoire Phénomènes de Transfert, FGM/GP, Université des Sciences et de la Technologie Houari Boumediene, U.S.T.H.B, BP 32 El-Alia, Bab-Ezzouar, Algeria

a. Corresponding author (rachida\_riha@yahoo.fr)

The aim of this study is to quantify the biogas production from the apricot and orange juice cocktail that comes with pulp from Algerian fruit juice industry. The experiments were conducted in a laboratory-scale using a stainless steel digester of a capacity of 5 liters under a mesophilic and a thermophilic temperature. During experiments various parameters have been recorded as: Chemical oxygen demand (COD), biological oxygen demand (BOD), cells growth, pH, total sugar content in juice, dry matter, etc. Note that the biogas analysis is carried out using headspace sampling coupled with gas chromatography (HS-GC). It was found that the maximum growth rate achieved was about 0.32 h<sup>-1</sup> under mesophilic temperature, while it was higher in the case of thermophilic temperature. The biodegradability of the effluent was about 200 mg/l under thermophilic temperature and it was higher than in the case of a mesophilic temperature. The quantity of biogas produced was about 435 ml under thermophilic temperature while it was about 144 ml under mesophilic temperature.

## **REMOVAL OF TRICHLOROPHENOL FROM AQUEOUS SOLUTION ONTO POROUS MATERIALS BY ADSORPTION IN A BATCH SYSTEM**

H. Zaghouane-Boudiaf<sup>a</sup>, Mokhtar Boutahala

Laboratoire de Génie des Procédés Chimiques (LGPC), Département de Génie des Procédés, Faculté de Technologie, Université Ferhat Abbas, Sétif 19000, Algeria

a. Corresponding author ( boudiaf hassina2000@yahoo.fr)

The removal of organic and inorganic pollutants from aqueous effluents has become a major topic of research, due to the toxicological problems caused by these compounds to the environment. Adsorption processes using activated carbons have been widely proposed and used for the treatment of polluted water. However, commercially activated carbons are expensive. A great effort has been put into the usage of low-cost adsorbents prepared from naturally agricultural wastes.

Coffee residue was used as a precursor to prepare activated carbon using zinc chloride as a chemical activation agent and temperature. The performance of the activated coffee residue (ARC) was characterized by N<sub>2</sub> adsorption-desorption isotherms, XRD, and FTIR. The removal of 2,4,5-trichlorophenol (TCP) from aqueous solution by adsorption on ARC was investigated. The kinetic data follow closely the pseudo-second order model. It was found that Langmuir-Freundlich model gives a good fit and shows maximum monolayer adsorption capacity of 405 mg/g.

## **SYNTHESIS AND CHARACTERIZATION OF POLYSTYRENE/ Mg(OH)<sub>2</sub> NANOCOMPOSITE**

Hussen Adeb Abas Ouj<sup>a</sup>, Ayla Altınten<sup>a</sup>, Sebahat Erdoğan<sup>a</sup>

<sup>a</sup>Gazi Univ., Faculty of Eng., Dept. of Chemical Eng., Ankara 06570

a. Corresponding author (huseyinavci@gmail.com)

In this study, as the matrix phase polystyrene (PS), as the reinforcement material magnesium hydroxide Mg(OH)<sub>2</sub> is used. An experimental study, preliminary, composite synthesis and characterization is planned. Hydrophilic surfaces of Mg(OH)<sub>2</sub> nanoparticles are not favorable for their dispersion in polymers, so oleic acid was used to modify the surfaces of Mg(OH)<sub>2</sub> nanoparticles to make them lipophilic and disperses homogeneously in the matrix. Synthesis process of nanocomposite carried out in the presence of toluene, using different ratio %1, %2 and %3 of Mg(OH)<sub>2</sub> nanoparticles, two different production method were used to obtain polymeric nanocomposite, in-situ polymerization and melt intercalation. Experiments were performed at constant temperature. Polystyrene is very sensitive to flame so Mg(OH)<sub>2</sub> has gradually been used in the flame retardancy of polystyrene, Mg(OH)<sub>2</sub> nanoneedles also improve the thermal stability and mechanical properties of polymers. At last monomer conversion % and viscosity average molecular weights were calculated and then characterization studies were performed, transmission electron microscopy (TEM), fourier transform infrared spectroscopy (FTIR), thermo gravimetric analysis (TGA) and shore D hardness measurement method. The results show that the dispersion of Mg(OH)<sub>2</sub> nanoparticles in melt intercalation production method is better than in situ polymerization method.

## **RESEARCH AND DEVELOPMENT OF TECHNOLOGIES OF OBTAINING THE COMPOSITE METAL MATERIALS FROM POWDER POOR AND OFF-BALANCED ORES**

Soyibjon Negmatov<sup>1</sup>, Aminjon Bozorov<sup>1</sup>, Fakhridin Rakhimov<sup>1</sup>, Hasan Sharipov<sup>1</sup>,  
Mahmudjon Yakubov<sup>1</sup>, Jahongir Negmatov<sup>1</sup>, Mahammadjon Tursunov<sup>1</sup>

1. SUE "Science and Progress" Toshkent State Technical Univ., Tashkent, Uzbekistan,  
a. Corresponding author: (polycomft2005@rambler.ru)

Based on research results we developed small volume technology for obtaining ferromanganese and ferromolybdenum by restoring (enrichment) of powdered manganese ore and molybdenum cakes.

We calculated and chose reagents, necessary equipment, material flow for modeling the hydrometallurgical process, we conducted and established consistent pattern of thermal studies and on their base developed a new way to extract the ferroalloys from powdered poor and off-balance ores, developed optimal technological mode of furnaces, which are fundamentally different from existing ones.

The developed technology of ferroalloys will provide the alloying component for metallurgical and engineering industry sectors.

## MESOPOROUS AEROGELS AND XEROGELS BASED ON SULPHATED ZIRCONIA DOPED WITH COBALT AS CATALYSTS OF N-HEXANE ISOMERIZATION

S. Raissi<sup>1,a</sup>, K. de Younes<sup>1</sup>, A. Ghorbel<sup>1</sup>

<sup>1</sup>Université Tunis El Manar, Faculté des Sciences de Tunis, Laboratoire de Chimie des Matériaux et Catalyse

*a.* Corresponding author ( r.sahar@hotmail.fr)

Solgel method is interesting for solid preparation. It permits considerable increase of surface area and offers good homogeneity of mixed oxides. This method was optimized to elaborate catalysts based on Co/ZrO<sub>2</sub>-SO<sub>4</sub>. Those catalysts are used for n-hexane isomerisation which is a reaction that attracts the petroleum refiner interest since it permits to produce clean fuel with an adequate octane number. Our study is focused on the evaluation of drying mode effect of gels on their structural, textural and spectroscopic characteristics and its impact on their catalytic properties. The N<sub>2</sub> physisorption reveals that aerogels have better porosity and higher S<sub>BET</sub>. This result is in concordance with XRD study that shows that all the solids develop the ZrO<sub>2</sub> tetragonal phase except the xerogels calcined at low temperatures. The UV-visible and XPS spectroscopies showed that cobalt contained in aerogels is on the oxidation state II. However, the xerogels cobalt is on the oxidation state III only at low calcination temperature. The IR spectra reveal that the sulphate retention of aerogels is more important than that of xerogels. The aerogels catalytic properties, in n-hexane isomerisation, are similar in contrast to the xerogels which are completely inactive until a calcinations temperature of 873 K.

## ORGANOFUNCTIONALIZED KAOLINITE FOR THE REMOVAL OF COPPER IONS IN AQUEOUS SOLUTION: SORPTION CAPACITY AND THERMODYNAMIC PARAMETERS.

Ana Lucia Santos, Claudio Airoidi

*a.* Corresponding author ( analucia@iqm.unicamp.br)

Clay mineral has been modified to increase its applicability as a sorbent of ions copper in aqueous solution. In the present investigation we modified Kaolinite clay with N-[3-(trimethoxysilyl)propyl]diethylenetriamine, before modification the basal distance was enhanced with a polar organic solvent dimethyl sulfoxide. The resulting organofunctionalized nanomaterial (3N-Kao) was characterized by elemental analysis, infrared spectroscopy, X-ray diffraction, carbon and silicon nuclear magnetic resonances in the solid state, thermogravimetry and electron scanning microscopy. The presence of a covalent silicon-carbon bond of the organosilyl moiety on the inorganic layered structure was confirmed through nuclear magnetic resonance. The thermodynamic parameters were obtained by titration calorimetry. The results show that the sorption could be best described by the pseudo- second-order Kinetic model and that the sorption isotherm is in good agreement with the Langmuir equation.

## **EXPERIMENTAL INVESTIGATION OF THE SELECTIVE PERMEABILITY OF HOLLOW GLASS MICROSPHERES WITH NANOSTRUCTURED SHELL**

Vitaly Zinovyev<sup>1,a</sup>, Ivan Kazanin<sup>1</sup>, Vadim Lebiga<sup>1</sup> and Alexey Pak<sup>1</sup>

1. Khristianovich Inst. of Theoretical and Applied Mechanics  
Novosibirsk, Russia
- a. Corresponding author (zinoviev@itam.nsc.ru)

In these experiments was shown the different types of sorbents under study are impermeable to methane and air but they are permeable to helium. The rate of the processes of absorption and desorption of helium are mainly depended on the difference of the partial pressures of helium inside and outside of the microparticles, if other parameters are fixed (temperature, size of the particles, et cetera). It has been established that the presence of associated gas in the volume phase has almost no effect on the sorption and desorption of helium. Modified cenospheres demonstrated a significant increase, more than an order of magnitude, in the rate of absorption of helium compared with microspheres. In turn, for the microspheres have been undergone joint granulation with aluminum hydroxide the permeability coefficient was increased by almost two orders of magnitude compared to the initial microspheres.

## **PRODUCTION OF CERAMIC TILES HAVING LIGHT AND POROUS FROM DIATOMITE – ALUMINA BASED WASTES VIA GEOPOLMERIZATION PROCESS**

Eda TAŞÇI<sup>1,a</sup>, Mustafa TUNCER<sup>1</sup>, M.Uğur TOPRAK<sup>2</sup>

<sup>1</sup>Dumlupınar University, Eng. Faculty, Materials Sci. and Eng. Dept., Kütahya.

<sup>2</sup> Dumlupınar University, Eng. Faculty, Civil Eng. Dept., Kütahya.

a. Corresponding author (edahoca@hotmail.com)

The aim of this study was to produce ceramic tiles from diatomite – alumina waste powder mixtures. Physical and chemical properties of tiles were conducted. The results show that these tiles can be used for coating material in houses because of their high resistance to flame and low thermal conductivity.

## **MAGNETIC HIERARCHICALLY POROUS ZrO<sub>2</sub>/Fe<sub>3</sub>O<sub>4</sub> NANOCOMPOSITE IMPREGNATED CHITOSAN BEADS FOR TREATMENT OF ORGANIC POLLUTANTS IN WATER**

Jinhuai Liu, Weihong Xu, Jing Wang

a. Corresponding author (jhliu@iim.ac.cn)

Magnetic hierarchically porous ZrO<sub>2</sub>/Fe<sub>3</sub>O<sub>4</sub> nanocomposite impregnated chitosan beads were successfully developed, and investigated for suitability as organic pollutant adsorbents using fulvic acids (FA) as an example. Batch experiments were performed to determine the rate of adsorption and equilibrium isotherm. The effect of adsorbent dose, pH, initial adsorbate concentration and the presence of co-existing cations and anions on the adsorption performance was studied. The adsorbent showed the maximum adsorption capacity of 194.8 mg/g for FA, while maintaining a residual FA concentration of 51.4 mg/L at an equilibrium pH 7. The adsorption equilibrium data fitted well to Freundlich isotherm, and the adsorption kinetics followed the pseudo-second-order model. A distinct advantage of this adsorbent is easy separation from water solutions by application of an external magnetic field. The study indicates that the adsorbent has potential applications in the removal of organic pollutants from water system.

## **FABRICATION OF RARE EARTH OXIDE DOPED TUNGSTEN POWDER BY SPRAY METHOD**

Wei Liu, Jinshu Wang, Meiling Zhou

School of Material Science and Technology, Beijing Univ. of Technology  
Pinleyuan 100#, Beijing, China

a. Corresponding author (liuw@bjut.edu.cn)

In this paper, rare earth oxide doped tungsten powder was prepared by the spray drying method combined with two-step hydrogen reduction. The microstructure, particle size distribution, reduction behaviors of scandia doped WO<sub>3</sub> powders was investigated by different analysis techniques. It is shown that Sub-micron sized scandia doped tungsten powders in the size range of 600-800nm with average particle size of 716nm were successfully prepared. The rare earth oxide elements distribute uniformly in the powders. The reduction temperature of precursor oxides have been shifted to a lower temperature, indicating that precursor powder with network structure have a good effect on the reduction temperature. In the meanwhile, the addition of Sc<sub>2</sub>O<sub>3</sub> accelerates the formation of cracks and pores in tungsten oxide particles, which lead to the bigger reaction interface.

## CHARACTERIZATION AND PARTICLE SIZE REDUCTION OF A TURKISH NATURAL CLAY: VERMICULITE

Emre Arkan, Metahan Atagür, Mücahit Sütçü, M.Özgür Seydibeyoğlu\*

Dept. of Materials Sci. and Eng., Izmir Katip Celebi Univ., Cigli Ana Yerleskesi, 35620, Izmir, Turkey  
a. Corresponding author (seydibey@gmail.com)

Increased industrial awareness makes vermiculite important minerals in the preparation of nanocomposites because of its remarkable properties such as interlayer carrying exchangeable cations for the reaction with organic and inorganic moieties as well as the ability of dispersion of particles into individual layers. This study shows the characteristic features of different manufacturing vermiculite mineral particles with different mechanical ways such vibratory disc mill, ball mill, sonicator and homogenizer to obtain ultra-fine minerals. The morphology of vermiculites samples prepared with different methods was studied using scanning electron microscopy (SEM) and the changes of vermiculite structures were monitored using X-ray diffraction (XRD) analysis. The particle size (PS) changes of vermiculites were characterized by the median particle size (d50), volume-weighted mean diameter (d43), mode diameter (dm) and span value. The thermal behavior of the vermiculites was analyzed by Differential Thermal Analysis (DTA) which allows the determination of the specific temperatures at which phase modifications take place, principally the ones attributed to the removal of the interlayer water molecules and the formation of a series of less hydrated phases. This study presents new and cost effective techniques to prepare nanoparticles and nanoclays that can find applications in various areas. Some of these but not the least, are adsorption studies, catalysis, cosmetic industry and polymer nanocomposites.

## SELECTIVE SEPARATION OF SIMILARLY SIZED PROTEINS WITH TUNABLE NANOPOROUS BLOCK COPOLYMER MEMBRANES

X. Qiu<sup>1</sup>, H. Yu<sup>1</sup>, M. Karunakaran<sup>1</sup>, N. Pradeep<sup>1</sup>, S. P. Nunes<sup>2</sup> and K.-V. Peinemann<sup>\*1</sup>

<sup>1</sup> Advanced Membranes and Porous Materials Center, <sup>2</sup> Water Desalination and Reuse Center, 4700 King Abdullah Univ. of Science and Technology (KAUST), Thuwal 23955-6900, Kingdom of Saudi Arabia

a. Corresponding author (klausvikt.peinemann@kaust.edu.sa)

A nanoporous membrane was fabricated in a fast and one step process by combining the self-assembly of the block copolymer (PS-b-P4VP) with non-solvent-induced phase separation.<sup>1-4</sup> The structure was found to be comprised of a thin layer of densely packed highly ordered cylindrical channels with uniform pore sizes perpendicular to the surface on top of a non-ordered sponge-like layer. The membrane obtained a water flux of more than 3200 L m<sup>-2</sup>h<sup>-1</sup> bar<sup>-1</sup>, which was at least an order of magnitude higher than the water fluxes of commercially available membranes with comparable pore sizes. Another remarkable property of this membrane is that it is stimuli (pH)-responsive. These attractive characteristics make this membrane particularly suitable for applications that require size-selective and charge-based separation of biomolecules. Biomolecule transport through this type of asymmetric self-assembled membrane has not previously been studied. With our membrane we efficiently separated similar-sized proteins with high selectivity. We further modified the whole membrane by quaternization to improve the separation selectivity of two similar-sized proteins. In this study, we report on the separation mechanism of PS-b-P4VP membranes with tunable pore sizes and charges. Our results<sup>5</sup> demonstrate the potential of our membrane to efficiently separate biological substances in bioscience, biotechnology and biomedicine applications.

## BIOMIMETIC STIMULI-RESPONSIVE NANOPOROUS PARTICLES BY BLOCK COPOLYMER SELF-ASSEMBLY

H. Yu<sup>1</sup>, X. Qiu<sup>1</sup>, S. P. Nunes<sup>2</sup> and K.-V. Peinemann<sup>\*1</sup>

<sup>1</sup> Advanced Membranes and Porous Materials Center, <sup>2</sup> Water Desalination and Reuse Center, 4700 King Abdullah Univ. of Science and Technology (KAUST), Thuwal 23955-6900, Kingdom of Saudi Arabia,

a. Corresponding author ( klausvikt.peinemann@kaust.edu.sa)

A novel and simple method to fabricate nanoporous particles by block copolymer (BCP) self-assembly<sup>1-3</sup> was described here for the first time. It is found that the particles had complex but highly ordered structures with very dense and regular nanopores. The macromolecular nature imparts to particles, an intrinsic stability and durability. These newly developed particles are easy to be transferred from various aqueous medium through centrifugation. Another remarkable property of the particles is that they are stimuli (pH, ion, et al.)-responsive. Their tunable nanopores can be used as sensitive gates controlled by pH without any modification. It means that our particles are able to mimic both the structure and the function of natural systems. We further trapped the intermediate structures at different time to help us deeper understand the possible formation mechanism of the particles. Proteins were then used as model drugs to investigate their loading abilities as versatile drug-delivery vehicles. The particles exhibit high loading capacity that might be related with the outer and inner porous structures. Moreover, with our particles we selectively separated not only two proteins of similar size ( BHB 65 kDa, BSA 66 kDa) but also two proteins of similar pI (BHB 7.4, IgG 7.3) in a very efficient way by controlling the environmental pH. Our results demonstrate the potential applications of our biomimetic<sup>4</sup> particles in protein separation/recognition, delivery systems of drugs or bioactive agents, etc.

## INVESTIGATION OF THE ATOMIC AND ELECTRONIC STRUCTURE OF THE H, OH, CO, AND H<sub>2</sub>O ADSORPTIONS ON PT(111) SURFACE BY THEORICAL

M. EVECEN<sup>\*a</sup>, M. ÇAKMAK<sup>b</sup>

<sup>a</sup>Dept. Of Physics, Amasya Univ., Ipekkoy, 05100 Amasya, TURKEY

<sup>b</sup>Dept. Of Physics, Gazi Univ., Teknikokullar, 06500 Ankara, TURKEY

a. Corresponding author ( meryem.evecen@amasya.edu.tr)

We studied a detailed investigation of the behavior of chemisorbed H, OH, CO, and H<sub>2</sub>O on Pt(111) using density functional theory (DFT). We have considered the five possible adsorption sites: top, bridge, fcc and hcp. We have found that Pt lattice parameter 3.978 Å, with confirm theoretical 3.98 Å and experimental 3.924 Å results. For H atom, we saw the binding geometry of top site (0,517eV) was energetically more favorable than the others sites. This situation and atomic key parameters of all systems have been compared other molecules with theoretical and experimental values. We have also calculated the reaction path and energy profiles for dissociation both H<sub>2</sub>O into OH-H and OH into O-H on Pt(111) surface.

## **FABRICATION OF NANO- TO MICRON-SIZED PATTERNS USING ZEOLITES: ITS APPLICATION IN BSA ADSORPTION**

Salih Kaan Kirdeciler, Can Ozen, Burcu Akata

*a.* Corresponding author ( kaankirde@gmail.com)

Zeolite A(Z-A) and silicalite(Z-SIL) patterns were generated using the combinations of electron beam lithography(EBL) or photolithography(PL) with direct attachment method to be able to generate differentiated areas on a surface in a cheap, facile way. The possibility to generate minimum-sized zeolite patterns on top of zeolite monolayers was investigated by using EBL for the first time. Also generation of large scale zeolite patterns on top of a different zeolite monolayer was investigated by using PL. It was shown that creating 3D zeolite architectures of different types with a perfect control was possible without chemical linker. In order to test the potential different behaviors that zeolites of different properties are offering in the adsorption of biomolecules, zeolite patterned surfaces were subjected to adsorption studies with BSA. Irrespective of zeolite type, BSA preferred the patterned regions rather than the underlying monolayers. It can be speculated that the obtained difference in roughness values facilitates the protein to be selectively adsorbed onto surfaces with increased roughness, i.e., the patterned regions. Moreover, we observed ~2-fold fluorescence intensity difference between Z-SIL and Z-A patterns, which were subjected to FITC-BSA. Hydrophobic interactions and charge repulsion are considered as two critical forces responsible for the observed adsorption differences.

## **EFFECT OF THE DEALUMINATION MODE OF THE ZEOLITIC SUPPORT ON THE PALLADIUM CATALYTIC BEHAVIOUR ON THE N-HEXANE ISOMERIZATION**

Hanene Najar

*a.* Corresponding author ( hanene.naj@gmail.com)

As the increasing community concern about the environment and the public health, high environmental standards have been implemented to eliminate the use of lead based additives for increasing the octane number in gasoline. Isomerisation of n-alkanes is becoming a major alternative for enhancing octane number. In this work, the n-hexane isomerisation was carried out over palladium based catalysts prepared by aqueous ion exchange with dealuminated NaY-zeolite support. The dealumination was realised using acid solution of HNO<sub>3</sub> and HCl with different concentrations. The catalysts were characterized by nitrogen physisorption, XRD, <sup>27</sup>Al-MAS-NMR and <sup>29</sup>Si-MAS-NMR and NH<sub>3</sub>-TPD. The catalytic reaction was performed in the temperature range between 498 and 548 K. Given the results, we can argue that the dealumination of the zeolitic support contributes significantly to improving the activity and selectivity of the prepared catalysts. In fact, it is shown that the combined effect of the stronger zeolitic support acidity and the Pd dehydrogenation role is assumed to be responsible for the good catalytic performance of Pd on modified zeolite. Besides, the Si/Al ratio and the presence of the extraframework species, which control the active Brønsted and Lewis acid sites, play an important role in the catalytic activity and selectivity.

## SMALL AND MEDIUM AMMUNITION PROJECTILE MADE BY INJECTION MOLDING PROCESS FROM PLASTICIZED MIXTURES OF $W_{95}Ni_{3.5}Cu_{1.5}$ MECHANICALLY ALLOYED POWDERS

Irina CARCEANU\*, Ioan NEDELCU\*\*, Corina MORARU\*\*\*, Rodica POPESCU\*\*\*

\* Metallurgical Research Inst. of Bucharest

\*\* SC TECHNOMAT PROD SRL

\*\*\* Univ. TRANSILVANIA of Brasov

a. Corresponding author ( irina\_carceanu@yahoo.co.uk)

After 11<sup>th</sup> September 2001, the global security environment has changed radically, passing from symmetrical to asymmetrical risks and threats. This is especially based a using different forms at rapid reaction based on using advance technologies in the field of communications sensors and ammunitions. The researches in the military field are working on identifying those solution which will allow counter acting those asymmetric actions through using conventional military means, and through increasing their efficiency and reducing the collateral damages. Nowadays, in medium and long range military actions are used 8360 tones of conventional ammunition per 5 days of action (implying large quantities of materials with negative impact on the environment), which have efficiency of max 50% from their real potential.

The paper presents the results of experiments concerning the manufacturing and development of complex materials with submicronic structure for achieving type arrow perforating projectiles using integrated technologies for industrial applications. One presents also applicative experimental researches concerning the current stage of manufacturing homogeneous powder mixtures of the W-Ni-Cu system and the processing of materials emphasizing submicronic structure obtained by mechanical alloying using modern methods of plastic moulding-powder injection molding.

Experimental research aimed at studying the behavior of the projectile perforated from parts that made up the experimental group and the impact of different high-speed armor.

## NANO-SIZED UPCONVERSION PHOSPHORS FOR DEEP OPTICAL IMAGING OF BIOLOGICAL TISSUES

Victor I. Sokolov<sup>1,a</sup>, Evgenii V. Khaydukov<sup>1</sup>, Andrei V. Nechaev<sup>2</sup>, Vladislav Ya. Panchenko<sup>1</sup>, Vladimir N. Seminogov<sup>1</sup>, Vladimir A. Semchishen<sup>1</sup>, Anna E. Guller<sup>3</sup>, Andrei V. Zvyagin<sup>1</sup>

1. Inst. on laser and information technologies of the Russian academy of sciences. Shatura, Russia

2. M.V. Lomonosov Moscow State Univ. of Fine Chemical Technologies. Moscow, Russia

3. I.M. Sechenov First Moscow State Medical Univ.. Moscow, Russia

a. Corresponding author (visokol@rambler.ru)

The nano-sized upconversion phosphor powders on the basis of inorganic crystallite host  $\beta$ -NaYF<sub>4</sub> doped with the rare-earth ions Yb<sup>3+</sup>, Er<sup>3+</sup>, Tm<sup>3+</sup> are synthesized. The particles have the size in the range from 10 to 100 nm and are stable in water solutions due to the special chemical modification of the surface. The upconversion efficiency coefficient of nanophosphors (i.e. power conversion of the pumping light to anti-Stokes luminescence) is 2 - 2.5%. The possibility of optical imaging of biological tissues labeled with upconversion nanophosphors by 975 nm laser light at diagnostically significant depth 10 mm is demonstrated experimentally. It is shown that by using the multi-fiber probe one can enhance the lateral resolution of strip markers by a factor of 2 in comparison with the resolution obtained with conventional CCD registration technique. The method can be used for deep high-resolution optical imaging of pathological bio-tissues in medicine.

## APPLICATION OF NANO-SIZED UP-CONVERSION PHOSPHORS DOPED WITH RARE-EARTH ELEMENTS IN POLYMER PHOTONICS

Alexander G. Savelyev<sup>1, a</sup>, Evgeny V. Khaydukov<sup>1</sup>, Andrey V. Nechaev<sup>2</sup>, Vladislav Ya. Panchenko<sup>1</sup>, Vladimir A. Semchishen<sup>1</sup>, Victor I. Sokolov<sup>1</sup>, and Andrey V. Zviagin<sup>1</sup>

1. Institute on Laser and Information Technologies of the Russian Academy of Sciences, Dept. of advanced laser technologies, Moscow, Russia
2. Lomonosov Moscow State Univ. of Fine Chemical Technologies, Moscow, Russia  
a. Corresponding author (A.G.Savelyev@gmail.com)

We have synthesized 20-100 nm up-conversion anti-Stokes crystals of  $\beta$  - NaYF<sub>4</sub>:Yb<sup>3+</sup>Er<sup>3+</sup>,  $\beta$  - NaYF<sub>4</sub>:Yb<sup>3+</sup>Tm<sup>3+</sup>, and NaYF<sub>4</sub>:Yb<sup>3+</sup>Tm<sup>3+</sup>Er<sup>3+</sup> phosphors with conversion coefficient 2-3% at 100 W/cm<sup>2</sup> pump intensity. A special method for embedding the nano-phosphors into photocurable liquid compositions on the basis of new fluorinated acrylic monomers is employed. These monomers have the fluorination degree above 80% and the absorption coefficient 0.26 dB/cm in the 1500 nm telecom range. The method of deep UV contact lithography is employed to fabricate polymer waveguides with embedded nano-phosphors.

The technique for measuring the IR propagation loss in the polymer waveguides is proposed. It is based on embedding nano-phosphors at concentration 0.005% into polymer waveguide core. The technique can be used for analyzing the waveguides with extremely low scattering losses as well as waveguide splitters and directional couplers.

## ANTI-INFLAMMATORY AND CHEMICAL COMPOSITION OF TWO PLANTS FAMILY ASTERACEAE GROWING IN SAUDI ARABIA

Eman Elsharkawy<sup>1, a</sup>, Mona Alshathly<sup>2</sup> and Mohamed Helal<sup>3</sup>

1. Northern Border Univ., Chemistry Dept., Arar, Saudi Arabia  
Desert Research center, Eco-Physiology Dept., Egypt
2. Northern Border Univ., Zoology Dept., Arar, Saudi Arabia
3. Northern Border Univ. Chemistry Dept., Rafha, Saudi Arabia  
a. Corresponding author (elsharkawyeman@yahoo.com)

The study was designed to investigate the anti-inflammatory and composition of essential oil of two plant family Asteraceae, *Acheliafragmentissima* and *lactucaserriolagrowing* under dry desert condition. The Anti-inflammatory effect of volatile oil extracted by hydrodistillation of plants was studied using carrageenan induced paw edema. Essential oil (100 mg/kg) and (200 mg/kg) were tested the two plant show high inhibition after four hour, concentration (200 mg/kg) show high inhibition than (100 mg/kg) after 4 hours. Sesquisabinene hydrate, Azuline and  $\alpha$ -Bisabolol are the main constituents of the volatile oil were investigated by capillary GC and GC-MS. The discussion shows the role of chemical compound azuline in inflammatory inhibition.

## REMOVAL OF SOME PHENOL DERIVATIVES ON MODIFIED PUMICE MONITORED BY IR SPECTROSCOPY

Belgin Bardakçı<sup>1</sup>, Taner Kalaycı<sup>1</sup>, Neslihan Kınaytürk<sup>2</sup>

1 Mehmet Akif Ersoy Univ., Faculty of Arts and Sciences, Physics Dept., Burdur, Türkiye  
2 Süleyman Demirel Univ., Experimental and Observational Student Research and Application Centre  
Isparta, Türkiye  
*a.* Corresponding author (bbardakci@mehmetakif.edu.tr)

Various derivatives of phenols and organic compounds are considered the most threatening human health. The removal of carcinogenic substances has been the subject of many research disciplines and interdisciplinary studies.

Volcanic pumice has been taking place in the industry in our country for recent years. Pumice gases during the formation of structure, quickly abandoned and as a result of sudden cooling consists of highly porous structure. Because of this porous structure of pumice and silica components is one of the ideal adsorbent. For pumice, cation exchanged is the one of the best feature of pumice to increase the adsorption ability.

In this study, X-Ray Fluorescence spectroscopy of pure pumice was used to identify the chemical composition of pumice and after modifying the pumice by cobalt, chromium, manganese, nickel, copper, silver; measurements of supported cations had been performed by AAS (the atomic absorption spectrometer). 2,4 dimethylphenol and 2,4-dinitrophenol were applied to on modified pumice. Adsorption process was monitored by IR Spectroscopy. It is concluded that metal cation loaded on pumice help removal of phenol derivatives on pumice.

## THE EFFECT OF NICKEL CATIONS ON PUMICE TO IMPROVE THE ABILITY OF ADSORPTION

Belgin Bardakçı<sup>1</sup>, Neslihan Kınaytürk<sup>2</sup>, Taner Kalaycı<sup>1</sup>

1 Mehmet Akif Ersoy Univ., Faculty of Arts and Sciences, Physics Dept., Burdur, Türkiye  
2 Süleyman Demirel Univ., Experimental and Observational Student Research and Application Centre  
Isparta, Türkiye  
*a.* Corresponding author (bbardakci@mehmetakif.edu.tr)

In this study, the adsorption of isomers of anisidine on Ni supported pumice has been performed. Pure pumice has not shown affinity to adsorb any type of anisidines. After failing the adsorption process, supported the pumice by some solutions of metal salts changed the results of our experiment. Adsorption process was investigated by using IR spectroscopy, ICP-OES was used to measure the Ni cations on pumice and scanning electron microscopy (SEM) results are used to observe the structure of pumice. Anisidines can be regarded as both occupational and environmental pollutants. As a result, pumice is commercially suitable catalysis for environmental pollutants. IR spectroscopic results proved that adsorption process occurred via metal cations on the surface. Inductive and coordinative effect of isomers affects adsorption simultaneously.

Furthermore, infrared intensities of 2, 3, 4- Anisidine were calculated by using the DFT/B3LYP/6-311++G(d,p) basis set. A comparison of theoretically calculated vibration frequencies with FT-IR experimental data shows good agreement between them.

## **AN INVESTIGATION OF MINERALOGICAL, HUMIDITY AND GAS ADSORBING PROPERTIES OF SOME NATURAL MINERALS**

Abdullah Bayram<sup>1</sup>, MÜCAHİT SÜTÇÜ<sup>1</sup>, SALİH OKUR<sup>1</sup>

<sup>1</sup>Dept. of Materials Sci. and Eng., Faculty of Eng. and Architecture, Izmir Katip Celebi Univ., 35620  
Izmir

*a.* Corresponding author (abdullahbayram7@gmail.com)

In this study, some minerals such as kaolin, calcined kaolin, exfoliated vermiculite and diatomaceous earth were used for investigation of their humidity and gas sorption properties. Mineralogical characterization of these minerals was carried out by different methods like X-ray fluorescence (XRF), X-ray diffraction (XRD), thermo-gravimetric analysis (TGA), scanning electron microscopy (SEM and EDS). In addition, their humidity and gas adsorbing properties were analyzed by using multi gas controller with different gases such as ethylene (C<sub>2</sub>H<sub>4</sub>), NH<sub>3</sub>, CO<sub>2</sub> and CO. To purpose of this work was to bring into the public view the natural minerals sorption event. The results revealed that the minerals can be used as humidity and gas adsorbing materials.

## **PREPARATION AND CHARACTERIZATION OF BIOBASED POLYURETHANE FOAMS THE USE OF BIOFUEL RESIDUES**

Nihan Özveren, M.Özgür Seydibeyoğlu<sup>a</sup>

Dept. of Materials Sci. and Eng., Izmir Katip Celebi Univ., Cigli Ana Yerleskesi, 35620, Izmir, Turkey

*a.* Corresponding author (seydibey@gmail.com)

Polyurethanes are important polymers as their mechanical, thermal, chemical properties can be controlled by the reaction of various polyols and diisocyanates. Polyurethanes have wide application areas, insulation foams, furniture applications, automotive, coatings, and biomedical, many other uses. In this study, commercial and biobased polyurethane foams were produced and required properties were determined. Commercial (polyether), biobased (soybean, cottonseed) polyols, pure and crude glycerol were used as polyols. All types of polyols were reacted with polymeric diphenyl methane diisocyanates (PMDI) for the production of insulation foams. Crude glycerol is a by-product of the biodiesel production, and it is a kind of biofuel residues, so its purification cost is high for Small and Medium Sized Enterprises. Thermal properties of polyurethane foams were examined by thermogravimetric analysis (TGA) and thermal conductivity tests. The structures of polyurethane foams were confirmed by Fourier Transformed Infrared (FTIR). Changes in surface structure were investigated by Scanning Electron Microscopy (SEM). Mechanical properties of polyurethane foams were determined by compression tests. This study identifies the critical aspects of polyurethane foam formation by the use of various polyols and furthermore offers new uses of crude glycerol that is a waste product from biodiesel industry.

## **MODIFICATION OF NATURAL ZEOLITE TO ENHANCE ITS NEUTRALIZING CAPACITY IN LACTIC ACID MEDIUM**

Ilker Polatoglu<sup>1\*</sup> and Fehime Cakıcıoglu-Ozkan<sup>2</sup>

1. Celal Bayar Univ., Bioengineering Dept., 45040-Muradiye Manisa
2. Izmir Inst. of Technology, Chemical Eng. Dept., Gulbahce Koyu, 35430-Urla Izmir
  - a. Corresponding author (ilker.polatoglu@cbu.edu.tr)

The aim of this study is to investigate the enhancement of neutralizing capacity of natural zeolite by modification in lactic acid medium. For this aim zeolitic tuff from Gördes (Manisa) deposit and its modified form with  $\text{Na}_2\text{CO}_3$  were interact with dilute  $\text{C}_3\text{H}_6\text{O}_3$  ( $\text{pH}_i=4$ ). The natural zeolite is named as low-silica clinoptilolite depending both on Si/Al ratio, cation content determined by ICP-AES and also characteristic peaks determined by X-Ray diffraction method. The characterization results also show that the total exchange capacity (TEC) increases with modification. The pH evolution results depicted that, the zeolites used in this study increased the medium pH by the possible mechanism of ion exchange and sorption. Final pH was higher when modified zeolite was used. This is because the modification made the surface rich in sodium and also with carbonate which is soluble in weak acid solution.

## **AFM SILICA-PROBING OF CHARGE DISTRIBUTION ON QUARTZ (0001) AND SAPPHIRE (0001) SURFACES**

Gulnihal Ozek Yelken, Ayse Gurel, Mehmet Polat

- a. Corresponding author (gulnihalyelken@iyte.edu.tr)

A quantitative prediction of the interactions between surfaces in electrolyte solutions is extremely important in numerous physico-chemical systems. Experimental in-situ measurements of these interactions are now possible with AFM down to sub-nanonewton levels. However, a proper analysis of the measured forces requires an in-depth understanding of the underlying theories which are significantly more complicated compared to vacuum or air due to complex behavior of ions in aqueous media. Proper use of these theories and their comparison with the experimentally measured force values require a knowledge of such material properties as Hamaker constants and charge on the interacting surfaces. Literature provides sufficient data for the first for numerous systems in air, vacuum or water media. However, for the latter, obtaining a charge distribution on a solid surface immersed in aqueous solutions is presently not possible. The current methods, whether electrophoretic or titration origin, provide only an average charge or potential value for the system under consideration. In this study, AFM was employed to estimate the surface charge or potential distribution of selected metal oxides using a silica colloid probe. The surface maps obtained show very good agreement with the average charge/potentials values from the literature and recent work.

## EFFECT of MICROBIOLOGICAL QUALITY of RAW MILK on THE PROPERTIES OF MILK POWDER

Durmus Sert, Emrah Torlak, Emin Mercan

*a.* Corresponding author (dsert@konya.edu.tr)

Milk powder is generally considered a product of good microbiological quality. However, several factors may contribute to changes in its physical and chemical properties which reduce shelf-life and thus its commercial value. Storage temperature and transportation may also influence the properties of milk powder, especially its insolubility index and acidity. The main point on the production of milk powders has turned toward the manufacture of products with specific properties and to minimizing treatments in order to optimize the nutritional value of the end product. The low water activity of milk powders precludes the growth of microorganisms and, generally, bacterial numbers in powder decrease during storage. The microbiological quality of the raw milk used to manufacture powder can have a bearing on its properties, especially solubility. Pasteurization will kill non-sporeforming pathogens and will significantly reduce the microbial loading of liquid feed-stock to the evaporator and spray dryer. Higher temperature pre-heat treatment will have an even greater effect, though thermophilic bacteria are most likely to survive and, consequently, are found in greater numbers in milk powders.

## INFLUENCE OF ANODIZATION CONDITIONS ON THE SELF-ORDERED NANOPOROUS TiO<sub>2</sub> FORMATION DURING ELECTROCHEMICAL ANODIZATION OF TITANIUM

Tuncay Dikici<sup>a,c,d</sup>, A. Halis Guzelaydin<sup>b</sup>, Serdar Yildirim<sup>c,d</sup>, Mustafa Toparli<sup>c</sup>

<sup>a</sup>Dept. of Materials Science and Eng., Izmir Katip Celebi Univ., Izmir, Turkey

<sup>b</sup>Dept. of Materials Sci. and Eng., Izmir Inst. of Technology, Izmir, Turkey

<sup>c</sup>Dept. of Metallurgical and Materials Eng., Dokuz Eylül Univ., Izmir, Turkey

<sup>d</sup>Center for Fabrication and Appl. of Electronic Materials (EMUM), Dokuz Eylül Univ., Izmir Turkey.

*a.* Corresponding author (tuncaydikici.35@gmail.com)

Nanoporous structures attained a promising position in various areas, such as photocatalytic, gas-sensing, solar energy conversion, orthopedic and dental applications. In the presented work, formation of nanoporous titanium oxide (TiO<sub>2</sub>) structures on titanium substrates by anodic oxidation was investigated. The influence of aqueous HF electrolyte concentration (0.5-4 M) and anodizing potential (10-80V) on the structure and morphology of the nanoporous TiO<sub>2</sub> formations has been studied. The surface morphology, topography and chemical composition were analyzed using scanning electron microscope (SEM), atomic force microscope (AFM) and X-ray photoelectron spectroscope (XPS), respectively. The surface roughness and wettability of nanoporous TiO<sub>2</sub> structures were assessed using profilometry and contact angle measurement system. The nanopores are about 300 nm long, with 10 to 40 nm thick vessel walls and inner diameters ranging from 40 to 100 nm. It was determined that the most favorable arrangement of nanopores was formed at the anodizing potential of 20 V. The results show that the morphology and dimensions of the TiO<sub>2</sub> nanopores can be altered by varying the anodization parameters.

## ON COMPUTER SIMULATION OF PROCESSES IN POROUS ELECTRODES OF LI-ION BATTERIES

Oleg Iliev

Fraunhofer Inst. for Industrial Mathematics, ITWM,  
Fraunhofer Platz 1, 67663 Kaiserslautern, German  
*a.* Corresponding author (iliev@itwm.fraunhofer.de)

Li-ion batteries are widely used currently in automotive industry, in electronic devices, etc. In this talk we will discuss challenges related to the multiscale nature of batteries, mainly the treatment of the porous electrodes at pore scale and at macroscale. A software tool for simulation of isothermal and non-isothermal processes in porous electrodes will be presented. The pore scale simulations are done on 3D images of the porous electrodes, or on computer generated 3D microstructures which have the same characterization as real porous electrodes. Finite Volume and Finite Element algorithms for the highly nonlinear problems describing processes at pore level will be shortly presented. Next, Multiscale Finite Element Method which addresses the multiscale nature of processes in the battery will be addressed. Simulations at battery cell level will also be presented. Finally, the challenges in modeling and simulation of degradation processes in the battery will be shortly discussed.

This is joint work with A.Latz (DLR) and M.Taralov, V.Nakova, J.Zausch, S.Zhang from Fraunhofer ITWM.

## METAL-ORGANIC FRAMEWORKS FROM HYBRID FUNCTIONAL GROUP LIGANDS

Tatiana Timofeeva, Qiang Wei, Benjamin Mattes, Tatiana Timofeeva

*a.* Corresponding author (tvtimofeeva@nmhu.edu)

We have been exploring synthesis of distinct metal-organic frameworks (MOFs) using organic ligands containing multifunctional groups. Groups of MOFs have been successfully synthesized from tetrazolate ligands, and shown uncommon frameworks structure. For instance, 1) a MOF containing both hydrophilic and hydrophobic channels, 2) a MOF possessing the bcu-topology and having 8-coordinated triangle copper cluster as second building units, and 3) a MOF with zig-zag channels with ship-in-bottle segments have been synthesized and their structure was supported by single crystal diffraction studies. MOFs in those groups can show color change according to the basicity of the solvents or show interesting excitation-wavelength dependence of fluorescence spectra. They also demonstrate high selective separation ability to CO<sub>2</sub> above ambient temperature.

## THE IMPACT OF LIPASE LOADING ON A PRACTICAL BIOCATALYZED ACYLATION OF CHIRAL ALCOHOLS USED AS DRUG PRECURSORS

Nassima BOUZEMI, Mounia MERABET-KHELASSI, Louisa ARIBI-ZOUIOUECHE, Jean Claude FIAUD, Olivier RIAANT

a. Corresponding author (nbouzimi@yahoo.fr)

Optically active secondary alcohols are versatile intermediates in the synthesis of many pharmaceutical compounds. Our study focused on sustainable and easy pathways to provide enantiomerically pure arylalkylcarbinols through biocatalyzed kinetic reaction. A comparison was performed between the enantioselectivity values recorded in the resolution reaction, in presence of *Candida antarctica* lipase B, with enol esters and succinic anhydride. The latter may offer a solution to the cumbersome chromatographic separation. The use of succinic anhydride resulted in a more or less increased enantioselectivity than that of the enol ester in each case. In the presence of succinic anhydride and by decreasing the amount of the lipase, the 1,2,3,4-tetrahydronaphthalen-1-ol a precursor of sertraline®, displayed an improvement of the enantioselectivity and the (R) enantiomer was obtained optically pure. When good enantioselectivity values are displayed with both succinic anhydride and the enol ester, the CAL-B / succinic anhydride system is the best one owing to the practical and cost-effective resolution of the arylalkylcarbinols. On the other hand, the minimum and effective amount of the biocatalyst has been established for each substrate in order to enhance the enzymatic selectivity.

## ONE-POT AND TEMPLATE-FREE SYNTHESIS OF MAGNETITE POROUS/HOLLOW NANOSTRUCTURE

Dung The Nguyen<sup>1</sup> and Kyo-Seon Kim<sup>1,a</sup>

1. Dept. of Chemical Eng., Kangwon National Univ.,  
Chuncheon, Kangwon-Do, 200-701, Korea

a. Corresponding author (kkyoseon@kangwon.ac.kr)

Porous/hollow magnetite nanoparticles are synthesized through a one-pot solvothermal process, using a sole iron precursor ( $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ ) and without any template. The product particles show a narrow size distribution, good crystalline and high magnetization saturation. We demonstrate the development of hollow structure of magnetite spheres by characterizing systematically the changes of morphology and crystal structure for different processing times. A detailed process mechanism to form the hollow structure of magnetite spheres is proposed, combining the formation of numerous tiny grains, the spherical assembly of those grains and the chemical conversion of the Fe (III) compounds to generate  $\text{Fe}_3\text{O}_4$  simultaneously coupled with the Ostwald ripening process within the magnetite spheres.

## **SYNTHESIS AND CHARACTERIZATION OF POROUS MATERIALS DOPED WITH LITHIUM**

C. Rodríguez, S. Alfaro\*, M. A. Valenzuela

Laboratorio de Catálisis y Materiales. ESIQIE-Instituto Politécnico Nacional, Zacatenco, México, D.F, México. C.P.07738.

a. Corresponding author (salfaroh@ipn.mx)

Carbon dioxide is a by-product of many industrial processes, mainly from combustion reactions that provokes a significant amount of this greenhouse gas. On the other hand, its recovery and reuse is a major problem that needs an urgent solution. The great concern on the global climatic change has motivated the search of new materials able to retain this gas. Clays, perovskites, zeolites have been utilized to capture the CO<sub>2</sub>. By the other hand, zeolites are widely used as molecular sieves in different industrial processes related to gas purification or gas separation. The above was the main motivation to study the synthesis of porous materials such as MCM and zeolites exchanged with lithium as potential materials for CO<sub>2</sub> retention. The materials were prepared by sol-gel and hydrothermal method respectively. The morphology, crystallinity, structure and chemical features were determined using several experimental techniques as XRD, SEM, FTIR. The CO<sub>2</sub> sorption capacity was evaluated by thermogravimetry analysis TGA.

## **MODELING THERMAL ENERGY STORAGE USING POROUS ADSORBENTS**

F. Handan Tezel, Burcu Ugur

a. Corresponding author (handan.tezel@uottawa.ca)

Thermochemical heat storage using reversible exothermic processes or reactions is the most promising technology for long term thermal energy storage. The adsorption process has been a leading candidate in the development of this technology. When water vapor is adsorbed from air into the adsorbent, heat is released due to the heat of adsorption which heats up the air. This air can be used for space heating. When adsorbent is saturated with water, it can be released from the adsorbent by exposing it to a heat source (it could be solar or waste heat) in order to regenerate it and store the energy. In our previous studies, we have shown that it is possible to have an energy density of 200 kWh/m<sup>-3</sup> by using hybrid adsorbents. In this study, a mechanistic model of this adsorption thermal energy storage system was developed in the Wolfram Mathematica environment and was validated with experimental results obtained. Mass and energy balances for the adsorption column were considered in this modeling. A preliminary economic analysis was done for different thermal energy storage capacities. Purchased equipment costs, total capital investment values, annual production costs and thermal energy prices were obtained for varying storage capacities.

## THE ROLE OF ELECTRON-ACCEPTOR SITES IN DESTRUCTIVE SORPTION REACTIONS ON MESOPOROUS MGO AND VOX-MGO

Alexander Bedilo, Ekaterina Ilyina, Ilya Mishakov, Aleksey Vedyagin

a. Corresponding author (abedilo@bk.ru)

Mesoporous aerogel-prepared alkaline-earth metal oxides attract significant attention as effective destructive sorbents and catalysts for conversion of various toxic compounds containing heteroatoms. We recently developed an original method for synthesis of mesoporous nanocrystalline VO<sub>x</sub>-MgO aerogels showing superior activity in oxidative dehydrogenation of propane and destructive sorption of CF<sub>2</sub>Cl<sub>2</sub>. In this study the role of electron-acceptor and electron-donor sites in the latter reaction and changes in their concentrations with time on stream was investigated. As prepared samples possessed substantial concentrations of electron-donor sites characterized by the formation of trinitrobenzene radical anions. However, no correlation between the concentration of such sites and the activity in the bulk reaction with CF<sub>2</sub>Cl<sub>2</sub> was observed. Meanwhile, a remarkable correlation between the concentration of weak electron-acceptor sites tested by the formation of radical cations from anthracene and the CF<sub>2</sub>Cl<sub>2</sub> destructive sorption rate was observed for different mesoporous MgO and VO<sub>x</sub>-MgO samples. The obtained results indicate that weak electron-acceptor sites are essential for initiating bulk reactions of apparently basic mesoporous sorbents based on alkaline-earth metal oxides with halocarbons. This information is very important for development of more efficient sorbents for decomposition of various toxic pollutants. This study was supported in part by RFBR (Project 12-03-00905-a).

## ADSORPTION OF LEAD (II) IONS FROM AQUEOUS SOLUTION ON POROUS AND CRYSTALLINE HAP

Arzu Yakar<sup>1,a</sup>, Ismail Girgin<sup>2</sup>

1. Afyon Kocatepe Univ., Dept. of Chemical Eng., 03200, Afyonkarahisar, Turkey

2. Hacettepe Univ., Dept. of Mining Eng., 06800 Beytepe, Ankara, Turkey

a. Corresponding author (ayakar@aku.edu.tr)

Adsorption tests were done to determine the Pb<sup>2+</sup> removal capacities of synthesized products of p-HAP and c-HAP from aqueous solutions. In these tests, p-HAP was found to be more effective and Pb<sup>2+</sup> removal capacity was found as 220.62 mg/g with corresponding value for c-HAP being only 75.95 mg/g. XRD and SEM analysis done on both samples collected after adsorption tests showed that Pb<sup>2+</sup> removal was based on formation of hydroxypyromorphite (Pb<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>(OH)<sub>2</sub>). For p-HAP and c-HAP, L-type adsorption were observed in Giles's classification system. Langmuir, Freundlich and Dubinin-Radushkevich (D-R) isotherms were applied to determine the adsorption capacity of adsorbents. The mean energy of adsorption, E, was also calculated from the determined D-R isotherm parameters. The values E of p-HAP and c-HAP were found as 1.58 and 2.36 kJ/mol, respectively. Kinetic studies indicated that Pb<sup>2+</sup> adsorption on p-HAP and c-HAP in a single component system followed second-order kinetics. Considering the available data, removal of Pb<sup>2+</sup> ions was explained by dissolution-precipitation mechanism and it was concluded that especially p-HAP could be successively used for the removal of Pb<sup>2+</sup> ions from aqueous solutions.

## SELECTIVE ION TRANSPORT THROUGH SELF-ASSEMBLED MONOLAYER MODIFIED NANOPOROUS MEMBRANE UNDER APPLIED POTENTIAL

Muhammed E. Oruc<sup>\*a</sup>, Damena D. Agonafer<sup>§</sup>, Edward Chainani<sup>†</sup>, Ki Sung Lee<sup>§</sup>, Mark A. Shannon<sup>§\*</sup>

<sup>\*</sup>Dept. of Chemical and Biomolecular Eng., <sup>§</sup>Dept. of Mechanical Sci. and Eng., <sup>†</sup>Dept. of Chemistry, Univ. of Illinois at Urbana-Champaign Urbana, IL, USA  
a. Corresponding author (oruc1@illinois.edu)

Gold coated nanoporous membranes are widely used to separate ions and charged molecules under applied potentials. However, it was observed that charge selectivity of the membrane was inhibited when anodic potentials were applied to the membrane due to adsorption of anions. In order to prevent adsorption of anions, surface modification of self-assembled monolayer (SAM) and the critical voltage range were investigated. In this work, the electrochemical interfacial properties of a well-ordered, SAM of 1-undecanethiol (UDT) on evaporated gold surface has been investigated by electrochemical impedance spectroscopy (EIS) in electrolytes without a redox couple. In order to demonstrate charge selectivity the transport of methyl viologen ( $MV^{2+}$ ) and 1,5-naphthalene disulfonate disodium salt ( $NDS^{2-}$ ) were studied using a conductive nano capillary array membrane (NCAM). EIS data shows that UDT incubated for 120 h, forms a monolayer whose critical voltage range extends from -0.3 to 0.5 V (vs. Ag/AgCl). Transport studies indicate that the selectivity coefficient increases from 4.3 to 6.2 for  $NDS^{2-}$  when UDT is attached to the gold-coated NCAM whereas it increases from 1.25 to 2.6 for  $MV^{2+}$ . We increased the quality of monolayers under longer incubation time which increases the charge selectivity of ions through nanoporous membrane under critical voltage range.

## CHARACTERIZATION OF VARIOUS PLANT POWDERS AS POTENTIAL REINFORCEMENT FOR COMPOSITES

Çağrı Kılınç, M.Özgür Seydibeyoğlu<sup>\*</sup>

Dept. of Materials Sci. and Eng., Izmir Katip Celebi Univ., Cigli Ana Yerleskesi, 35620, Izmir, Turkey  
a. Corresponding author (seydibey@gmail.com)

Usage of plant materials as filler and/or reinforcement materials in polymeric composites is increasing because of their properties such as high specific strength, being eco-friendly, and low cost. Different plantal materials are being used in polymeric composite production to reinforce the polymer material. In this work different plants were investigated that as potential reinforcement for composites. Special plants were chosen from Turkey and characterized. Plants are chestnut shell, hazelnut shell, vine stick, rice husk, and olive stone that are grinded and characterized. These plants grinded with vibratory disc mill, and cutting mill. The morphology of gained powders were characterized by a scanning electron micrographs (SEM) and phase analysis was carried out by X-ray diffraction (XRD). Thermal properties of powders were investigated by thermogravimetric analysis (TGA). Plant powders were characterized by Fourier transform infrared (FTIR), elemental analysis and cellulose and hemicellulose content of powders was determined. After these investigations, polymer composites will be prepared with the chosen fiber that will optimize composite performance.

## INVESTIGATION OF INDUSTRIAL METHODS FOR SYNTHESIS OF COPPER OXIDE NANOSTRUCTURES

M.Goli<sup>1</sup>, H.Haratzadeh<sup>1</sup>

<sup>1</sup>Dept. of Physics, Shahrood Univ. of Technology, 3619995161, Shahrood, Iran  
a. Corresponding author (marzie\_goli@yahoo.com)

We report novel, inexpensive and one-step approaches for synthesis of metal oxide nanoparticles using the novel electrical arc discharge in water and thermal oxidation. The aim of this project was to find feasible methods for mass produce of CuO Nano-structures. In the first method, the electrical arc discharge has been used to form CuO Nano-structures from industrial Cu electrodes in water. The purity grade of Cu electrodes has been measured by XRF. Size and morphology of CuO nanoparticles were studied using different arc currents as a crucial parameter in properties of final product. Fig. 1 exhibits the XRD of CuO crystal structures.

In second method, CuO Nano-structures have been synthesized by using thermal oxidation of industrial Cu foil on tube furnace at the temperature of 470°C in air atmosphere. The effect of oxidation time on formation of CuO Nano-structures has been studied in the case of 72 and 96 hours. It is also found that both CuO and Cu<sub>2</sub>O phases appear in this method but the CuO phase dominates when the Cu foil was heated up to 470°C for 96 h (Fig. 2). The structural study of Copper oxide Nano-structures have been done by XRD and Scanning Electron Microscopy (SEM).

## SPECTRAL INVESTIGATION ON GGG:CR<sup>3+</sup> NANOPOWDERS PREPARED BY COPRECIPITATION METHOD

Hümeyra Örucü<sup>1</sup>, Gönül Özen<sup>2</sup>, Baldassare Di Bartolo<sup>3</sup>

1.Dept. of Physics, Ege Univ., 35100, Izmir, Turkey  
2.Dept. of Physics, Istanbul Technical Univ., 34469, Istanbul, Turkey  
3.Dept. of Physics, Boston College, 02467, Chestnut Hill, MA, USA  
a. Corresponding author (humeyraorucu@gmail.com)

Garnets activated with transition and lanthanide ions have attracted considerable attention as a solid-state laser material widely used in luminescence systems, as window materials for a variety of light sources, for fiber-optic telecommunication system and applied as phosphors in cathode-ray tubes, field emission, vacuum fluorescent and electroluminescent displays, and as scintillators in x-ray and positron emission tomographs. It has been shown that Cr<sup>3+</sup> doped garnet crystals are potential for tunable laser application at room temperature. Owing to the recently developed technology, high-quality transparent ceramics for lasers and scintillators has been obtained. As a starting material for the ceramic sintering, the nanopowders (NPs) are used [1-4].

In the present work, Gadolinium gallium garnet nano and bulk powders doped with chromium ions (GGG:Cr<sup>3+</sup>) were synthesized by the coprecipitation method. The average particle sizes of the powders was about 40 nm and 1 µm. The spectroscopic characterization of the powders were analyzed by fluorescence spectroscopy. The Cr<sup>3+</sup>-doped nano and bulk powders showed strong luminescence upon 460.0 nm excitation. The effect of the temperature on the spectral lines was investigated in the temperature range 32-300 K. The difference between the luminescence spectra, line-width and line-shift of the nano, bulk and crystal samples were compared.

## **IN SITU REMEDIATION OF CR(VI)-CONTAMINATED GROUNDWATER USING PERMEABLE REACTIVE BARRIERS PACKED WITH PYRITE: ROLE OF SOLUTION CHEMISTRY AND PARTICLE PROPERTIES**

Çetin Kantar, Cihan Arı, Didem Ertürk Gürel

Canakkale Onsekiz Mart Univ., Dept. of Environmental Eng., 17100 Canakkale, Turkey  
a. Corresponding author (ckantar@comu.edu.tr)

Permeable reactive barriers, installed in subsurface in the path of flowing groundwater can offer a viable option for in situ remediation of Cr(VI)-contaminated groundwater. In this study, the applicability of ground-pyrite samples (< 45 µm and 75-45 µm) as the barrier filling material was tested to remove dissolved Cr(VI) from aqueous systems under variable chemical and physical conditions (e.g., pH). Batch experiments show that increasing particle size and solution pH led to a significant decrease in Cr(VI) removal. Column experiments suggest that partial removal of Cr(VI) by pyrite occurs at rapid flow conditions due to kinetically controlled reactions. The removal mechanism for Cr(VI) by pyrite can be explained through the reduction Cr(VI) to Cr(III), coupled with the oxidation of Fe(II) to Fe(III) and S<sub>2</sub><sup>2-</sup> to SO<sub>4</sub><sup>2-</sup> at the pyrite surface as well as in aqueous phase. However, the X-ray photoelectron spectroscopy (XPS) measurements indicate that the precipitation of sparingly soluble Fe(III)-Cr(III) (oxy) hydroxide phases on pyrite surface with increasing solution pH leads to surface passivation, which, then, inhibits further Cr(VI) reduction. The addition of a natural chelating agent, tartrate led to a catalytic effect on Cr(VI) reduction by removing the surface oxidation products under acidic to slightly alkaline pH conditions.

## **PREPARATION OF HIGHLY ORDERED ANODIC POROUS ALUMINA FOR FUNCTIONAL APPLICATIONS**

Hideki Masuda

a. Corresponding author (masuda-hideki@tmu.ac.jp)

Preparation of highly ordered porous structures with uniform-sized pores of nanometer dimensions has recently attracted increasing interest because of demands for the development of several kinds of functional nanodevices<sup>1</sup>). Anodic porous alumina, which is formed by the anodization of Al in acidic electrolyte, is a typical self-ordered material with a porous structure of nanometer dimensions. For applications to the device development, improvement of the ordering of the porous structures is essential to optimize the properties of the fabricated devices. We have been studying the various types of fabrication processes of anodic porous alumina with highly ordered pore arrangement; naturally occurring long-range ordering under appropriate anodizing conditions<sup>2</sup>), and pretexturing process of Al for ideally ordered pore arrangement<sup>3</sup>). In the report, recent results of the preparation of highly ordered anodic porous alumina and its applications will be presented. In addition to the formation of plate type porous alumina, the process for the fabrication of porous hollow spheres of alumina basen on anodization of Al will be also reported. 1)H. Masuda et al., J. Photochem. Photobio. A, 221, 199 (2011). 2)H. Masuda and K. Fukuda, Science, 268, 1466 (1995). 3)H. Masuda, et al., Appl. Phys. Lett., 71, 2770 (1997).

## MICROSTRUCTURE AND ELECTRICAL PROPERTIES OF $\text{Ce}_2\text{O}$ AND $\text{TiO}_2$ DOPED $\text{ZnO}$ VARISTOR CERAMICS

Savas Ozturk<sup>1</sup>, Metehan Atagur<sup>1</sup>, Tuncay Dikici<sup>1</sup>, Serdar Yildirim<sup>2</sup>, Mucahit Sutcu<sup>1</sup>, Erdal Celik<sup>2,3</sup>

<sup>1</sup>Dept. of Materials Sci. and Eng., Faculty of Eng. and Architecture, Izmir Katip Celebi Univ., 35620 Izmir, Turkey

<sup>2</sup>Dept. of Metallurgical and Materials Eng., Faculty of Eng., Dokuz Eylul Univ., 35160 Izmir, Turkey

<sup>3</sup>Dokuz Eylul Univ., Center for Production and Applications of Electronic Materials (EMUM), 35160 Izmir, Turkey

*a.* Corresponding author (ozturkksavas@gmail.com)

ZnO-based varistor ceramics doped with  $\text{Ce}_2\text{O}$  and  $\text{TiO}_2$  (between 0-0.5 wt%) have been prepared by intensive high-energy ball milling method. The mixture of oxides reacted with mechano-chemical activation by using the milling parameters such as time (30min - 2 hours) and speed (600-1200 rpm). Milled powders were characterized by XRD and SEM analysis. Milled powders were uniaxially pressed into cylindrical pellets and sintered for different times between 1-2 hours at temperatures of 1000-1200°C. The phase composition, microstructure and electrical properties of the varistor ceramics have been investigated by XRD, SEM and a V-I source/measure unit, respectively. In this study, effect of intensive high-energy ball milling method on the properties of the ceramics was also studied.

## ADSORPTION/DESORPTION PROPERTIES OF ZEOLITE X COATINGS CRYSTALLIZED ON METAL SURFACES

Melkon Tatlier and Ayşe Erdem-Şenatalar

Dept. of Chemical Eng., Istanbul Technical Univ., Maslak, 34469, Istanbul, Turkey

*a.* Corresponding author (tatlierm@itu.edu.tr)

Zeolite coatings prepared by crystallization on various substrates, such as metals, silicon wafers and ceramics, may be useful for applications related to separation, catalysis, sensing and adsorption heat pumps. Zeolite coatings are obtained conventionally by immersing the substrate in a reaction mixture kept at constant temperature. Other methods have also been developed, especially targeting the production of relatively thin or thick coatings.

Thick coatings may be prepared by using the substrate heating method, in which the metal is heated directly while the reaction mixture is kept at a lower temperature. These coatings seem to be promising for adsorption heat pump applications. Crystallinities and textures of the coatings are critical in determining their adsorption capacities and kinetics for heat pump as well as other applications.

Zeolite X has a relatively high water adsorption capacity and its coatings were prepared on stainless steel plates from various clear solution compositions in previous studies. However, the adsorption properties of these coatings have not been investigated yet in detail. In this study, zeolite X coatings were prepared on stainless steel and copper plates by conventional and substrate heating methods using various synthesis conditions. X-ray diffraction, adsorption and thermal gravimetry were used to characterize the samples.

## DISPERSION OF CHITOSAN ON PERLITE FOR ENHANCEMENT OF DYE ADSORPTION CAPACITY

Seda Çınar BECERİK, Ahmet ESER, Tülin AYDEMİR, Ayşe DINÇER

a. Corresponding author (sedacin@yahoo.com)

Pollution caused by industrial wastewaters has become a common problem for many countries. Especially, organic, inorganic and dye pollutions from industrial effluents disturb human health and ecological equilibrium. Therefore, it should be required that undesirable pollution is removed. Perlite is an inert glassy volcanic rhyolitic rock which will expand when quickly heated to above 870 °C. It expands up to 20 times its original volume. Expanded perlite acts as an excellent insulator, both thermal and acoustical, resists fire and is classified as ultra-lightweight material. Chitosan is a natural biopolymer, hydrophilic, and has the ability to form complexes with metals. It is also a non-toxic, biodegradable and biocompatible material. Both chitosan and perlite is widely used as adsorbent for cleaning wastewater. In this study, the adsorbent of chitosan coated onto perlite was prepared as spherical beads and was evaluated for removal of dye in the different concentration. Morphology of the sorbent was discussed using FTIR, TGA and SEM analysis. Influence of contact time, initial pH, temperature and initial concentration of dye were studied. To predict the nature of the adsorption process, the non-linear Langmuir and Freundlich isotherms were used to fit the equilibrium adsorption data.

## MICROSTRUCTURE AND ELECTRICAL PROPERTIES OF AL<sub>2</sub>O<sub>3</sub>, FE<sub>2</sub>O<sub>3</sub> AND CE<sub>2</sub>O DOPED ZNO VARISTOR CERAMICS

Metehan Atagur<sup>1</sup>, Savas Ozturk<sup>1</sup>, Tuncay Dikici<sup>1</sup>, Serdar Yildirim<sup>2</sup>, Mucahit Sutcu<sup>1</sup>, Erdal Celik<sup>2,3</sup>

<sup>1</sup>Dept. of Materials Sci. and Eng., Faculty of Eng. and Architecture, Izmir Katip Celebi Univ., 35620 Izmir, Turkey

<sup>2</sup>Dept. of Metallurgical and Materials Eng., Faculty of Eng., Dokuz Eylul Univ., 35160 Izmir, Turkey

<sup>3</sup>Dokuz Eylul Univ., Center for Production and Applications of Electronic Materials (EMUM), 35160 Izmir, Turkey

a. Corresponding author (metehan.atagur@ikc.edu.tr)

ZnO-based varistor ceramics doped with Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub> and Ce<sub>2</sub>O (between 0-0.5 wt%) have been prepared by intensive high-energy ball milling method. The mixture of oxides reacted with mechano-chemical activation by using the milling parameters such as time (30min - 2 hours) and speed (600-1200 rpm). Milled powders were characterized by XRD and SEM analysis. Milled powders were uniaxially pressed into cylindrical pellets and sintered for different times between 1-2 hours at temperatures of 1000-1200°C. The phase composition, microstructure and electrical properties of the varistor ceramics have been investigated by XRD, SEM and a V-I source/measure unit, respectively. In this study, effect of intensive high-energy ball milling method on the properties of the ceramics was also studied.

## MICROSTRUCTURE AND ELECTRICAL PROPERTIES OF CUO DOPED ZNO VARISTOR CERAMICS

Tuncay Dikici<sup>1</sup>, Metehan Atagur<sup>1</sup>, Savas Ozturk<sup>1</sup>, Serdar Yildirim<sup>2</sup>, Mucahit Sutcu<sup>1</sup>, Erdal Celik<sup>2,3</sup>

<sup>1</sup>Dept. of Materials Sci. and Eng., Faculty of Eng. and Architecture, Izmir Katip Celebi Univ., 35620 Izmir, Turkey

<sup>2</sup>Dept. of Metallurgical and Materials Eng., Faculty of Eng., Dokuz Eylul Univ., 35160 Izmir, Turkey

<sup>3</sup>Dokuz Eylul Univ., Center for Production and Applications of Electronic Materials (EMUM), 35160 Izmir, Turkey

a. Corresponding author (tuncaydikici.35@gmail.com)

ZnO-based varistor ceramics doped with CuO (between 0-0.5 wt%) have been prepared by intensive high-energy ball milling method. The mixture of oxides reacted with mechano-chemical activation by using the milling parameters such as time (30min - 2 hours) and speed (600-1200 rpm). Milled powders were characterized by XRD and SEM analysis. Milled powders were uniaxially pressed into cylindrical pellets and sintered for different times between 1-2 hours at temperatures of 1000-1200°C. The phase composition, microstructure and electrical properties of the varistor ceramics have been investigated by XRD, SEM and a V-I source/measure unit, respectively. In this study, effect of intensive high-energy ball milling method on the properties of the ceramics was also studied.

## FABRICATION OF ZNO TETRAPOD BY USING CHEMICAL VAPOUR DEPOSITION: EFFECT OF TEMPERATURE

Rabia Özemre

a. Corresponding author (rozemre@gyte.edu.tr)

We report on ZnO tetrapods which were fabricated by using chemical vapor deposition (CVD) technique in different temperatures and oxygen flow rates. SEM, XRD and EDX analyses were applied to study the morphological, chemical, crystallographic features of the structures. SEM data showed, it is possible to gain perfectly fabricated and randomly precipitated tetrapods on the surface of the substrate and the size of the nanostructures. The study was carried out in different temperatures between 900-1100 °C and the flow rates of the oxygen flow were between changed as well. It was observed that the morphology of the structures clearly depends on the temperature and oxygen flow. The sizes of the structures were increased with increasing temperature. The leg of tetrapod was increased from 1 um to 10 um with enhancing temperature. But the diameter of the leg was decreased with increasing temperature. As a result, it is found that the diameters of the nano structures changed up to the oxygen gas flow and there is a close correlation between the gas flow and the aspect ratio. Acknowledgement: This work was supported by the project sponsored by The Scientific and Technological Research Council of Turkey (TUBITAK –Project No : 111M261).

## **PURIFICATION OF SLIME PHOSPHORIC ACID FROM $Fe^{2+}$ CATIONS BY NATURAL ZEOLITE**

G.Sh. Sultanbayeva, R.M.Chernyakova, U.Zh.Jussipbekov

Inst. of Chem. Sciences named after A.B.Bekturov, Almaty, Kazakhstan, gitakz@rambler.ru

*a.* Corresponding author (gitakz@rambler.ru)

Results of studies of the sorption activity of natural zeolite with respect to  $Fe^{2+}$  are presented. The influence of ratio of zeolite:slime phosphoric acid (SPA) and the duration of sorption process on the degree of iron removal from acid is reported. The highest degrees of acid purification were achieved in the first 10 minutes of the process and in the ratio zeolite:SPA=5:100 with removal of 86,38 % for Fe.

## **CHEMICAL DENITRIFICATION OF NITRATE IN WATER WITH COMBINED ULTRASOUND AND ZERO VALENT MAGNESIUM**

Onder Ayyildiz<sup>1</sup>, Burcu Ileri<sup>1</sup>, Omer Apaydin<sup>2</sup>

<sup>1</sup>Canakkale Onsekiz Mart Univ., Dept. of Environmental Eng., 17100 Canakkale, Turkey

<sup>2</sup>Yıldız Technical Univ., Dept. of Environmental Eng., Istanbul, Turkey

*a.* Corresponding author (oayyildiz@comu.edu.tr)

There has been lately an ongoing research on the use of zero valent metals for oxidation or reduction of organic and inorganic contaminants in water. Magnesium is one of the high surface-activated metals which make it suitable for the reduction of contaminants in liquid. However, an effective use of magnesium particles for water treatment requires continuing proton ( $H^+$ ) addition to water or providing more acidic conditions, as alkaline pH values lead to surface passivation due to the formation of thin magnesium oxide (MgO) films. In this study, ultrasound was used to prevent the surface passivation of  $Mg^0$  particles and as a result increase the extent of chemical reaction for nitrate. The batch experimental results indicated that simultaneous application of ultrasound (US) and zero-valent magnesium ( $Mg^0$ ) significantly increased the rate of nitrate reduction beyond the additive effects of US and  $Mg^0$ . The synergistic effect of combined ultrasound and  $Mg^0$  system has been attributed to ultrasonic bubble “break up” and “surface activation”. The results from BET, SEM, and particle-size analyses revealed that ultrasonic shear forces provide continuous cleaning effect on the surface of magnesium particles and thereby increase the chemical denitrification of nitrate in water.

## **METALIZED PLASTICS ( POLYACRYLONITRILE-PAN): MAGNETIC AND DIELECTRIC PROPERTIES AT MICROWAVE FREQUENCIES**

Hüseyin Kavas

Istanbul Medeniyet Univ., Faculty of Science, Dept. of Physics Eng., Istanbul, Turkey

a. Corresponding author (huseyin.kavas@medeniyet.edu.tr)

The metalized Plastics ( Polyacrylonitrile-PAN) are obtained by reduction of polymer-incorporated Iron (Fe), Nickel (Ni) and Cobalt (Co) salts via electroless deposition techniques. The diluted sodium borohydride aqueous solution is used as reducing agent and about 2 mm thicker films are prepared. The structural, morphological and magnetic characterizations were investigated by means of X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Vibrating Sample Magnetometry (VSM) techniques. The XRD results show metal crystallinity with other phases. While Ni coated samples have Superparamagnetic and Ferromagnetic nature, Co deposited one have competing Ferromagnetic and Paramagnetic property. The PAN film with Fe deposition shows paramagnetic characteristic which is the possible results of iron oxidation at room temperature deposition conditions. All films complex dielectric permittivities and magnetic permeabilities were derived from Transmission Reflection Line(TRL) waveguide techniques at the X-band (8.2-12.4 GHz) frequencies.

## **STRUCTURAL AND THERMAL PROPERTIES OF POLYACRYLONITRILE/HUNTITE COMPOSITES**

Zeynep ÇELİK<sup>a</sup>, Seyfullah MADAKBAŞ, M. Vezir KAHRAMAN, Ferhat ŞEN

Marmara Üniversitesi Kimya Bölümü Göztepe Kampüsü, 34722 Kadıköy, Istanbul

a. Corresponding author (celikzeynep@hotmail.com)

Composites are when two or more different materials are combined together to create a superior and unique material.

Polyacrylonitrile (PAN) is an important engineering polymer with commercial importance due to its unique thermal properties and good solvent resistance.

The composite of PAN/huntite is very new materials there are not so much investigations on it. As it is known that huntite has good flame retardancy properties.

After fabrication of PAN/huntite reinforced polymer composites samples, they were characterized by using DSC, SEM, TGA. According to the those results it was clearly that the new composites of PAN/huntite has better thermal stability than PAN. In addition to this results electrical and other properties of the PAN became much more beneficial.

## **INVESTIGATING A MODEL FOR MECHANICAL PROPERTIES OF THE COMPOSITE MATERIALS IN A CASE PUMICE BRIQUETTE**

Assoc.Prof.Dr. Semiha Yilmazer

Bilkent University, Faculty of Art, Design and Architecture, Dept. of Interior Architecture and Environmental Design, 06800, Bilkent, Ankara  
CSY Ar-ge ve Mühendislik Mimarlık Danışmanlık ,  
Cyberpark B227, Bilkent, Ankara  
a. Corresponding author (semiha@bilkent.edu.tr)

In case the modelling of the characteristics of the composite material which consists of the aggregates, cement, water, etc. and the applied process; the basic properties of the material such as compressive strength, thermal conductivity, weight, porosity, etc., are able to be calculated / simulated. To be able to make a pre-design in simulation media will provide the optimization of how much building material; which will be produced with different types of materials and forms, approach to the desired properties. This optimization, with a cost efficient design process, will create an opportunity for a large fan of customer dedicated production with different forms and features. In the project; regarding its light and porous structure, “Pumice Briquette” which has a high potential of usage in earthquake areas, will be used as a sample for a Building Material Design System (Hardware and Software) made a prototype. An algorithm/model for mechanical behavior of the materials has been improved and applied by using composite material included pumice aggregates.

## **INVESTIGATION OF FRICTION BEHAVIOR OF GRANITE POWDER ADDED BRAKE PADS**

I.Sugoza

Dept. of Automotive Eng., Univ. of Mersin, Mersin/ Turkey,  
a. Corresponding author (ilkersugoza@mersin.edu.tr, ilkersugoza@gmail.com)

Brake linings which are used in automotive disk are usually composed of various components. The expected properties of a brake lining are the standards value of wear resistant, the friction coefficient and economical manufacturing. Brake lining extremely warms up during braking due to friction. The braking performance of braking lining has been changeable or braking lining has been undergone to mechanical deformation due to excessive temperature.

In this study, the effect of granite powder in the brake friction material on various aspects of friction characteristics was investigated. Three friction material specimens were produced based on an experimental formulation, and they contained 2%, 6% and 10% granite powder, respectively, fixing the composition of other ingredients. Tribological properties of the friction materials were obtained using a brake dynamometer. Results showed that the friction materials containing 2% and 6% granite powder improved friction stability and fade resistance.

## STUDY OF TRANSPORT OF LIQUIDS THROUGH GLASSY POLYMERS BY NEW EXPRESS DYNAMIC TECHNIQUE

A.A. Belogorlov<sup>1</sup>, A.M. Grekhov<sup>1</sup>, E.V. Pastukhova<sup>1</sup>, Yu.S. Eremin<sup>1</sup>, A.A. Yushkin<sup>2</sup> and A.V. Volkov<sup>2</sup>

<sup>1</sup> National Research Nuclear Univ., MEPhI, Kashirskoe shosse 31, Moscow, 115409, Russia

<sup>2</sup> A.V.Topchiev Inst. of Petrochemical Synthesis, Russian Academy of Sciences, Leninskii pr. 29, Moscow, 119991, Russia

*a.* Corresponding author( aabelogorlov@mephi.ru)

The advances of membrane technology have led to development of new materials with unique properties for the separation of mixtures, such as glassy polymers. These materials have high mechanical and film-forming properties and used as membrane materials for gas and vapor separation, pervaporation, nanofiltration of organic mixtures and membrane gas-liquid contactor. This wide range of applications requires an understanding of material behavior during the operation, which is closely related not only with its original structure, but also with the interaction of the material and the separated mixture. We investigated the transport of ethanol, propanol, ethylene glycol, glycerol and water through the high-permeability polymer poly (1-trimethylsilyl-1-propyne) (PTMSP). This membrane material can be used for organic solvent nanofiltration and membrane gas-liquid contactors. Membrane material was characterized by helium pycnometry and nitrogen adsorption. Measurement of liquid flow through the membrane was carried out by dynamic pressure decay method at temperatures of 20 to 90°C and pressure range of 10-200 bar. In this study, microheterogeneity of PTMSP free volume structure and solvent-polymer interaction were investigated by extended hydrostatic weighing method. The results were interoperated in the frame of solution-diffusion model and quasi-hydrodynamic flow regime. Authors express the gratitude to V.S. Khotimskii for providing of polymer samples.

## CE OR FE INCORPORATED ZIRCONIA BY COMPLEXATION METHOD FOR DIMETHYL CARBONATE REACTION

Birce Pekmezci<sup>1</sup>, Timur Doğu<sup>2</sup>, Gülşen Doğu<sup>1</sup>

<sup>1</sup>Dept. of Chemical Eng., Gazi Univ., 06570 Ankara, Turkey

<sup>2</sup>Dept. of Chemical Eng., Middle East Technical Univ., Ankara, Turkey

*a.* Corresponding author( bircepekmezci@gazi.edu.tr)

Due to their acid/base properties and good stability, zirconia based catalysts have attracted considerable attention in recent decades. Materials having both acidic and basic sites have good potential to be used as catalysts to produce dimethyl carbonate by the reaction of CO<sub>2</sub> with methanol. In this study, Ce and Fe incorporated mesoporous zirconia catalysts having different Ce/Zr or Fe/Zr ratios were prepared following a complexation procedure. XRD, nitrogen adsorption-desorption and SEM analysis of the materials containing Ce/Zr and Fe/Zr molar ratios of one showed formation of mesoporous structures having average pore diameters of about 2 nm. Nitrogen adsorption-desorption isotherms of these materials were all Type IV and BET surface areas of Ce-Zr and Fe-Zr materials were found as 36 and 169 m<sup>2</sup>/g, respectively. XRD patterns of the materials gave information about the crystal structures and SEM-EDX analysis showed that Ce/Zr and Fe/Zr ratios in the produced materials were quite similar to the synthesis solution. The activity tests performed for dimethyl carbonate synthesis at 300 bar and 80°C indicated some activity of Ce incorporated zirconia for this reaction.

## **THE USE SOFT POROUS HYDROGELS AS SUPPORTING MATERIALS FOR METAL NANOPARTICLE PERPARATION AND CATALYSIS FOR HYDROGEN GENERATION**

<sup>1</sup>Fahriye Seven, <sup>1</sup>Aysel Çağlar, <sup>1</sup>Selehattin Yılmaz, <sup>1,2</sup>Nurettin Şahiner

<sup>1</sup>Canakkale Onsekiz Mart Univ., Faculty of Sciences and Arts, Chemistry Dept., <sup>2</sup>Nanoscience and Technology Research and Application Center (NANORAC), Terzioğlu Campus, 17100, Canakkale-Turkey.

a. Corresponding author (sahiner71@gmail.com )

Poly acrylamide (p(AAm)), poly(2-hydroxyl ethyl methacrylate) p(HEMA), and poly(N-Hydroxymethacrylate) p(n-HMA), poly(N-vinyl pyrrolidone) (p(N-VP), were prepared via redoks/photo polymerization methods in the presence modified silica particle containing vinyl groups. The silica particles with vinyl groups were obtained by very well known Stöber methods with some modification. Upon the removal of silica from hydrogel networks by HF and/or NaOH treatments, newly formed pores are generated. Furthermore, the new functional groups are formed inside hydrogel network by chemical modification by treatment with various modifying agents such NaOH and NaBH<sub>4</sub>. The properties these porous and nonporous hydrogels were compared in terms of their mechanical, thermal and structural properties. The characterization studies of the modified porous and nonporous hydrogels carried out with swelling experiments, FT-IR, TGA and BET analysis. Moreover, the modified and unmodified hydrogel were used as template for in situ metal nanoparticle preparation. The amounts of metal nanoparticles formation were determined by Atomic Absorption Spectroscopy (AAS). Finally, the metal nanoparticle containing hydrogel composite were used as catalyst for hydrogen production from the hydrolysis of NaBH<sub>4</sub>. Various parameters affecting the catalytic performance of the prepared soft porous materials were investigated.

## **SURFACE ROUGHENING OF STAINLESS STEEL PLATES BY ELECTROCHEMICAL ETCHING TECHNIQUES USED FOR POROUS P/M APPLICATIONS**

Onur Günel, Yusuf Usta\*

Başkent Univ., Fac. of Eng., Mechanical Eng. Dept., Ankara, Turkey

\*Gazi Univ., Fac. of Eng., Mechanical Eng. Dept., Ankara, Turkey

a. Corresponding author (uyusuf@gazi.edu.tr)

Porous structures are of the methods for increasing the surface area in order to improve the heat transfer capacity specially used in fuel cell's heat exchangers. Due to both acidic media and the leakage of cooling fluids stainless steel powders and a solid substrate from same material is to be used to have proper functions. A bonding between powders and the substrate is expected during the pressing step. Higher toughness of stainless steel materials causes a difficulty for bonding of those powders and the substrate. Surface roughening of the substrates are one of the methods to improve the bonding capability. In this study, an electrochemical method which is applied under FeCl<sub>3</sub>.6H<sub>2</sub>O acidic media has been used to have corrosions on the surfaces of the substrates. A substrate which is 0.6mm in thickness and SS316L material is selected for corrosion tests. Taguchi method has been used to employ numeric values of the experimental parameters such as temperature, electrical current, concentration and the time. The effects of these parameters on the surface roughness are investigated and a max. of 23 µm surface roughness is measured whereas 30 µm are noted on some areas. The larger pitting corrosions are observed with the increasing concentration, temperature and the time.

## **SYNTHESIS OF FERRITE COBALT (COFe<sub>2</sub>O<sub>4</sub>) NANOPARTICLES USING COMBUSTION, COPRECIPITATION, AND PRECIPITATION: A COMPARISON OF SIZE, STRUCTURAL, AND MAGNETIC PROPERTIES**

Mahboubeh Houshiar<sup>1</sup>, Ali Alidoust<sup>1</sup>, Zohre Askari<sup>1</sup>, Fatemeh Zebhi<sup>2</sup>

1- Shahid Beheshti Univ., Tehran, Iran

2- Semnan Univ., Semnan, Iran

a. Corresponding author (mhoushiar1@yahoo.com)

Investigating the effect of decreased particle size on magnetic properties of nanoparticles has recently gained attention. In this regard, it is usually not possible to maintain magnetic properties of particles upon decreasing their size within nanoscale.

In this research, Ferrite Cobalt (CoFe<sub>2</sub>O<sub>4</sub>) nanoparticles were synthesized using three different methods; combustion, coprecipitation, and precipitation. Their size, structural, and magnetic properties were determined and compared using x-ray diffraction (XRD), scanning electron microscopy (SEM), and vibrating sample magnetometer (VSM). XRD data analysis showed a mean size of 69.5 nm for combustion, 69.5 nm for coprecipitation, and 34.7 nm for precipitation samples which concurred with SEM figures. XRD data further revealed a reverse cubic spinel structure with the space group Fd-3m in all three samples. VSM data of samples showed a saturation point in the magnetic field of less than 15kOe. Magnetization saturation (M<sub>s</sub>) was 56.7emu/g for combustion synthesized samples, 55.8emu/g for coprecipitation samples, and 47.2emu/g for precipitation samples. Coercivity (H<sub>c</sub>) was 2002 Oe for combustion synthesized samples, 850 Oe for coprecipitation samples, and 230 Oe for precipitation samples.

We conclude that various methods of nanoparticle synthesis can lead to different particle sizes and magnetic properties. H<sub>c</sub> and M<sub>s</sub> are greatest in the combustion method and least in precipitation method.

## **FRACTURE BEHAVIOR OF ALUMINUM CHIPS COMPOSITION PRODUCED BY POWDER METHOD**

M. Turan Demirci<sup>1</sup>, Rashad Guluzade<sup>2</sup>, Ahmet Avci<sup>3</sup>

<sup>1</sup>Selçuk Üniversitesi Teknik Eğitim Fakültesi, Makine Eğitimi Bölümü, 42003, Konya,

<sup>2</sup>Üniversitesi Önallar Tarım Makineleri Ltd. Şti. 1. Organize Sanayi Bölgesi, Konya,

<sup>3</sup>Selçuk Üniversitesi Mühendislik-Mimarlık Fakültesi, Makine Mühendisliği Bölümü, 42003, Konya

a. Corresponding author (turandemirci@selcuk.edu.tr)

There has been rapid growth in the powder technology in recent. One of these advances is using of waste materials. When metal products are manufactured, considerable amounts of waste in the form of chips and discards are produced. These waste and scraps are returned to smelters, whereby some of the metal is recovered and reutilized in production processes. During the recycling of the waste a lot of the metal is lost as a result of oxidation and the costs of labor and energy as well as the expenditure on environmental protection raise the general cost of such processes. In this paper, recycling aluminum (Etial 65) l chip composition were produced with powder method. Aluminum chip size was determined as 1000 µm. The process was performed in following steps; granulation of chips (1000um screening apparatus used ), using zinc stearate as lubricating for press molding, hot press molding (under 200MPa pressure), sintering process at 650°C which contain new method for oxidation without vacuum and shielding gas. The flexural modulus, flexural strength and critical stress intensity factors were determined j integral method.

## **EFFECT OF DIFFERENT TYPES OF CONCRETE MINERAL ADMIXTURES ON THE STRENGTH OF CONCRETE IN FIRE**

Arif Emre SAĞSÖZ, Ahmet Ferhat BINGÖL, Majid Atashafrazeh, Murat CAF, Ilhan Tohumcu

a. Corresponding author (aesagsoz@atauni.edu.tr)

The results of an experimental investigation to study the effects of three different percentages of silica fume, marble dust and also fly ash are presented (0%, 5%, 10%, and 15% of the cement volume). Nowadays knowledge of concrete technology concentrates attention primarily on the use of different materials in the production of concrete, industrial wastes in particular. The use of silica fume, marble dust and also fly ash in concrete is an important subject and is growing day by day. Using silica fume, marble dust and fly ash in concrete may both provide economical advantages and better properties in the production of concrete. Besides, concretes produced with three different ratios of them were compared to the normal concrete without any concrete admixtures against fire. According to the results of the study, 10% of silica fume and also 10% of marble dust and also 10% of fly ash improve concrete strength and also 10% of silica fume improves strength more than two others and 10% of marble dust in the second rank and the other one in the third stage.

## **POLYPHENOL QUANTIFICATION OF PINEAPPLE THROUGH FERMENTATION PROCESS AND THE USE IN MUFFINS**

Segovia, F; Font, F; Sánchez L; Almajano, MP<sup>a</sup>

Chemical Eng. Dept., Technical Univ. of Catalonia  
Avda Diagonal 647, 08028 Barcelona (Spain)

a. Corresponding autor (m.pilar.almajano@upc.edu)

The Pineapple (*Ananas comosus*) is a tropical plant that can be cultivated. It can be consumed fresh, cooked, juiced and preserved. It is found in a wide array of cuisines. In addition pineapple are not only used in desserts such as fruit salad, but also as a main ingredient in savory dishes. It is an excellent source of minerals, vitamins and polyphenols.

Usually is peeled and generates an amount of waste equivalent to 30% of initial weight. These pineapple wastes containing polyphenols that helps to prevent several diseases. Also have enzymes such as bromelain highly demanded worldwide and used in the food industry as a food additive.

The aim of this study has two parts: on the one hand to know how can affect the alcoholic fermentation in the evolution of the enzyme and polyphenols; for the other hand to analyze the use residue juice as natural antioxidant in the muffins homemade. The influence of the temperature and the juice concentration is studied.

The results show that the residue is rich in natural antioxidants and the muffins durability increases more than a 50% (measure by TBARS).

In conclusion it has been found that a byproduct can be a value added in the food industry and can also provide a natural flavour appreciated by consumers.

## MODIFIABLE HYDROGELS AS TEMPLATES FOR METAL NANOPARTICLE PREPARATION AND CATALYSIS MEDIUM FOR VARIOUS REACTION

<sup>1</sup>Sahin Demirci, <sup>1</sup>Elif Karacan, <sup>1</sup>Selehattin Yılmaz, <sup>1,2,a</sup>Nurettin Sahiner

<sup>1</sup>Canakkale Onsekiz Mart Univ., Faculty of Sciences and Arts, Chemistry Dept., <sup>2</sup>Nanoscience and Technology Research and Application Center (NANORAC), Terzioğlu Campus, 17100, Canakkale-Turkey.

a. Corresponding author (sahiner71@gmail.com)

Hydrogels derived from poly(4-vinyl pyridine) (p(4-VP), poly(1-imidazole) (p(VI), p(acryl amide) p(AAm) poly(acrylic acid) p(AAc), and p(methacrylic acid) p(MAc) were prepared via free radical and/or photo polymerization techniques in the presence of functional silica particles containing vinyl groups. The hydrogel-silica composites were characterized with various techniques. The hydrogel networks were treated with HF and NaOH to dissolve silica for the generation additional pores, useful for further utilization of hydrogel network as soft and porous materials for fast absorption of different species (metal ions, dyes and nitro compounds) and reactions. New functional groups are generated within hydrogel network via chemical modification upon treatment of porous and nonporous hydrogels by quaternization agents e.g., mono/di-bromoalkanes with different chain lengths and different quaternary ammonium salts depending on the nature of the hydrogels. The properties these porous and nonporous hydrogels were compared in terms of swelling studies in DI water and different buffers. Also, their mechanical, thermal and structural properties were investigated employing Elemental analysis, FT-IR spectroscopy, TG analysis, and Surface area and Pore Measurements (BET). Finally, modified and non-modified hydrogel were used in metal nanoparticle preparation such as Co, Ni, Cu etc and in catalysis of some nitro compound and dyes for environmental applications.

## NICKEL PHOSPHATE MOLECULAR SIEVES AS NEW CATALYTIC MATERIALS

M.N. Timofeeva<sup>1</sup>, V.N. Panchenko<sup>1</sup>, Zubair Hasan<sup>2</sup>, Sung Hwa Jung<sup>2</sup>

<sup>1</sup> Borekov Inst. of Catalysis SB RAS, Prospekt Akad. Lavrentieva 5, 630090, Novosibirsk, Russian Federation

<sup>3</sup> Dept. of Chemistry and Green-Nano Materials Research Center, Kyungpook National Univ., Sankyuck-Dong, Buk-Ku, Daegu 702-701, Republic of Korea  
a. Corresponding author (mariya-timofeeva@yandex.ru)

Metal phosphate molecular sieves (MPMS) are widely used as catalysts in a wide variety of chemical processes. Nickel phosphate molecular sieves, such as VSB-5, have particular interest among various MPMS due to their unique structural and physicochemical properties, such as high stability, microporosity, large surface area and the ability to control acid-base and red-ox properties with the isomorphous substitution technique.

With this perspective, we tried to give a critical view of the possible explanation of catalytic properties of MTI-VSB-5 (M = Fe, V, Mn). Textural and acid-base properties of these materials were studied by XRD, N<sub>2</sub>-adsorption/desorption analyses, FT-IR spectroscopy using pyridine, PhCN and CDCl<sub>3</sub> as probe molecules and EPR spectroscopy by a spin probe method. Catalytic properties were investigated in a broad list of catalytic reactions, such as reaction of propylene oxide with methanol, synthesis of monosaccharides via condensation of dihydroxyacetone with formaldehyde, isomerization of  $\alpha$ -pinene oxide, cyclohexene and phenol oxidation with H<sub>2</sub>O<sub>2</sub>,  $\alpha$ -pinene oxidation with molecular oxygen. Emphasis is placed upon the relationship between the physicochemical properties and their catalytic properties in hydrogenation, oxidation and acid-base type reactions. Because of the simultaneous existence of acid-base and red-ox pairs, MTI-VSB-5 can adapt to catalytic systems and provide necessary active sites.

## SYNTHESIS AND BIOLOGICAL EVALUATION OF SOME NOVEL ALLYL IMIDAZOLE DERIVATIVES

Adel Marzouk

a. Corresponding author (adel\_marzouk77@yahoo.com)

Multi-component reactions (MCRs) have drawn great interest enjoying an outstanding status in modern organic synthesis and medicinal chemistry because they are one-pot processes bringing together three or more components and show high atom economy and high selectivity. One such reaction is the synthesis of imidazoles. Imidazoles are a class of heterocyclic compounds that contain nitrogen and are currently under intensive focus due to their wide range of applications, Tetrasubstituted imidazole is a core section in many biological systems such as Losartan, Trifenagrel, Eprosartan and Olmesartan. The presence of an imidazole ring in natural products and pharmacologically active compounds has instituted a diverse array of synthetic approaches to these heterocycles. One of the aims we have in mind is to introduce a new, efficient reusable and green catalyst for synthesis of 2,4,5-trisubstituted imidazoles with cost effectiveness and mild condition in high yields. In continuation with our research program concerning the synthesis and antimicrobial evaluation of medicinally important compounds, in the present study we have synthesized N1-(allyl) trisubstituted imidazoles. Recent literature revealed that N1-substitution of imidazoles improves the antibacterial activity. This created interest among us to synthesize 1N-(allyl)-trisubstituted imidazoles and screen them for their antimicrobial activity.

## PREDICTION OF CATALYTIC PROPERTIES OF METAL-ORGANIC FRAMEWORKS IN ACID-BASE CATALYSIS

V.N. Panchenko<sup>1</sup>, M.N. Timofeeva<sup>1,a</sup>, Z. Hasan<sup>2</sup>, J.W. Jun<sup>2</sup>, Sung Hwa Jung<sup>2</sup>

<sup>1</sup> Borekov Inst. of Catalysis SB RAS, Pr. Akad. Lavrentieva 5, 630090, Novosibirsk, Russia

<sup>2</sup> Kyungpook National Univ., Sankyuck-Dong, Buk-Ku, Daegu 702-701, Republic of Korea

a. Corresponding author (mariya-timofeeva@yandex.ru)

Nowadays, metal-organic frameworks (MOFs) materials are an ongoing subject for research as heterogeneous acid-base catalysts due to their unique textural and physicochemical properties. The change of chemical compositions and structure opens up the broadly possibility of using MOFs in catalysis. Unfortunately, the question of the influence of the nature of active sites on the activity of systems is weakly investigated and needs detailed analysis.

With this perspective, we tried to give a critical view of the possible explanation of catalytic properties of MOFs, such as amino-modified UiO-66 materials (NH<sub>2</sub>-UiO-66) and aluminum trimesate solids MIL-96, MIL-100 and MIL-110. Textural and acid-base properties of these materials were studied by XRD, N<sub>2</sub>-adsorption/desorption analyses, FT-IR spectroscopy using pyridine, PhCN and CDCl<sub>3</sub> as probe molecules and EPR spectroscopy by a spin probe method. Catalytic properties were investigated in a broad list of catalytic reactions, such as Knoevenagel condensation of benzaldehyde with malononitrile to 2-benzylidenemalononitrile, the synthesis of propylene glycol methyl ether from methanol and propylene oxide, and isomerization of  $\alpha$ -pinene oxide. It was demonstrated correlation between catalytic properties of MOFs and their acid-base properties ((1) the type of active site, 2) the concentration of the active sites, and 3) the strengths of the active sites).

## **SYNTHESIS OF PEI PARTICLES AND PEI-SILICA COMPOSITE AND THEIR USE IN CATALYSIS**

<sup>1</sup>Sahin Demirci, <sup>1,2</sup>Nurettin Şahiner

<sup>1</sup>Canakkale Onsekiz Mart Univ., Faculty of Sciences and Arts, Chemistry Dept., <sup>2</sup>Nanoscience and Technology Research and Application Center (NANORAC), Terzioğlu Campus, 17100, Canakkale-Turkey.

a. Corresponding author (sahiner71@gmail.com)

Polyethyleneimine (PEI) microgels and composite as polyethyleneimine-silica (PEI-Si) microparticle hydrogels were synthesized using a micro-emulsion polymerization technique. Porous PEI particles were generated after removal of silica particles upon treatment of composite PEI-Silica microparticles with HF. The PEI particles and porous PEI particles loaded with Co(II), Ni(II), Fe(II/III) and Cu(II) etc ions from their aqueous solutions and treated with aqueous NaBH<sub>4</sub> for in situ preparation of the corresponding metal nanoparticles. Additionally, PEI, PEI-Si and, porous PEI matrices were modified with various chemical agents to generate new functional groups. These modified PEI based materials were also used in different metal nanoparticle preparation. And PEI-M particles (M:Co,Ni, Cu or Fe etc) composites were used as catalyst in the hydrolysis of NaBH<sub>4</sub> for hydrogen generation and reduction of 4-NP, and some dyes such as Methylene Blue and Rhodamine. The catalytic performance of these materials was investigated taking into consideration of the various parameters such as the amounts of catalyst, chemical reagents, temperature, and so on. Various instrumental tools such as FT-IR, AAS, TGA, BET, UV-Vis were used in the characterization and catalysis reactions.

## **SYNTHESIS AND CHARACTERIZATION OF HYDROXYAPATITE**

Atifet Elif ÇIÇEKLI

a. Corresponding author (aelif1559@gmail.com)

Synthesis and characterization of hydroxyapatite Biomaterials are used to replace or support the human organs or tissues. There are four different groups of biomaterials such as metallics, ceramics, polymers and composites. Biocompatibility is considered as the most important feature in biomaterials, allowing the surrounding tissue to differentiate normally and preventing undesired reactions. Hydroxyapatite is one of the form of calcium phosphate which is designated as Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>(OH)<sub>2</sub>. Hydroxyapatite has a high biocompatibility and slow degradation. The chemical structure of hydroxyapatite and bone mineral is very resemble. There may be a very strong bonds between the surface of hydroxyapatite bone-implant bone and accelerates the growth of this surface. Space consisting of hydroxyapatite in bone tumor surgery, as the filler material, as a bridge to grab the bone defect repair of a broken bone, supply and implant dentistry tooth root used in coatings. Hydroxyapatite ocular implant is used in practice Hydroxyapatite, in plastic surgery, cheek, upper and lower jaw, nose, forehead, face such as are used in the reconstruction of the parts. The aim of this study was to sintering of hydroxyapatite powders were synthesized and characterized by different degrees of sintering is.

## THE INFLUENCE OF DIFFERENT MESOPOROUS SILICA SUPPORTS IN THE CATALYTIC PERFORMANCE OF POLYOXOMETALATE BASED COMPOSITES

Salete S. Balula<sup>a</sup>, Susana Ribeiro<sup>a</sup>, Luís Cunha-Silva<sup>a</sup> Isabel C. M. S. Santos<sup>b</sup>

<sup>a</sup>REQUIMTE & Dept. of Chemistry and Biochemistry, Faculty of Sciences, Univ. of Porto, 4169-007 Porto, Portugal

<sup>b</sup>QOPNA, Dept. of Chemistry, Univ. of Aveiro, 3810-193 Aveiro, Portugal  
a. Corresponding author (sbalula@fc.up.pt)

The design of novel composites capable to be recyclable, robust and efficient catalysts is an important and actual topic of research.[1] In fact, transform cheap compounds into valuable intermediates for organic synthesis, both in the laboratory and in industry, is a remarkable field of research and development.

The main goal of this work is to immobilize the catalytic active polyoxometalate ( $\text{SiW}_{11}$ ) into different silica mesoporous materials (Periodic Mesoporous Organosilica, PMO and SBA-15). The catalytic performance and the stability of the composites  $\text{SiW}_{11}$ @PMO and  $\text{SiW}_{11}$ @SBA-15 will be compared for the oxidation of monoterpenes and sulfoxides. All materials were characterized by various methods: FT-IR, FT-Raman, XRD, SEM with EDX, and textural analysis. The stability of the composites was investigated after catalytic use by the same techniques.

## PROPERTIES OF CHALCOGENIDE STRUCTURES DEPOSITED ONTO POLYIMIDE SUBSTRATE

Petronela Prepelita (married as Garoi)

a. Corresponding author (petronela.garoi@inflpr.ro)

The chalcogenide structure was obtained from targets (99.99 % purity) deposited by RF magnetron sputtering onto polyimide (i.e. kapton) substrate. Properties of the deposited thin films (i.e.  $\text{CuIn}_x\text{Ga}_{1-x}\text{Se}_2$  (1500 nm), CdS (60 nm)) and contact electrodes (i.e. Mo (500 nm) and ITO (300 nm)) deposited onto kapton were investigated. The surface topography of the samples was analyzed using scanning electron microscopy (SEM). As a result, a roughness dependence on the thickness of the samples was noticed. This affected the properties of the chalcogenide structure. A polycrystalline nature of the films was observed from XRD patterns. The dependence of structural properties and optical properties on the films were studied. Transmission spectra were analyzed for each layer and for the final chalcogenide system. Results showed that transmittance and the optical band gap decrease with increasing thickness of the sample. A transmittance of 74% at 800 nm for the 60nm-thick CdS film and 96% for the 300nm-thick ITO film was obtained. The study of electrical properties of all the samples was carried out by analyzing the electrical conductivity dependency on the temperature, and considering the nature of the substrate. These properties are suitable for various optoelectronics applications, such as chalcogenide solar cells.

## MULTI-FUNCTIONAL POROUS TISSUE SCAFFOLDS

Bahattin Koc, AKM Bashir Khoda

a. Corresponding author (bahattinkoc@sabanciuniv.edu)

In this paper, a multi-functional tissue scaffold is designed with heterogeneous internal architecture. The proposed design method uses radial and spiral layers consecutively to generate functionally gradient porosity. The medial region of the designed scaffold is constructed from medial axis and used as an internal geometric feature for each layer. The radial layers are determined by connecting the boundaries of the medial boundary and each layer's outer contour. The points on the contours are matched by applying optimization algorithms. Iso-porosity regions are determined by dividing the sub-regions into pore cells. The combination of consecutive layers generates the pore cells with desired porosity. To ensure the fabrication of the designed scaffolds, both contours have been optimized for a continuous, interconnected, and smooth deposition path-planning. The proposed methodologies can generate the structure with gradient (linear or non-linear), variational or constant porosity that can provide localized control of variational porosity along the scaffold architecture. The designed porous structures can be fabricated using bio-additive fabrication processes.

## DEVELOPMENT OF POLYMERIC DRUG DELIVERY MATERIALS IN THE CONTROLLED DRUG DELIVERY SYSTEMS

Gamze ÇELİK<sup>1</sup>, Ayşegül UYGUN ÖKSÜZ<sup>1\*</sup>

<sup>1</sup>Süleyman Demirel Univ., Faculty of Arts and Sciences, Dept. of Chemistry, ISPARTA

a. Corresponding author (gamzecz3557@gmail.com)

Recently, significant advances have been made in the development of biodegradable polymeric materials for biomedical applications. Polymeric drug delivery systems are able to improve therapeutic efficacy, and enhance compliance of the patients by delivering drugs at a controlled rate over a period of time to the site of action. Over the past few years, there has been increasing interest in polymer ultrafine micro/nanofibers for biomedical applications that are produced by several fabrication techniques. Through the fiber-forming material, drug loaded nanofibers can be prepared by the solution, emulsion and melt systems in the solute media or by the blending method. Drug release profiles can be estimated from the drug used in this way and the shape of targeting of the drug can be minimized. The mathematical models of drug release from nanofibers can be used to predict the basis of drug release mechanisms and drug release kinetics as a function of nanofibers. In this work the release of the drug from polyvinylalcohol (PVA), polyvinylalcohol/chitosan (PVA/Ch) and polyvinylalcohol/chitosan/Ibuprofen (PVA/Ch/IBU) nanofibers (Figure 1) obtained by the electrospin method will be monitored by Quartz Crystal Microbalance (QCM) method with mass/frequency ratio changes depending on time. Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR) analysis will be used to determine whether the drug is held on the polymer surface or not.

## **PREPARATION OF NANOROUGH METAL OXIDE COATINGS BY ULTRASOUND-ASSISTED SOL-GEL DEPOSITION METHOD**

Kerem Karakuş<sup>1)</sup>, H. Enis Karahan<sup>1)</sup>, and Özgür Birer<sup>1,2)</sup>

1) Chemistry Dept., Koç Univ., Istanbul, Turkey

2) KUYTAM, Surface Technologies Research Center, Koç Univ., Istanbul, 34450, Turkey

a. Corresponding author (obirer@ku.edu.tr)

Sol-gel coating is a practical route for the preparation of metal oxide surfaces. Sols can be surface applied using different techniques such as dip-, spin-, and brush-coating. Each technique has some advantages, but peeling and cracking are common challenges due to poor adhesion. Ultrasound-aided deposition of reactive sol particles is promising for adhesion improvement. In this novel technique, sols accelerated towards the surfaces under ultrasonic field form well-adhered coatings.

Ultrasound-aided sol-gel deposition benefits from a good control over particle size. So, we first studied the effect of chemical composition on sol-gel growth kinetics using dynamic light scattering. Acetone/ethanol mixtures in different ratios were used as solvent and the amount of titanium isopropoxide and tetraethoxysilane (precursors), acetic acid (catalyst), and water (hydrolyzing agent) were changed in reaction mixtures. We found a certain solvent composition makes sol particles smaller and delays gelation time. We also observed that acetic acid is primarily effective on particle size. Then the effect of acetic acid on film deposition was investigated. Coatings were analyzed with electron microscopy, atomic force microscopy, and X-ray photoelectron spectroscopy. We prepared titania and titania/silica hybrid coatings with nanorough morphology and good homogeneity. Developed nanocoatings are highly promising for photocatalytic applications.

## **A FACILE SYNTHESIS OF IRON BASED NANO-ADSORBENT FOR REMOVAL OF AS(V) FROM WATER**

Z. Ozlem Kocabas Ataklı and Yuda Yurum\*

Faculty of Natural Sci. and Eng., Sabanci Univ., Orhanlı Tuzla, Istanbul, Turkey

a. Corresponding author (ozlemkocabas@sabanciuniv.edu)

Titanium dioxide has been extensively tested in environmental applications, especially in separation technologies. In the present study, ferric ion impregnated titanium dioxide nanoparticles were tested for As(V) removal from water due to high affinity of iron toward inorganic arsenic species. Ferric ion impregnated titanium dioxide nanoparticles were synthesized via sol-gel method and their efficiency for the removal of As(V) from water was compared with pure titanium dioxide nanoparticles. The synthesized nanoparticles were characterized by x-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), x-ray photoelectron spectroscopy (XPS), and scanning electron microscopy (SEM). The maximum As(V) removal percentage was found ~99.5 % at pH 3, respectively, at an initial arsenic concentration of 1 mg/l. The results of the sorption experiments, which take into consideration the effects of equilibrium concentration on adsorption capacity, were analyzed with two popular adsorption models, Langmuir and Freundlich models. From the comparison of  $R^2$  values, the adsorption isotherms of As(V) for ferric ion impregnated titanium dioxide nanoparticles was fitted satisfactorily well to the Freundlich equation. The mean free energy of adsorption values found in our work were less than 8 kJ/mol, physical adsorption due to weak van der Waals forces was also occurring in addition to chemisorption.

## **PROPERTIES OF POROUS CORDIERITE CERAMICS PRODUCED VIA STARCH ADDITION**

Ovunc POLAT, Selin SIVASLI, Ayse KALEMTAS

Mugla Sitki Kocman Univ., Dept. of Metallurgical and Materials Eng., Mugla, TURKEY  
a. Corresponding author (akalemtas@mu.edu.tr)

Porous ceramics have been used in wide range application areas such as high-temperature gas or liquid filters, separation membranes, dust or soot collector, catalyst carriers and bioreactors. Cordierite ceramics have inherent high thermal shock resistance due to their low thermal expansion coefficient. Therefore, they become important candidates for high temperature filtering applications. In this study, porous cordierite ceramics were fabricated by a mixture of starch, talc, clay with low impurity, alumina and silica. Samples were sintered in air between 1200-1350°C. Depending on the sintering temperature, various secondary phases were formed beside cordierite phase. The effect of these secondary phases on porosity formation and thermal properties were investigated in this study.

## **KINETIC STUDY OF THE ADSORPTION OF A CATION DYE (METHYLENE BLUE) BY CARBON IN MEDIUM AQUEOUS**

Z'hour Hattab, Radia Mazouz, Naima Filali, Kamel Guerfi

a. Corresponding author (zoumourouda20012000@yahoo.fr)

The elimination of the dyes (methylene blue) starting from an aqueous solution by adsorption on Carbon was carried out in static mode. The study of adsorption made it possible to determine the time of contact which is equal to 180 minutes by an output of elimination of 97% for an initial concentration 20 mg/l. The influence of parameters (mass, initial concentration, and pH), made it possible to note an improvement of the capacity and speed of adsorption of the methylene blue on Carbon. In addition, the isotherm of adsorption of methylene blue follows the models of Freundlich and Langmuir with a maximum quantity of adsorption of 3.7 mg/g.

## **SURFACE FUNCTIONALIZATION OF NANOFIBERS OF PCL/ PVP FOR BIOMEDICAL APPLICATIONS**

Ece Polat<sup>1</sup>, A. Sezai Saraç<sup>1,2</sup>

<sup>1</sup>Dept. of NanoScience & NanoEng., Istanbul Technical Univ., Maslak, Istanbul, Turkey

<sup>2</sup>Dept. of Chemistry and Polymer Science and Technology, Istanbul Technical Univ., Maslak, Istanbul, Turkey

*a.* Corresponding author (ecepolat@yahoo.com)

Polycaprolactone is a hydrophobic biocompatible polymer that can be used in tissue engineering or other biomedical purposes. For good cell attachment hydrophilic surface and protein rich surface is important so in this study PCL was blended with PVP. Also, highly porous structure with increased surface to volume ratio is important for tissue engineering. To achieve that porosity, electrospinning method was applied. PCL and PVP was dissolved in THF/DMF solution with the weight ratio of 20% (w/v) and nanofibers were electrospun under the parameters of 15 kV, 0.5 ml/hour (feed rate) and 20 cm (distance between tip and collector).

To have functionalized surface, poly anthranilic acid was used. Poly anthranilic acid is a conducting polymer and can be suitable in protein immobilization with having –COOH functional group. In immobilization study, EDC/NHS crosslinkers were used.

In second part, biotin was added to PCL/PVP electrospinning solution and non-covalent biotin-streptavidin interaction was observed with incubation of nanofibers in streptavidin solution. Protein rich surface was obtained.

Spectroscopic investigation of nanofibers were performed with FTIR-ATR and UV-vis spectroscopy. Also, scanning electron microscopy and confocal microscopy was used for morphologic investigation of nanofibers.

## **MICROSTRUCTURAL INVESTIGATION OF FUNCTIONAL GRADIENT POROUS MULLITE CERAMICS PRODUCED VIA POLYMER REPLICA METHOD**

Ayşe KALEMTAS

Mugla Sitki Kocman Univ., Dept. of Metallurgical and Materials Eng., Mugla, TURKEY

*a.* Corresponding author (akalemtas@mu.edu.tr)

Porous mullite ceramics represent an excellent combination of good thermal-shock resistance and low thermal expansion coefficient as well as high mechanical and chemical stability at elevated temperatures. In the current study, porous functional gradient mullite ceramics are produced via polymer replica method using alumina and kaolin. Polyurethane sponges with a different number of pores per inch are joined together to produce an open porosity gradient in the structure. Bulk density, open porosity, pore size distribution, phase composition and microstructural evolution of the samples are investigated as a function of sintering temperature and dwell time.

## **SURFACE CHEMISTRY AND POROSITY MODIFICATION OF FUNCTIONALIZED BIOSILICA SUPPORTS BY ATOMIC LAYER DEPOSITION**

Didier Arl, Nouredine Adjeroud, Moustapha Sarr, Diana Li, Naoufal Bahlawane, Damien Lenoble

*a.* Corresponding author (arl@lippmann.lu)

Diatomite powder is highly considered as a good agent for filtering applications and optical tracers. Its large specific area has been used to produce biphased fluorescent materials. Active composites can be then produced by selectively integrating semiconducting nanoparticles into these mesoporous bio-originated structures. The challenge is to balance between the stabilization of the nanoparticles onto the surface and the preservation of the optical properties. We propose to investigate the efficiency of Atomic Layer Deposition (ALD) to control the properties of these heterostructures. Sol-gel synthesis of II-VI nanosemiconductors is used to functionalize Diatomite structures. Optical properties of the biphased compounds are obtained by Absorbance and Photoluminescence spectrometries. Morphology and crystalline states are characterized by Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and X-Ray Diffraction (XRD). ALD coating processes are described by using Quartz Microbalance (QCM) and Residual Gas Analyser (RGA). Large-scale applications using Fluidized-Bed Reactor (FBR) vapour-phase are also reported.

## **PRODUCTION OF FUNCTIONAL GRADIENT POROUS ALUMINA CERAMICS VIA STARCH ADDITION**

Ayşe KALEMTAS

Mugla Sıtkı Kocman Univ., Dept. of Metallurgical and Materials Eng., Mugla, TURKEY

*a.* Corresponding author (akalemtas@mu.edu.tr)

In the current study, porous functional gradient alumina ceramics are produced via starch addition. Various types of starch sources having different particle size and distribution are used to produce an open porosity gradient in the material. Bulk density, open porosity, pore size distribution, phase composition, thermal properties and microstructural evolution of the samples are investigated as a function of selected sintering additives, temperature and dwell time.

## **ZEOLITE FILLED POLYVINYLALCOHOL MEMBRANE PREPERATION AND ALCOHOL DEHYDRATION BY PERVAPORATION**

Filiz Ugur Nigiz<sup>1,a</sup>, Nilufer Durmaz Hilmioglu<sup>1</sup>

1. Kocaeli Univ., Chemical Eng. Dept., Kocaeli, Turkey  
a. Corresponding author ( filiz.ugur@kocaeli.edu.tr)

Pervaporation (PV) is a membrane process which separates azeotropic and thermal sensitive compounds efficiently. Compared to the other membrane processes, a phase change occurs during the transition in PV. The selected material dissolved onto the membrane surface, diffuses through the membrane and desorbed as vapor phase.

The performance and productivity of the system are directly related to the membrane selection. In PV; polymeric, inorganic and composite membranes are used. Generally, inorganic membranes are suitable for commercial scaled plants since they are durable and can be operated at high temperature. On the other hand inorganic materials are expensive and it is hard to form them as membrane since they are brittle. Polymeric materials are able to form as membrane module but polymers are organic structured material and it is not possible to use them at high temperature. Therefore the inorganic filled polymeric membranes which are called as “Mixed Matrix” or “composite” membranes have become more suitable.

In this study pristine and 3A zeolite loaded polyvinylalcohol membranes have been prepared and operated in PV process to dehydrate isopropanol-water mixture. The performance of PV has been determined by flux and selectivity. Effects of zeolite loading, feed composition and temperature on performance have been evaluated.

## **COMPOSITE MEMBRANE SYNTHESIS FOR PERVAPORATION MEMBRANE BIOREACTOR**

Filiz Ugur Nigiz<sup>1,a</sup>, Nilufer Durmaz Hilmioglu<sup>1</sup>

1. Kocaeli Univ., Chemical Eng. Dept., Kocaeli, Turkey  
a. Corresponding author ( filiz.ugur@kocaeli.edu.tr)

Bioethanol is sustainable and renewable fuel energy source which is biologically produced by fermentation from biomass. However the production of high purity ethanol has some drawback such as requirement of complex production, separation steps which have high energy consumption. Recently hybrid fermentation – separation processes have been recommended to overcome the cost and efficiency problem. In this system fermentation and ethanol purification steps are carried out simultaneously. This system not only prevents the product inhibition, but also provides high quality ethanol production. In literature there have been numbers of suggested hybrid systems such as azeotropic distillation, extractive distillation and pervaporation coupled by fermentation. Pervaporation is a membrane separation process. The performance of the system is commercially proved by hundreds of alcohol dehydration plant around the world.

Pervaporation membrane bioreactors (PVMBR) is a pervaporation coupled fermentation hybrid process. In PVMBR, ethanol is selectively removed from fermentation broth by polymeric, inorganic or composite membranes. Mostly hydrophobic membrane is preferred to purify the ethanol.

In this study ZSM-5 loaded polydimethylsiloxane composite membrane has been prepared and employed in PVMBR for bioethanol production from molasses. The effect of zeolite loading on ethanol production and purification has been evaluated.

## **THE EFFECTS OF A FLY ASH FILLER ON FIRE BEHAVIOUR AND PHYSICOMECHANICAL PROPERTIES OF THERMOPLASTIC POLYURETHANE MATERIALS**

Nazım Usta<sup>a</sup>, Recep Yurtseven, Ali Rıza Tarakçılar, Muzaffer Topcu, Erkin Akdoğan

a. Corresponding author ( n\_usta@pau.edu.tr)

Fly ash which is a by-product of coal-fired power stations may be defined as an inorganic material. The chemical composition of fly ash may change depending on the type of coal and the combustion used in the power station. Although fly ash is used in different industrial applications such as construction industry; most of the fly ash is stored in lagoons adjacent to power stations and results in serious environmental pollution. In this concept, some studies related to the usage of fly ash in the production of polymeric materials have been performed to investigate the effects of the incorporation of fly ash in the materials. In this study, the fly ash obtained from Kemerköy Coal-Fired Power Station (Muğla-Turkey) was added to a thermoplastic polyurethane material in 5.0 and 10 wt %. Effects of the fly ash filler additions on the physicomechanical properties and fire behaviour of the material were investigated.

## **PUMICE AS ALTERNATIVE RAW MATERIAL FOR CERAMIC AND NATURAL STONE SURFACES OF THE GLAZE WORK FOR THE IMPLEMENTATION**

Ali SARIİŞİK<sup>1</sup>, Erdal TUSUN<sup>2</sup>, Münnever ÇAKI<sup>3</sup>

1. Afyon Kocatepe Uni. Eng. Faculty, Mining Eng. Dept., ANS Campus, AFYON/TURKEY
2. Afyon Kocatepe Uni. Art Faculty, Ceramic Eng. Dept., ANS Campus, AFYON/TURKEY
3. Anadolu Uni. Art Faculty, Ceramic Eng. Dept., Eskişehir, TURKEY,  
a. Corresponding author ( sariisik@aku.edu.tr)

Tatvan and Isparta regions and different characteristics from the ground pumice, ceramic and natural stone as a more cost-effective way to apply the glaze. In this project the surface of the ceramic plate and andesite pomzada raw material produced in the glaze, glaze techniques, applied both indoors and outdoors as the product is intended for use artistic and decorative features. Andesite pumice between 1000 °C–1200 °C by monitoring compliance with glazes made from different views, giving the surface, indoors and outdoors to investigate the applicability of the material in the industry and the artistic field as the availability of new products will be presented. The new TS EN standards, industrial products, building material may be evaluated. Characteristics of natural stone used as a clean and well today, uncontrolled use of natural stone and natural stone reserves of raw materials come to the stage of exhaustion due to reasons such as reduced and it can be used indoors and outdoors depending on the research of various raw materials is known. For this purpose, such as andesite volcanic origin, the disadvantaged status of raw materials of natural stone advantageous, is to make high value added products. New product for the products produced will be used in interior and exterior spaces.

## ASYMMETRIC DIELS-ALDER REACTION IN THE PRESENCE OF CHIRAL ORGANIC CATALYSTS

Eldar H.Mammedbeyli, Gulsum E.Haciyeva, Ilqar H.Ayubov

Inst. of Petrochemical Processes of NASA, Baku city  
a. Corresponding author (eldar\_mamedbeyli@mail.ru)

The results of investigations of interaction between cyclopentadiene and acrolein in the presence of chiral homogenous catalysts to synthesis of chiral norborn-5-ene-2 aldehyde have been showed in the present work. The nature chiral aminoacids (S-proline, S- $\alpha$ -methylproline, S-threonine, S-tertiary-butoxythreonine) and alcohols (l-menthol, butan-2-ol, (-)-hydroxybicyclo[2.2.2]octan-2-ol) with different structure have been used as chiral catalysts. The reaction was lead in temperature range  $-40^{\circ}$  ÷  $20^{\circ}$ C in the presence of different amount of catalysts in organic solvents during 3 h. Benzene, toluene,  $\text{CH}_2\text{Cl}_2$  have been used as solvents. The molar relation of catalyst to dienophil changed from 0.1 to 0.75. The influence of temperature, amount and type of catalyst, nature of solvent to chemical and optically yields have been studied. It is established, that the decreasing of temperature to  $-40^{\circ}$ C lead to increase of optically yield of obtained compounds and reach 88 %. The decreasing of temperature lead to decrease of total yield of adduct. The increasing of catalysts amount it is not turns out the influence to optically yield, but adducts total yield increased. The nature of solvent almost is not influence to optically yield of adduct and in all synthesis it have been obtained only (R)-(+)-isomer.

## IDENTIFICATION AND TREATMENT OF HEAVY METALS FROM SOIL

Monica Saplonțai<sup>1,a</sup>, Viorica Saplonțai<sup>1</sup>, Roxana Trușcă<sup>2</sup> and Nicolae Bâlc<sup>1</sup>

1. Technical Univ. of Cluj-Napoca, Muncii Boulevard, 103-105, Cluj-Napoca, Romania
  2. S.C.Metav-Research Development S.A., Bucharest, Romania
- a. Corresponding author( monica\_saplontai@yahoo.com)

Due to the heterogeneous nature of the soil, several studies have focused on the interactions of heavy metals, presents in the soil, and the others constituents. Remediation of contaminated soils and removing the metals from contaminated soils are very costly and arduous tasks. As an alternative, in situ chemical immobilization is less costly than evacuating and filling the land, and provides a long-term solution to fix it, through the formation of stable and/or precipitated metallic minerals. The aim of this study is to identify the heavy metals from the soil (Baia Mare area, Romania) and to test the effects of treating the soil with hydroxyapatite. Determination of heavy metals from soil, it was done according to SR ISO 11047: 1998, ISO SR 11466: 1999, with Atomic Absorption Spectrophotometer and scanning electronic microscopy (Quanta Inspect F with EDAX). It has been identified Pb, Cd, Cu and Zn. Exchange capacity of metals has been reported for  $\text{Cd}^{2+}$ ,  $\text{Zn}^{2+}$  and  $\text{Cu}^{2+}$ . HA has a greater affinity for  $\text{Pb}^{2+}$ . Apatites reactivity for Pb, Cd, Cu and Zn, has the following order: synthetic > biological > mineral. It is therefore necessary to examine the status of soil contamination with heavy metals and to assess their impact on the environment.

## PREPARATION AND CHARACTERIZATION OF THE COMPOSITES WITH HA/ZrO<sub>2</sub>/POLY(METHYL METHACRYLATE)

Ileana Cojocaru<sup>1a</sup>, Stanca Boboia<sup>2</sup>, Viorica Saplontai<sup>3</sup>, Doina Prodan<sup>2</sup>, Laura Silaghi Dumitrescu<sup>2</sup> and Marioara Moldovan<sup>2</sup>

1. Univ. of Craiova, Craiova, Romania;
  2. Babes Bolyai Univ. - Raluca Ripan Chemistry Research Inst., Cluj-Napoca, Romania;
  3. Technical Univ. of Cluj-Napoca, Romania
- a. Corresponding author (i\_cojocaru2005@yahoo.com)

The materials properties of conventional organic–inorganic hybrid materials produced by mixing or dispersing inorganic materials in organic polymers are mainly determined by the nature of the interface between the organic and inorganic components, as well as by the size and dispersibility of the inorganic filler material. ZrO and hydroxyapatite nanoparticles of various sizes have been incorporated by compounding in a poly(methyl methacrylate) (PMMA) matrix to enhance its mechanical properties. SEM and XRD were used to determine component and morphology of the composite. Results indicated that HA and Zr particles were dispersed well in PMMA matrix, The mechanical properties of the composite were evaluated by using flexural strength (LOYD LR5K Plus). It was found that the flexural strength. The addition of HA can also reduce the ratio of water absorption of composite, which postponed the retention of mechanical properties of composite under moisture condition. The possibility of combining properties of organic and inorganic materials have been explored some years ago. One aspect was the development of composite membranes using a ceramic porous support and a selective top layer of an organic or hybrid polymer.

## A NOVEL SENSOR FOR ELECTROCATALYTIC DETERMINATION OF ASCORBIC ACID IN THE PRESENT OF DOPAMINE BASED ON ZEOLITE MODIFIED CARBON PASTE ELECTRODE

Maryam Abrishamkar<sup>1\*</sup>, Sakineh Bahmani<sup>2</sup>

1. Dept. of Chemistry, Islamic Azad Univ., Science and Research Branch, Khouzestan, Ahvaz, Iran.
  2. Young Researchers Club, Khouzestan Science and Research Branch, Islamic Azad Univ., Ahvaz, Iran
- a. Corresponding author( m.abrishamkar@umz.ac.ir)

In this study a new method for electrocatalytic oxidation and determination of ascorbic acid(AA) in the present of dopamine was developed. The proposed electrode was a zeolite-modified carbon paste electrode, doped with Ni(II) (Ni<sup>2+</sup>/Y/ZMCPE). Ni(II) ions were doped in Y-zeolite framework by ion-exchange mechanism and act as catalyst to oxidize ascorbic acid. Firstly, the electrochemical behavior of Ni(II), incorporated in the Y type zeolitic modified electrode was studied. The obtained results confirm that diffusion can control the Ni(II)/Ni(III) redox process at the Ni<sup>2+</sup>/Y/ZMCPE. Then, electrocatalytic oxidation of ascorbic acid, using cyclic voltammetry and chronoamperometry techniques was investigated. The diffusion coefficient and current density of ascorbic acid were calculated as  $1.491 \times 10^{-4} \text{ cm}^2 \text{ s}^{-1}$  and  $5.17 \times 10^3$  respectively. A linear dynamic range for determination of ascorbic acid and detection limit using proposed modified electrode were 0.1– 4.10 mmolL<sup>-1</sup>. and  $3.71 \times 10^{-4} \text{ mol L}^{-1}$  respectively.

## **OBTAINING AND CHARACTERISATION OF HYDROXYAPATITE–ZIRCONIA POWDERS BY CHEMICAL PRECIPITATION**

Marioara Moldovan<sup>1,a</sup>, Doina Pordan<sup>1</sup>, Cristina Prejmerean<sup>1</sup>, Codruța Saroși<sup>1</sup>, Vasile Eugen<sup>2</sup> and Aniela Saplonțai-Pop<sup>3</sup>

1. "Babeș Bolyai" Univ., "Raluca Ripan" Chemistry Research Inst., Cluj-Napoca, Romania;
  2. S.C.Metav-Research Development S.A., Bucharest, Romania
  3. "Tuliu Hațieganu" Univ. of Medicine and Pharmacy, Cluj-Napoca, Romania
- a. Corresponding author ( mmarioara2004@yahoo.com)

Hydroxyapatite (HAP) is the most important inorganic phase of the hard tissues of mammals and other organisms. Zirconia ( $ZrO_2$ ) is an important biomaterial due to its excellent biocompatibility and high mechanical strength.  $ZrO_2$  exhibits the best mechanical properties of oxide ceramics. The combination of two components hydroxyapatite-zirconia shows a promising candidate that can be used as dental materials, with a high impact due to their mechanical properties. HAP-zirconia are new materials that can be used as fillers in the formulation of restorative and endodontic dental materials. The paper presents a study related to the obtaining and characterization of HAP- zirconia nanoparticles. The HAP-zirconia nanoparticles are synthesized by precipitation of HAP in the presence of zirconia. The starting materials were CaO,  $H_3PO_4$  for synthesized HAP and  $ZrOCl_2 \cdot 8H_2O$  as precursor for zirconia. Following the precipitation the obtained sol was subjected to heat treatment at 120°C, 400°C, 850°C and 1050°C. X ray diffraction was used in order to study the structural properties of the obtained powder. FT-IR was used in order to evaluate the interactions between HAP and zirconia. Scanning electron microscopy (SEM) was applied to investigate the morphology. The microstructure of the HAP-zirconia products was further observed by transmission electron microscopy (TEM) and high resolution transmission electron microscopy (HRTEM).

## **THE APPLICATION OF NANOCATALYSTS IN THE PROCESSES OF DECARBOXYLATION OF DIFFERENT ACIDS**

Sevil Khalilova, Arif Hasanov, Ilgar Ayyubov

a. Corresponding author( sevilxalilova@gmail.com)

The application of nanocatalysts in different fields of organic and petrochemical industry have been described. Our investigations have studied the influence of nanocatalysts on decarboxylation of petroleum acids and high aliphatic acids received from plant oils. Nano-sized oxides of some metals as magnesium and titanium have been used as a nanocatalysts in the processes of decarboxylation of the same acids. At first, the influence of nanocatalysts on the process of decarboxylation of petroleum acids received from crude oils is investigated. The application of nano-sized magnesium oxides make reduced the total acid number of petroleum acid from 260 mg KOH/g to 1,5. This process conducted at the 300-350 0 C temperature and 0,7 h-1 volume rate. It is established that , the application of nanocatalysts in these processes can lead to decreasing of total acid number to the minimum. Thus, it affects to the economical expenses, positively.

## **ELECTROCATALYTIC OXIDATION OF HYDROCARBONS USING NANO NI/NI-ZSM-5 ZEOLITE MODIFIED CARBON PASTE ELECTRODE**

Maryam Abrishamkar<sup>\*</sup>, Leila Babnadi

Dept. of Chemistry, Islamic Azad Univ., Science and Research Branch, Khuzestan, Ahvaz, Iran  
a. Corresponding author (m.abrishamkar@umz.ac.ir)

This study investigates the electrocatalytic oxidation of hydrocarbons on the nickel/nickel-zeolite modified carbon paste electrode as an enzyme free electrode in alkaline solution. Cyclic voltammetric experiments were used for the electrochemical study of this modified electrode. The transfer coefficients and detection limits for hydrocarbons were calculated using cyclic voltammetric method. Finally, the electrocatalytic oxidation peak currents of hydrocarbons exhibited a good linear dependence on concentration, and their quantification can be done easily. The good analytical performance, low cost and straightforward preparation method make this novel electrode promising for the development of an effective hydrocarbons sensor.

## **ORDERED MESOPOROUS CARBON SYNTHESIS**

Prof. Dr. F.Çiğdem Güldür<sup>1</sup>, Ercan Yılmaz<sup>1</sup>

<sup>1</sup>Gazi Univ., Eng. Faculty, Chemical Eng. Dept., Maltepe, Ankara  
a. Corresponding author (cguldur@gazi.edu.tr)

Porous carbonaceous materials are important in many areas of modern science and technology, including water and air purification, gas separation, catalysis, chromatography, and energy storage. This wide-spread use of porous carbons results from their remarkable properties, such as high specific surface areas, large pore volumes, chemical inertness, and good mechanical stability. Most porous carbons are primarily microporous. Porous carbons are usually obtained via carbonization of precursors of natural or synthetic origin, followed by activation. The microporous nature of the majority of porous carbons is well-suited to many applications, including molecular sieving, adsorption, and catalytic reactions of small molecules. However, there are numerous other potential applications in which materials with carbonaceous surfaces would be attractive, for instance adsorption of large hydrophobic molecules (such as vitamins, dyes, humic acids, dextrans), chromatographic separations, electrochemical double-layer capacitors, and lithium batteries. In these cases, the presence of wider pores, preferably in the mesopore range, would be advantageous. Therefore, there has been recently a considerable interest in the synthesis of mesoporous carbons.

In our study 'carbonization of polymer aerogels or cryogels' method is used to synthesis ordered mesoporous carbon (OMC). Specific mass percent of resorcinol and pluronicF127 was dissolved in the solution including water, ethanol and HCl. The addition of formaldehyde waited a while, for phase separation. The polymer-rich layer was separated and then applied pyrolysis. As the next step, TGA, XRD, SEM-EDS, BET analysis is to be applied. The desired uniform structure and 15-25 nm pore size are expected to be for the PEM fuel cells. TGA measurements show that mesoporous carbon structure was successfully synthesized.

## **BEHAVIOR OF MICELLAR STRUCTURES IN SIMULATED BODY FLUIDS FOR DRUG DELIVERY PURPOSES**

Fatos Nacar, Ahmet Erkin Ermis, Mehmet Polat, Hurriyet Polat

a. Corresponding author (fatosnacar@gmail.com)

Micellar structures are becoming increasingly important in drug delivery applications. Morphology of these structures is extremely important in determining the form and the amount of the drug to be enveloped as well as how the release mechanisms will function. Though there are numerous works on micelles in the literature in aqueous media, understanding is lacking with respect to the specifics of the micelle formation and the exact morphology of the micelles produced within simulated body fluids. In this work, we have studied the conditions to create well-defined micellar structures in simulated body fluids using different well-known surface active agents. The surface energies, micelle size distributions and electrokinetic potentials were the main parameters studied.

## **NANO CALCITE AS HUMIDITY SENSOR**

Ekrem Özdemir, Sevgi Kılıç Özdemir, Salih Okur, Abdullah Bayram

a. Corresponding author (ekremozdemir@iyte.edu.tr)

Water is essential for living organisms. However, when present, moisture can easily degrade the foods and food stocks either directly or maintaining a hostile media for bacterial growth. In current study, about 200 nm monodispersed nano calcite particles were synthesized and employed for humidity sensing element on a QCM microbalance. It was observed that the moisture adsorption was rapid and reversible.

## **SIMPLE SILICON VAPOR ETCHING TECHNIQUE TO FORM THIN SiO<sub>x</sub>/Si/SiO<sub>x</sub> STRUCTURES**

Aouida Selma, Ennejah Nassima, Bessais Brahim

a. Corresponding author (salma.aouida@crtten.rnrt.tn)

Chemical vapor etching (CVE) of silicon substrate transform silicon crystalline structure to hexafluorosilicates ((NH<sub>4</sub>)<sub>2</sub>SiF<sub>6</sub>) crystalline white powder [1]. This powder presents different properties, which have been studied in previous work [2, 3]. The transformed silicon can vary from a few micrometers to the total substrate thickness. The analysis of the silicon/(NH<sub>4</sub>)<sub>2</sub>SiF<sub>6</sub> interface reveal an SiO<sub>x</sub> structure, which is an intermediate state for silicon transformation. The CVE of double side silicon substrate generate SiO<sub>x</sub>/Si/SiO<sub>x</sub> structures. The shape and the thickness of these structures can easily define by the masked silicon surface and the experimental CVE conditions. In this work we present the kinetic study of the CVE of silicon substrate in particular conditions. We establish that this technique is sensitive to temperature and the chemical vapor composition which vary during the reaction advancement and lead to different kinetic behavior in the same experimental conditions. [1] M. Saadoun, B. Bessais, N. Mliki, M. Ferid, H. Ezzaouia, R. Bennaceur, Appl. Surf. Sci. 210 (2003) 88. [2] S. Aouida, M. Saadoun, K. Ben Saad, B. Bessais, Thin Solid Films, 495 (2006) 357– 360. [3] S. Kalem, Superlattices and Microstructures, 44 (2008) 705-713.

## **SONO-SYNTHESIS OF NOVEL NANOCOMPOSITE (BA-DOPED Bi<sub>2</sub>O<sub>3</sub>-Γ-Fe<sub>2</sub>O<sub>3</sub>) AND ITS APPLICATION IN MINERALIZATION OF AMOXICILLIN FROM AQUEOUS SOLUTION BY SUNLIGHT**

M. H. Entezari\*<sup>1</sup>, S. Ramandi<sup>1</sup>, N. Ghows<sup>1</sup>.

<sup>1</sup>Dept. of Chemistry, Ferdowsi Univ. of Mashhad, 91775, Mashhad, Iran

a. Corresponding author (moh\_Entezari@yahoo.com)

In this study, a nano-magnetic composite (Ba-doped Bi<sub>2</sub>O<sub>3</sub>-γ-Fe<sub>2</sub>O<sub>3</sub>) was synthesized through a combination of ultrasound and co-precipitation method under mild conditions. The properties of the synthesized nano-composite were investigated by X-ray diffraction (XRD), TEM, and FT-IR. The XRD indicated that the size of nanoparticles to be 20 nm. This nano-composite showed a high catalytic activity under solar light for the decomposition and mineralization of amoxicillin, in comparison with undoped Bi<sub>2</sub>O<sub>3</sub> -γ-Fe<sub>2</sub>O<sub>3</sub>. The extent of degradation depends on the operating conditions such as type of catalyst, concentration of catalyst, and etc.

## **A SPECTROSCOPIC ANALYSIS OF THE WEATHERING EFFECTS ON LOW DENSITY POLYETHYLENE**

Asma Abdelhafidi, Imane Babaghayou, Salem Chabira

a. Corresponding author (abasma80@yahoo.fr)

The weathering of low density polyethylene film used as greenhouse covering has been carried out in sub-Saharan region. UV spectroscopy analysis has revealed the presence of chromophoric structures responsible in part of the photosensitivity of the polymer toward UV light. In fact, the conjugated bonds (diene) being photosensitive are regarded among others as good initiator to the photooxidation process. An ATR-FTIR analysis has allowed the identification of these photochemical products essentially developed on the surface of the film.

## **ORGANIC POLLUTANT REMOVAL USING ANIONIC CLAY FOR ENVIRONMENTAL PROTECTION**

Nacera BOUDAUD, A.E.K TAYEB, Hafida MILOUDI

a. Corresponding author (boudaoud\_2007@yahoo.fr)

In the present study, the adsorption characteristics of insecticide Methomyl (méthylthio-1éthylidène-amine). on layered double hydroxides (LDHs) were evaluated under laboratory conditions with particular attention to the effect of layer charge, original interlayer anion and morphology. The final objective is the use of LDHS and modified LDH materials as recyclable adsorbents and heterogeneous catalysts for the treatment of contaminated waste waters. We tried to enhance the properties of HDL in trapping anion or toxic molecules. Indeed, with a lamellar structure, exchange capacities among the highest in ion exchangers, and a hydroxylated surface very reactive promoting chemisorption anionic clays are very interesting materials for adsorption and intercalation of anions or molecules environmentally undesirable. These species include those used in agriculture in the region such as pesticides or industry such as heavy metals.

## LAYERED DOUBLE HYDROXIDES AS ADSORBENTS OF THIOSULFATE SODIUM FROM AQUEOUS SOLUTIONS: SYSTEMS MG-AL, NI-AL AND NI-MG-AL

Assia Benhouria, Fatima Gomri, Mokhtar Boutahala, Hassina Zaghouane

a. Corresponding author (chimieassia@hotmail.fr)

Hydrotalcite-like compounds Mg-Al-CO<sub>3</sub>, Ni-Mg-Al-CO<sub>3</sub> and Ni-Al-CO<sub>3</sub> (LDHs) and their calcined products respectively HTC1, HTC2, HTC3 were studied as potential adsorbents of the thiosulfate sodium ions from aqueous solution. The prepared samples were characterized by XRD, FTIR spectroscopy and isoelectric point (pHPZC) analysis. The XRD showed that the HT are well solved, this is due to a better crystallinity of the samples. Batch adsorption studies were conducted under various conditions, such as pH, competitive anions, adsorbent mass and temperature. It was found that the HTC had the largest adsorption capacity at pH 7. Adsorption kinetics of the thiosulfate sodium ions onto calcined products followed pseudo-first-order model. Adsorption isotherm results were showed that Langmuir model fit the experimental results very well with high correlation coefficients.

## ATTACHMENT OF THIOLYGLYCOLAMIDO GROUP ON POLY(STYRENE-CO-DIVINYLBENZENE) MICROBEADS AND THEIR CHARACTERIZATION

Cengiz Uzun<sup>a</sup>, Matin Yazdani Kohneshahri, Filiz Karagöz, Belma Işık

Dept. of Chemistry, Hacettepe Univ., Beytepe, Ankara 06800, Turkey

a. Corresponding author (uzun@hacettepe.edu.tr)

The synthesis of thiol(-SH) group carrying resins is of specific interest due to their chelating properties to remove heavy-metal ions and recovery of metal ions, strong radical and nucleophile scavenger properties, and also to improve of mucoadhesion. The most widely thiolated resin is the polystyrene/crosslinked-polystyrene, and its thiolation has been carried out by nucleophilic or electrophilic aromatic substitution with alkyl sulfanyl group and followed by dealkylation to obtain thiol side group. The other matrix to prepare thiolated resin is chloro-methyl-polystyrene (Merrifield resin) and its thiolation involves reaction with thiourea and alkali hydrolysis. In this study, aminated-poly(styrene-co-divinylbenzene) (NH<sub>2</sub>-PSDVB) micro-beads were prepared and used as a matrix for thiolation. The reaction between amine groups of beads and thioglycolic acid (HSCH<sub>2</sub>CO<sub>2</sub>H) in dichloromethane by using dicyclohexylcarbodiimide reagent results with thioglycoamido side groups (HS-CH<sub>2</sub>CONH-PSDVB). The appearance of thiol (-SH) band at 2556 cm<sup>-1</sup> and amide carbonyl band at 1662 cm<sup>-1</sup> followed from FTIR spectra together with the gravimetric data prove that these beads with thioglycolamido side groups have been successfully synthesized. Active thiol(HS-) groups on beads (4.3 mmol HS-/g-bead) were determined by studying the adsorption of Ag<sup>+</sup> ions (Volhard method) and compared with the theoretical value 5.18 mmol/g. The adsorption of some metal ions onto HS-PSDVB beads has been tested. During the adsorption study, achieved in the solution containing Al<sup>3+</sup>, Cr<sup>3+</sup>, Pb<sup>2+</sup>, Fe<sup>3+</sup>, Cu<sup>2+</sup>, Zn<sup>2+</sup>, Mn<sup>2+</sup>, Ni<sup>2+</sup>, Co<sup>2+</sup> and Cd<sup>2+</sup> ions, it has been determined that the concentration of Al<sup>3+</sup>, Cr<sup>3+</sup>, Pb<sup>2+</sup>, Fe<sup>3+</sup> ve Cu<sup>2+</sup> ions have decreased over 92 %.

## **STUDY BY DSC OF THE MICRO-CONSTITUENTS EFFECT ON THE PRECIPITATION OF NANOMETRIC PHASES IN THE AL-ZN-MG-(CU) ALLOYS**

L. BOUMAZA<sup>a</sup> and L. HADJADJ

Phase transformations laboratory, Faculty of Exact Sciences,  
Mentouri Univ. of Constantine1, Ain El Bey Road, Constantine 25000, Algeria.  
a. Corresponding author ( boumazaleila@yahoo.fr)

The use of aluminium-based alloys is due to their formidable mechanical properties, in particular those of series 7000 (Al–Zn–Mg with or without Cu), their utilization in the various fields of industry encourages the researchers to intensively study them. However the phenomena of precipitation and the mechanisms which govern them remain subject of intensive research. Generally the addition of micro-constituents modifies enormously the behaviour of alloys during the heat treatments by supporting the appearance of certain phases to the expense of the other phases appearing in the sequence of precipitation of the alloy.

According to the literature [1,2] the sequence of precipitation most generally allowed in this system is as follows: (SSS)→(ZGP)→(□')→(□). Other researchers mentioned in their work the presence of another phase called T of (Al, Zn)<sub>49</sub>Mg<sub>32</sub> composition which can make its appearance for alloys having undergone thermal treatment temperatures higher than 200 °C. For other researchers this equilibrium T phase, preceded by an intermediate phase T', results from another sequence of precipitation in these alloys for certain compositions or nuances (SSS→zone GP→T'→T) [3,4]. The aim of this work is to present the results of a calorimetric study of the effect of the addition of micro-constituents (copper and magnesium, essentially the copper) on solid state reaction in Al-Zn-Mg alloy. The results show that the addition of copper modifies the number and the nature of nanometer phases that precipitate in this alloy. In addition the effect of heat treatment on the formation and the redissolution of the GP zones during the early-stage of precipitation and the stability of the phases in naturally and artificially aged materials, seems to be independent of the copper and magnesium contents.

## **ELABORATION AND STUDY OF METAL OXIDES FOR THEIR USE IN GAS DETECTORS**

Azzedine Aïn-Souya, Nadia Chahmat, Rachid Ganfoudi, Ammar Haddad, Mokhtar Ghers

a. Corresponding author ( ainsouyaa@yahoo.fr)

The materials which were used for this study are ZnO and SnO<sub>2</sub> oxides. They were prepared by thermal oxidation of Zn and Sn layers deposited by vacuum evaporation at respective temperatures of 450° C and 220° C. The analysis of the samples by x-ray diffraction shows that the preferential orientation of the grains is parallel to the plans (002) for the ZnO layers and depends on the nature of the substrate for tin oxide. The observations by optical microscopy and electronic microscopy show that the grains sizes are almost homogeneous and of the order of 200 nm. Oxygen adsorptions and desorptions, at various temperatures, cause significant variations of electric resistance R of the samples. The results indicate temperature ranges of higher sensitivity to oxygen, that the layers reheated under O<sub>2</sub> have a more stable behavior and that the qualities of the surface reactions with oxygen are multi-energetic. The maximum of sensitivity to oxygen is obtained at relatively high temperatures, neighbouring 200C. The gas to be detected may be oxygen reductor. The mechanism of its capture results in a variation of the electric resistance indicative of its presence in the ambient conditions

## **THE STUDY OF THE ORDER-DISORDER TRANSITION AND HARDENING BEHAVIOR IN AUCUAG ALLOY**

L. Amiour, D. Hamana

a. Corresponding author ( l\_amiour@yahoo.fr)

The order-disorder transition takes a very important place because of its influence on the physical and mechanical characteristics of metals. The Cu-Au system provides a classical example of such type of transition. The presence of silver additions to the AuCu alloys leads to the changes in the ordering process and hardening behavior in AuCu system [1- 4]. Therefore, we paid our attention to the study of the different phase transitions in the Au-35% wt. Ag-15% wt. Cu alloy using differential scanning calorimetry (DSC) and dilatometry (DT1000). In addition, the hardening behavior was investigated in this alloy by hardness testing at different transition temperature. The obtained results show that the silver additions make increase the hardness of AuCu alloy with the occurring of Ag-rich  $\alpha_1$  and AuCu<sub>3</sub> ordered phases.

## **CHARACTERISATION OF MECHANICALLY MILLED SB<sub>2</sub>SE<sub>3</sub> POWDER**

A. Amara<sup>1</sup>, N. Abdennouri<sup>1</sup>, A. Drici<sup>1</sup>, M. Bououdina<sup>2</sup>, M. Guerioune<sup>1</sup>

(1) Université BADJI mokhtar d'Annaba, Algérie

(2) Univ. of Bahrain

a. Corresponding author( amara.abdelaziz@yahoo.fr)

Powder has been synthesized via mechanical milling of antimony and selenium as starting materials. X-ray diffraction characterisation has revealed that the powder is a single phase and belonging to the orthorhombic system with space group Pbnm. Reitveld refinement was used to fit X-ray diffraction data. The morphology of the ball milled powder was studied by scanning electron microscopy (SEM). Raman spectroscopy is also exploited to confirm the phase formation of the material. M-H (Magnetization versus Magnetic field) curve indicates that Sb<sub>2</sub>Se<sub>3</sub> has a ferromagnetic behavior.

## **INTERACTION OF OXYGEN WITH LAYERS OF SEMICONDUCTOR ZnO AND SnO<sub>2</sub>**

Ammar Haddad, Abdelhak Hafidi, Nadia Chahmt, Rachid Ganfoudi, Azzedine Ain-Souya, Mokhtar Ghers

a. Corresponding author( haddadammar@yahoo.fr)

The materials used in the study are layers of ZnO and SnO<sub>2</sub>. They are characterized by a behavior of n-type semiconductor and broad - band [1-3]. They were obtained by vacuum evaporation on substrates of different natures (glass, alumina ...). The SnO<sub>2</sub> layers have been prepared by oxidation at 220°C of tin deposited by evaporation. ZnO layers were prepared by oxidation at 450°C of zinc deposited by vacuum evaporation under the same conditions as those of SnO<sub>2</sub>. Tests of adsorption of oxygen at different temperatures show considerable variation in their electrical resistance R. The results put in evidence domains at high temperature sensitivity to oxygen. For some layers, the isotherms desorption have been sufficient for a complete regeneration of the samples. The other layers often requires programmed desorption (TPD) with temperature, for their restoration to the initial state, after ionosorption of oxygen. The operating curves of variation of R during TPD allow determining the provided energy. Key words: adsorption; conductance; desorption; oxygenate; semiconductor surfaces

## **BIO-PITCH: A NOVEL PRECURSOR FOR CARBON FOAM PRODUCTION**

Murat KILIÇ\* and Ayşe Eren PÜTÜN

Dept. of Chemical Eng., Faculty of Eng., Anadolu Univ.,  
26480 Eskişehir, TURKEY

a. Corresponding author (mkilic3@anadolu.edu.tr)

Walter D. Ford was first obtained the organic foam in the late 60's . After James Klett's discovery in 1997, the carbon foams have become popular among the carbon materials because of their potential application and unique properties. Generally carbon foams were fabricated by using raw coal, coal tar pitch, petroleum pitch, synthetic pitch from organics such as AR pitch, and polymeric foams. It is obvious that most of the precursors, used for obtaining mesophase pitches are usually belong to the fossil fuel resources or fossil fuel derived materials.

On the other hand, biomass pyrolysis oil (tar) with its aromatic hydrocarbon content seems to be an effective and alternative mesophase pitch precursor for producing carbon foam. Therefore, this study was focused on to determine the possible usage of biomass tar for carbon foam production. It is believed that production of carbon foam from this bio-pitch will be less expensive and easier to fabricate than fossil fuel derived pitches.

## MODELLING OF DRYING OF POROUS MEDIA

Leila Remache, Nacerddine Djermane

a. Corresponding author (remachesamira@rocketmail.com)

Problems involving heat and moisture migration in porous building materials arise a number of engineering interests, such as wall drying, the solar house designing, cooling load calculating of air conditioning. Affected by porous structure, temperature gradients, moisture gradients and environmental characteristic, heat and moisture transport in porous building materials is quite complex. One of the most complex processes based on heat and mass phenomena is drying. It is modelled using a continuous or discrete approach. The continuous approach is based on a description of the system as a fictitious continuum by using effective coefficients of heat and mass transfer. In the discrete approach, it is represented by a network of pores and transport phenomena are directly described at the pore level. Different versions of the receding front model were developed in order to get a better understanding and describe the influence of other mechanisms (capillarity, gravity or external forces in gradients of pressure and temperature) on the motion of water during drying. The main objective of this study is to discuss the phases and mechanisms involved in the drying process of building materials (clay, concrete, plaster, brick) and to compute the moisture and heat behaviour of these materials.

## CHARACTERIZATION OF THE POWDER OF ALGERIAN MONTMORILLONITE INTERCALATED BY A POLYCATION OF ALUMINIUM

O. Tobbi<sup>1,a</sup>, K. Guerfi<sup>2</sup>, N. Rebbani<sup>2</sup>

1. Higher Normal School-Constantine (ENS), Constantine, Algeria.
  2. laboratory water treatment and recycling of industrial waste, Dept. of Chemistry, university of Annaba, Annaba, Algeria.
- a. Corresponding author (wafa\_chims@yahoo.fr)

The inorgano-clay is Na-montmorillonite modified with  $[Al_{13}O_4(OH)_{24}(H_2O)_{12}]^{7+}$ . The purpose of this work was to study the behaviour of local material, montmorillonite clay, and to look at the ability of this clay exchanged to sorb hazardous materials.

The work involves synthesis inorgano-clay. The method of preparation is reported. The powder has been further characterized by infra-red spectroscopy, BET, DRX.

The results obtained show that the intercalated clay has a large surface area that allows us to use for the removal of pollutants.

## **SIMPLE SILICON VAPOR ETCHING TECHNIQUE TO FORM THIN $\text{SiO}_x/\text{Si}/\text{SiO}_x$ STRUCTURES**

Selma Aouida<sup>1,a</sup>, Nassima Ennajeh<sup>2</sup>, Nesrine Bachtouli<sup>3</sup> and Brahim Bessais<sup>4</sup>

1, 2, 3, 4. Photovoltaic Laboratory, Research and Technology Centre of Energy, Borj-Cedria Science and Technology Park, BP 95, 2050 Hammam-Lif, Tunisia  
a. Salma Aouida (salma.aouida@crten.rnrt.tn)

Chemical vapor etching (CVE) of silicon substrate transform silicon crystalline structure to hexafluorosilicates ( $(\text{NH}_4)_2\text{SiF}_6$ ) crystalline white powder. The transformed silicon can vary from a few micrometers to the total substrate thickness. The analysis of the silicon/ $(\text{NH}_4)_2\text{SiF}_6$  interface by infrared investigation reveals a  $\text{SiO}_x$  structure, which presents an intermediate state in silicon transformation. The CVE of double side silicon substrate generates  $\text{SiO}_x/\text{Si}/\text{SiO}_x$  structures. The shape and the thickness of these structures can be easily defined by the masked silicon surface and the experimental CVE conditions. In this work we present the reaction mechanism and the kinetic study of the CVE of silicon substrate in particular conditions. We establish that this etching technique is sensitive to the temperature and the chemical vapor composition. The vapor composition varies during the reaction progress and lead to different etching rates in the same experimental conditions. Cross-sectional scanning electron microscopy (SEM) images show a thin  $\text{SiO}_x$  layer of about 300 nm sandwiched between silicon bulk and  $(\text{NH}_4)_2\text{SiF}_6$  powder.

## **SILICON NITRIDE BONDED SILICON CARBIDE WITH SILICON AND SILICON CARBIDE AS A STARTING MATERIAL**

Sajid Ali<sup>1,a</sup>, Ferhat Kara<sup>1,2</sup>, Hasan MANDAL<sup>1,3</sup>

<sup>1</sup>MDA Advanced Ceramics Ltd. Eskisehir Technological Development Region, Turkey

<sup>2</sup>Anadolu Univ., Dept. of Materials Sci. and Eng., Eskisehir, Turkey

<sup>3</sup>Sabancı Univ., Dept. of Materials Sci. and Eng., Istanbul, Turkey

a. Corresponding author (sajjidalvii@gmail.com)

Porous silicon nitride bonded silicon carbide with porosity generated from infiltrated melted silicon and its conversion to fibrous silicon nitride has been prepared using silicon, silicon carbide and carbon as a starting material. Three different sizes of silicon particle have been used, namely, fine (13  $\mu\text{m}$ ), intermediate (45  $\mu\text{m}$ ) and coarse (80  $\mu\text{m}$ ). The sintering temperature was varied between 1400 °C and 1600 °C with different soaking time. The work has been performed to improve the nano soot filtration efficiency of the present diesel particulate filters by attempting to create needle shape particles of  $\text{Si}_3\text{N}_4$ . It has been observed that varying temperature and soaking time effects the silicon infiltration in the silicon-silicon carbide mix and consequently the conversion of silicon to silicon nitride during nitridation at high temperature.

## **CRACK BRIDGING ANALYSIS FOR ALUMINA MULLITE ZIRCONIA COMPOSITES**

<sup>a</sup>F.Gheldane, L.Ain Souya, S.Bouras

Laboratory of Advanced Materials, Dept. of physics, Univ. Badji Mokhtar Annaba, Algeria.

a. Corresponding author ( gheldane@yahoo.fr)

Crack propagation behaviour of alumina mullite zirconia ceramic is investigated under monotonic and cyclic loading by means SENB bending method. This material show R-curve effects, i.e. an increase in crack growth resistance with increasing crack depth. The morphological study showed that the resistance of the crack propagation is mainly connected to the crack bridging. The value of bridging stress is in good agreement with the literature.

Furthermore, cyclic-loading fatigue is caused by a decrease in the stress-shielding effect, due to degradation of bridging sites under cyclic loading.

## **STUDY OF THE RESISTANCE TO CRACK PROPAGATION IN NANO-FINE GRAINED ALUMINA BY ACOUSTIC EMISSION**

<sup>a</sup>,Seddik Bouras, Ines Zerizer, Farid Gheldane

Laboratory of Advanced Materials, Univ. of Annaba B.P. 12, Annaba 23000 – Algeria

a. Corresponding author (bourasseddik@yahoo.fr)

The R-curve effect was studied in nano-fine grained alumina using the acoustic emission. This effect is shown in the literature by the increase of the stress intensity factor KI versus crack extension, or by the decrease of crack velocity V versus KI under flexure tests. In the studied nanometric alumina, using 3- point flexure test, the increase of the stress intensity factor versus crack extension is shown clearly. On the other hand the detected A.E. due to the crack propagation show the decrease of the rate of the acoustic events count, (like the crack velocity): the material shows a crack growth resistance. The bridging by grains and the crack ramification are responsible of the crack propagation resistance.

## REMOVAL OF PESTICIDES BY HYBRID MATERIALS

<sup>a</sup>H. Mohammedi ; H. Miloudi ; A.Tayeb ; A. Bengueddach.

Laboratoire de Chimie des Matériaux \_Oran\_ Algérie.

a. Corresponding author (mohammedihabib@yahoo.fr)

The pollution by pesticides and the ions metallic have an impact is direct or indirect, on the balance ecosystem and on the human health, the quality of grounds can be also altered.

We adopted a system of cleanup into which we introduce our materials silicas which were Synthesized in our laboratory, the latter were functionalized by organic ligands then they were analyzed by various physiquo-chemical techniques.

Although the study on the removal of metallic ions and pesticides is in the course of finalization, but we have some results can be discussed

## NEW MULTIFUNCTIONAL LIGHTWEIGHT MATERIALS BASED ON CELLULAR METALS – MANUFACTURING, PROPERTIES AND APPLICATIONS

<sup>a</sup>Günter Stephani, Olaf Andersen, Peter Quadbeck and Thomas Studnitzky

Dept. of Cellular Metals

Fraunhofer-Inst. for Manufacturing Technologies and Advanced Materials Research

Winterbergstrasse 28, D-01277 Dresden, Germany

a. Corresponding author (guenter.stephani@ifam-dd.fraunhofer.de)

Cellular metallic materials are a new class of materials which have been the focus of numerous scientific studies over the past few years. The increasing interest in cellular metals is due to the fact that the introduction of pores into the materials significantly lowers the density. These highly porous materials also possess combinations of properties which are not possible to achieve with other materials. Besides the drastic weight and material savings that arise from the cell structure, there are also other application-specific benefits such as noise and energy absorption, heat insulation, mechanical damping, filtration effects and also catalytic properties. Cellular metallic materials are hence multi-functional lightweight materials.

Besides the well investigated Al foams, other cellular structures especially based on steel, have gained interest during the last two decades because of their unique properties and materials compatibility in most potential applications which are mainly based on steel.

During the past numerous technologies have been developed for the manufacturing of cellular structures like powder compact foaming techniques, the space holder method, investment casting, self-propagating high-temperature synthesis, casting and unidirectional solidification of saturated gases into molten metal. Recently the metal hollow sphere process, open cell foaming, the direct typing technology and 3d-wire structure methods were developed for cellular materials.

At present cellular metallic materials can be manufactured with a specific weight between 0.05 -1.5 g/cm<sup>3</sup>. Further characteristics are a low thermal conductivity, which can reach 0.1% of the bulk material; an excellent sound absorption of up to 10dB compared to state of the art material (like glass wool) and a very good energy absorption which can be up to 20kJ/kg using steel based sintered metal hollow sphere structures.

## **INFLUENCE OF RHEOLOGICAL PROPERTIES ON THE FOAMING PROCESS OF POLYLACTIDE**

Joanna Macyszyn, Marek Kozłowski<sup>a</sup>

Wrocław Univ. of Technology, Faculty of Environmental Eng., Wrocław, Poland

a. Corresponding author( [marek.a.kozlowski@pwr.wroc.pl](mailto:marek.a.kozlowski@pwr.wroc.pl))

An experimental study on the influence of rheological properties of two grades of polylactide (PLA) on the foaming process has been carried out. The cellular structure of PLA was obtained during extrusion process using the chemical blowing agent (CBA). The influence of coupling agents on the degree of crystallinity and viscoelastic properties that are critical during the foaming process of polylactide was investigated. Selection of the preferred PLA grade has been correlated with a structure of the polymer.

## **KINETIC STUDIES AND ADSORPTION ISOTHERME ON ADSORPTION OF SODIUM DODECYLBENZENESULFONATE INTO MG–NI–AL–CALCINED LAYERED DOUBLE HYDROXIDES**

Chafia TIAR, Moktar BOUTAHALA

a. Corresponding author( [chafia.tiar@yahoo.fr](mailto:chafia.tiar@yahoo.fr))

Layered double hydroxides (LDHs) can be structurally described by the stacking of positively charged layers with host anionic species in the interlayer domain. LDH material was prepared by one-step coprecipitation method from a mixed salt solutions containing Mg(II), Ni(II) and Al(III) salts. The as prepared samples have been characterized by X-ray powder diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR). These materials can be used as an alternative adsorbent to remove pollutant anions from waste waters. In this work, we have studied the influence of the pH, time of contact, temperature, and adsorption isotherm on the adsorption of sodium dodecylbenzenesulfonate (SDBS) in Mg–Ni–Al–calcined.

## OVERVIEW OF BIOMATERIALS USED IN IMPLANT TECHNOLOGIES

Ismet KÖKSAL\*, Zehra Bedriye AKDEMİR<sup>1,\*</sup>, Funda Güler ÖZDİLER ÇOPUR\*, Serian DOMA\*

\*T.C. Sağlık Bakanlığı Türkiye İlaç ve Tıbbi Cihaz Kurumu, Tıbbi Cihaz Etüd, Proje, Yetkilendirme ve Koordinasyon Dairesi

a. Corresponding author (bedriye.akdemir@titck.gov.tr)

Biomaterials are natural or synthetic materials intended to use for provide or support functions of living tissues in human body. Synthetic materials can be divided into four main categories as metals, ceramics, polymers and composites. Implant materials put into the body, continuously or at certain intervals contact body fluids, exposed to mechanical and chemical effects. Usage of implants in the body depend upon several factors especially material properties, design and biocompatibility. Studies on implant technologies has gained acceleration recently. Development of new materials and methods is of great significance to put forward new approaches in this issue.

## 2D+2D POLYCATENATED COORDINATION POLYMER CONSRUCTED FROM 5-NITROISOPHTHALATE AND 1,3-BIS(IMIDAZOL-1-YLMETHYL)BENZENE

Okan Zafer Yeşilel<sup>1,a</sup>, Mürsel Arıcı<sup>1</sup> and Onur Şahin<sup>3</sup>

<sup>1</sup>Dept. of Chemistry, Faculty of Arts and Sciences, Eskişehir Osmangazi Univ., 26480 Eskişehir, Turkey

<sup>2</sup>Scientific and Technological Research Application and Research Center, Sinop Univ., 57010 Sinop, Turkey

a. Corresponding author ( yesilel@ogu.edu.tr)

The rational design and construction of porous coordination polymers (PCPs) with entangled architectures have attracted interest due to their fascinating structural topologies and potential applications in diverse fields such as gas adsorption/separation, molecular magnetism, catalysis, luminescence and nonlinear optic materials [1,2]. Catenated networks are one of the most investigated type of coordination polymers Formation of polycatenated networks generally gives rise to one dimensional pores in the structure. incorporation with polycarboxylates and bis(imidazole) auxiliary ligands has become an effective approach for construction of new frameworks with the intriguing versatile architectures In this study, polycatenated 2D+2D→ 3D {[Co(μ-nip)(μ-1,3-bix)]·H<sub>2</sub>O}<sub>n</sub> (1) coordination polymers with 5-nitroisophthalate (5nip) and 1,3-bis(imidazol-1-ylmethyl)benzene (1,3-bix) was synthesized and structurally characterized by single crystal X-ray diffraction, IR spectroscopy as well as elemental analysis. Moreover, topological studies were performed.

## CONTINUUM SIMULATION OF THE DISCHARGE OF POWDERS IN SILOS WITH AND WITHOUT INSERTS

Silvia Volpato<sup>1</sup>, Riccardo Artoni<sup>2</sup>, Andrea C. Santomaso<sup>1a</sup>

<sup>1</sup> APTLab – Advanced Particle Technology Laboratory, Dipartimento di Ingegneria Industriale, Università di Padova, Italy

<sup>2</sup> L'UNAM / IFSTTAR, Route de Bouaye CS4 44344 Bouguenais, France  
a. Corresponding author( andrea.santomaso@unipd.it=

In this work the results of several simulations of full-scale silo discharge were carried out using the hydrodynamic continuum model proposed by Artoni et al., Chem.Eng.Sci. 64 (2009), 4040-4050. These simulations have been compared with experimental literature data on the wall stresses and the flow patterns observed during discharge of the silo with and without inserts. The comparison has shown the ability of the model to capture quantitatively the main features of both the flow and the wall stress profiles even when flow corrective inserts are put in the hopper of the silo in order to convert the discharge regime from funnel flow to a mass flow regime.

## SYNTHESES, CHARACTERIZATIONS AND LUMINESCENT PROPERTY OF TWO NEW ZINC(II)-MOFS CONSTRUCTED FROM DIPYRIDYL-BASED LIGANDS

Okan Zafer Yeşilel<sup>1</sup>, Güneş Günay<sup>2,a</sup>, Seda Keskin<sup>3</sup>, Orhan Büyükgüngör<sup>4</sup> and Murat Taş<sup>5</sup>

<sup>1</sup> Dept. of Chemistry, Eskişehir Osmangazi Univ., Eskişehir, Turkey

<sup>2</sup> Dept. Of Medical Services and Techniques, Bartın Univ., Bartın, Turkey

<sup>3</sup> Dept. of Chemical and Biological Eng., Koç Univ., Istanbul, Turkey

<sup>4</sup> Dept. of Physics, Ondokuz Mayıs Univ., Samsun, Turkey

<sup>5</sup> Dept. of Chemistry, Giresun Univ., Giresun, Turkey

a. Corresponding author (ggunay@bartin.edu.tr)

Recently, metal organic frameworks (MOFs) have been designed and constructed due to their variety of intriguing topologies and their potential applications in areas such as magnetism, catalysis, gas storage and conductivity[D'Alessandro et al. 2010, Lu o et al. 2010].Using mixed ligands and hydrothermal reactions, two new coordination polymers,  $[Zn(\mu_3\text{-pzdc})(\mu\text{-dpeten})_{0.5}]_n \cdot 3H_2O$  (**1**) and  $[Zn(\mu_3\text{-pzdc})(\mu\text{-dpetan})_{0.5}]_n$  (**2**) ( $H_2pzdc$  = pyrazine-2,3-dicarboxylic acid; dpetan = 1,2-bis(4-pyridyl)ethane; dpeten = 1,2-bis(4-pyridyl)ethylene) were obtained and structurally characterized by spectral method (FT-IR and photoluminescence), thermal analysis (TG, DTG, DTA) and single crystal X-ray diffraction techniques. Complexes possess 3D metal-organic frameworks. The most important feature of **1** is that it exhibits a 3D porous framework with 1D infinite channel. When dpetan instead of dpeten was used, complex **2** was obtained, which is of a three dimensional (3D) two-fold interpenetrated framework. We used molecular simulations to examine adsorption and separation of gas mixtures in complexes. Results show that complex **1** promising candidates for  $CH_4/H_2$ ,  $CO_2/CH_4$  and  $CO_2/H_2$  separations due to their high  $CO_2$  selectivity and permeability. Thermal stabilities of complexes were discussed. The excitation and emission spectra were investigated in the solid state at room temperature.

# HYDROTHERMAL SYNTHESSES, CRYSTAL STRUCTURES AND CHARACTERIZATIONS OF A NOVEL POROUS HETEROMETALLIC METAL ORGANIC FRAMEWORK CONSTRUCTED BY METALLOLIGAND

Fatih Semerci<sup>1,2,a</sup>, Okan Zafer Yeşilel<sup>1</sup> and Orhan Büyükgüngör<sup>3</sup>

<sup>1</sup>Eskişehir Osmangazi Univ., Dept. of Chemistry, 26480 Eskişehir, Turkey

<sup>2</sup>Kırklareli Univ., Dept. of Chemistry, 39300 Kırklareli, Turkey

<sup>3</sup>Ondokuz Mayıs Univ., Dept. of Physics, Samsun, Turkey

a. Corresponding author (f\_semerci@hotmail.com)

A rational way to combinatorial searching for novel porous materials is to put together molecular building blocks showing the desired property. The size and the chemical environment of the resulting empty spaces are defined by the length and functionalities of the organic ligands [Li et al. 1999, Noro et al. 2005]. In this study, we report the hydrothermal syntheses, crystal structures of a novel 2D heterometallic metal-organic framework of  $[\text{Cu}(\mu\text{-}2,3\text{-pydc})_2]$  metalloligand; 2,3-pydc, pyridine-2,3-dicarboxylate,  $\{[\text{Cu}(2,3\text{-pydc})_2\text{Ag}_2(4,4'\text{-bipy})]\cdot 6\text{H}_2\text{O}\}_n$  (**1**); 4,4'-bipy, 4,4'-bipyridine. The new heterometallic MOF was characterized by elemental analysis, IR spectra and single crystal X-ray diffraction. The single crystal analysis on **1** reveals that, **1** crystallizes in triclinic space group P-1. Complex **1** is a two-dimensional (2D) layers built from  $[\text{Cu}(\mu\text{-}2,3\text{-pydc})_2]$  metalloligand units interconnected by  $[\text{Ag}(4,4'\text{-bipy})_2]$  ligands (Fig.1). Each Cu(II) is penta-coordinated with two nitrogen and five oxygen atoms from three individual 2,3-pydc ligands forming a distorted  $[\text{CuO}_4\text{N}]$  square pyramidal geometry. The metalloligand units connected each other through  $[\text{Ag}_2(4,4'\text{-bipy})]$  units to result 2D porous metal-organic framework.

## ONE-POT, THREE-COMPONENT SOLVENT FREE QUANTITATIVE SYNTHESIS OF NEW HYDROXYAMINOALKYLNATHALEN-2-OL DERIVATIVES USING POTASSIUM HYDROGEN SULPHATE

Ahmed M. M. El-Saghier<sup>a</sup>

Chemistry Dept., Faculty of Science, Sohag Univ., Egypt

a. Corresponding author (el\_saghier@yahoo.com)

One-pot, three-component reaction of 2-naphthol, aromatic aldehyde, and hydroxyl amine solvent free in presence of  $\text{KHSO}_4$  as a catalyst leads to the formation of the corresponding hydroxyaminonaphthols. These novel bases were prepared by one-pot Betti's addition reaction using different aromatic aldehydes. The structure of all the synthesized compounds were elucidated by elemental analysis and different spectroscopic techniques (IR, <sup>1</sup>H- NMR and Mass spectroscopy).

## PREPARATION OF NANOCHITOSAN USING MALEIC ACID

Mazyar Sharifzadeh baei<sup>1,a</sup>, Camellia Zareie<sup>2</sup>, Ghasem Najafpour Darzi<sup>2</sup>

<sup>1</sup>Islamic Azad Univ., Ayatollah amoli branch

<sup>2</sup>Noshirvani Babol Univ. of Technology, Faculty of Chemical Eng., Shariati Avenue, Babol, Iran

a. Corresponding author (mazyar.sharifzadeh@gmail.com)

Reduction in nanochitosan size makes it a superior environmentally friendly material and improves nanochitosan properties, strenges and untibacterial effects. In this research nanochitosan was prepared by a novel method based on ionic gelation using low-molecular-weight chitosan and maleic acid. The produced nanochitosan studied by Fourier transform infrared spectroscopy (FTIR), Atomic Force Microscopy (AFM) analysis. The particle size was dependent on the chitosan and maleic acid concentration used during the preparation method and pH of solution. Nanoparticles with sizes smaller than 100 nm were achieved, that can be extremely important for various applications. The obtained nanoparticles presented a very homogeneous morphology showing a quite uniform particles size distribution and a rather spherical shape.

## PARAMAGNETIC CENTERS GENERATED RADIOLYTIALLY IN MOLECULAR SIEVES TiAlMCM TYPE – EPR STUDY

<sup>a</sup> Anna Bugaj, Jarosław Sadło, Marcin Sterniczuk, Grażyna Strzelczak, Jacek Michalik

Inst. of Nuclear Chemistry and Technology  
Warsaw; Poland

a. Corresponding author (a.bugaj@ichtj.waw.pl)

Molecular sieves are one of the most important class of materials used in chemical industry. They consist of an open, three-dimensional cage-like structure and a vast network of open channels. Because of their unique porous properties zeolites are used in a variety of applications i.e. for selective sorption of elements and molecules. Moreover, zeolites have the ability to act as catalysts for chemical reactions owing to Brönsted acid centers. Metal cations in exchangeable positions or built in the lattice are also active catalytic centers.

The aim of our study is to identify the Ti paramagnetic centers generated radiolytically in TiAlMCM molecular sieves containing different amount of Ti in the lattice. TiAlMCM structures could be used as photocatalysts and sorbents.

The TiAlMCM samples after degassing were irradiated at 77 K with dose of 2 kGy in Co-60 source and measured using EPR spectroscopy in the temperature range 100-280K. The differences in local electron structure of the paramagnetic centers were observed in different MCM samples which were associated with close environment of Ti cations.

## **EPR STUDY OF PARAMAGNETIC CENTER GENERATED RADIOLYTICALLY IN ZEOLITES**

<sup>a</sup> Marcin Sterniczuk, Jarosław Sadło, Anna Bugaj, Grażyna Strzelczak, Jacek Michalik

Inst. of Nuclear Chemistry and Technology, Warsaw, Poland,  
a. Corresponding author ( m.sterniczuk@ichtj.waw.pl)

Zeolites are crystalline microporous solids often used in industry. They have well-defined structures containing tetrahedral TO<sub>4</sub> building blocks that are connected to each other by sharing O atoms. T represents Si, Al or other tetrahedrally coordinated atoms. Their features like shapeselective properties, well-defined microporous network and good thermal and mechanical stability make them attractive for petroleum, nuclear and chemical industries.

We present the study of radical centers generated radiolytically in different types of molecular sieves. The samples were  $\gamma$ -irradiated at liquid nitrogen. Electron Paramagnetic Resonance have been used for the study of radicals over the temperature range 77-293 K. The identification and the structure of radical centers as well as their stabilization sites were achieved by comparison of experimental EPR parameters with the results of theoretical DFT calculations.

## **SELECTIVE CITRAL HYDROGENATION OVER TiO<sub>2</sub> AND TiO<sub>2</sub>/SiO<sub>2</sub>**

Hassanain Hassan<sup>1</sup>, Selahattin Yilmaz<sup>2,a</sup>

<sup>1,2</sup> Izmir Inst. of Technology, Dept. of Chemical Eng., Izmir, Turkey

a. Corresponding author (selahattinyilmaz@iyte.edu.tr)

The liquid phase citral hydrogenation was studied over Ru (2 wt.%) catalysts supported on SiO<sub>2</sub>, TiO<sub>2</sub> and supported oxide TiO<sub>2</sub>/SiO<sub>2</sub>. TiO<sub>2</sub>/SiO<sub>2</sub> was prepared by different methods, sol-gel deposition, impregnation and absorption. The effect of the supports and catalyst reduction temperature, 300 °C (LTR) or 450 °C (HTR) on citral conversion and selectivity to unsaturated alcohols were investigated. Ru/SiO<sub>2</sub> catalyst displayed a lower activity (15.5 % conversion). Ru/TiO<sub>2</sub>/SiO<sub>2</sub>-ABS catalyst gave the highest conversion (57.7 %) at lower reduction temperature among the different Ru/TiO<sub>2</sub>/SiO<sub>2</sub> catalysts. Its selectivity to UA was also high (70.2 %). This was attributed to a better metal support interaction obtained by this method. Generally, activity of the catalysts was observed to decrease as reduction temperature increased from 300 °C to 450 °C. Citral conversion decreased from 57.7 % to 42.3 % over Ru/TiO<sub>2</sub>/SiO<sub>2</sub>-ABS. However, selectivities to unsaturated alcohol (nerol and geraniol) for Ru/TiO<sub>2</sub> and Ru/TiO<sub>2</sub>/SiO<sub>2</sub> catalysts were increased at HTR reaching about 80 %. This was suggested to be due to SMSI effect (strong metal support interaction). There was no significant change in the selectivity to UA obtained at HTR for Ru/SiO<sub>2</sub>. This was related to the inert nature of SiO<sub>2</sub>.

## **SYNTHESIS AND CRYSTAL STRUCTURE OF A NOVEL POROUS MIXED LIGAND NI(II) COORDINATION POLYMER WITH 5-HYDROXYISOPHTHALATE AND N,N-DIMETHYLETHYLENEDIAMINE**

Handan Günay<sup>1</sup> Alper Tolga Çolak<sup>1,a</sup>, Ersin Temel<sup>2</sup>, Orhan Büyükgüngör<sup>3</sup> and Ömer Andaç<sup>3</sup>

<sup>1</sup> Dumlupınar Univ., Dept. of Chemistry, 43820 Kutahya, Turkey

<sup>2</sup> Ondokuzmayıs Univ., Dept. of Physics, 55200 Atakum, Samsun, Turkey

<sup>3</sup> Ondokuzmayıs Univ., Dept. of Chemistry, 55200 Atakum, Samsun, Turkey

*a.* Corresponding author (tolga.colak@dpu.edu.tr)

Porous framework materials are of interest because of their applications in various area such as catalysis, gas storage and molecular sieve [Yaghi et al.]. In this study, we report the synthesis and crystal structure of a novel 1D coordination polymer  $[\text{Ni}(\text{hip})(\text{dmen})(\text{H}_2\text{O})_2]_n$  (**1**); hip: 5-Hydroxyisophthalate and dmen: N,N-Dimethylethylenediamine. The novel coordination polymer was characterized by elemental analysis, IR spectrum and single crystal X-ray diffraction. 1D coordination polymers linked via hydrogen bonds and forms 3D structure. The structure contains  $369.9 \text{ \AA}^3$ , 10.4%, solvent accessible void and can be used for gas storage. Ni(II) is octahedrally coordinated by oxygens of hip and water ligands and nitrogens of dmen ligand.

## **THE BIFUNCTIONAL CATALYST PT / RE USED IN THE PLATFORMING UNIT FOR OBTAINING HIGH OCTANE NUMBER OF THE GASOLINE.**

Menouar Hanafi

Dept. of Chemistry, Faculty of Sciences,

The Univ. of Science and Technology of ORAN (ALGERIA )

*a.* Corresponding author (hanafi951@yahoo.com)

The original function of the process of platforming is to develop heavy naphtha (HSRN), coming from the atmospheric unit of distillation with a weak octane number (NO = 44), to obtain a mixture of fuels a number octane raised by catalytically supporting specific groups of chemical reactions. The installation is divided into two sections: section hydrobon. Section platforming.

The rafinat coming from the bottom of column 12C2 to feed the section platforming, is divided into two parts whose flows are controlled and mixed with gas rich in hydrogen.

Bottom of the column, one obtains stabilized reformat which is aspired by there pump to ensure the heating of the column whereas a part is sent towards storage after being cooled by the air cooler and the condenser.

In catalytic catalyst of reforming, there is voluntarily associated a hydrogenating function - dehydrogenating, brought by platinum deposited, with an acid function brought by the alumina support (Al<sub>2</sub>O<sub>3</sub>). The mechanism of action of this bifunctional catalyst depends on the severity of the operation, of the quality of the load and the type of catalyst.

The catalyst used in the catalytic process of reforming is a very elaborate bifunctional catalyst whose performances are constantly improved thanks to the experimental research supported on an increasingly large comprehension of the phenomena.

The American company Universel Oil petroleum (UOP) marketed several series of bimetallic catalysts such as R16, R20, R30 and R62 consisted Platinum / Rhenium on an acid support consisted the alumina added with a halogenous compound (chlorine).

## POROUS SILICON BASED HUMIDITY SENSOR

Ersin Kayahan<sup>1,2,3,a</sup>, Olgay Yılmaz<sup>1,2</sup>, and Fatih Gönen<sup>1,2</sup>

<sup>1</sup>Kocaeli Univ. , Electro-optic and Sys. Eng. Umuttepe-Kocaeli-TURKEY

<sup>2</sup>Kocaeli Univ., LATARUM Laboratory, Yenikoy-Kocaeli-TURKEY

<sup>3</sup>Kocaeli Univ., Hereke MYO, Hereke-Kocaeli-TURKEY

a. Corresponding author ( kayahan.ersin@gmail.com)

In this work, humidity-sensitive electrical properties of nano-porous silicon (NPS) have been investigated. Electrical measurements in a controlled humidity atmosphere were performed to test the sensor response towards the water vapor. It was found that NPS surface is very sensitive against to the vapor. The experimental results suggested that NPS surface is candidate a promising material for using as humidity sensor.

## THE STRATEGY AND THE DEVELOPMENT OF THE PRODUCTION OF THE SYNTHETIC RESINS IN ALGERIA .

Mohamed Hanafi<sup>1</sup>, Menouar Hanafi<sup>2</sup>

<sup>1</sup>The College Hammou Boutlelis , Oran, ALGERIA

<sup>2</sup>The Univ. of Science and Technology of Oran, ALGERIA

a. Corresponding author (hammouda\_992@yahoo.fr)

The development of petrochemical industry became a priority axis in the energetic strategy in ALGERIA . The petrochemical complex of Arzew-ALGERIA , has as a principal objective the production of Methanol and Synthetic Resins . The resins are mixtures of linear solid polymers , macromolecular compounds used in the manufacture of the plastics , paintings , etc . We can classify polymers into natural and artificial synthetics , the latter resulting from the chemical conversion of natural polymers , the macromolecular skeleton being preserved , at the time of this transformation . According to the kinetic behaviour and the mechanism of reactions which leads to the formation of the macromolecular compound , we traditionally distinguish two principal types from reactions of polymerization . The reactions of polyaddition which intervene in the polymerization of the monomers ethylene (vinyl) and of the heterocycles , and reactions of polymerization , for which the formation of the macromolecules results from condensation . They intervene in the preparation of polystyrenes , polyamides , polymethacrylates , resins , epoxies .

An intermediate unit between the unit Methanol and the Resins unit is essential , because the production of formaldehyde uses as raw material methanol , and the unit resins has as a raw material the formaldehyde . This unit is to produce formaldehyde in aqueous solution 36 % in weight or 80 % of formurea . The formaldehyde is a raw material for the manufacturing unit of the phenolic resins . In this complex we produce the ureic resins and the phenolic resins . The ureic resin in solution is prepared by condensation of the urea mixture and formaldehyde in acid medium . For the production of the atomized ureic resin , we leave the resin in solution . The phenolic resins of resolic type , are obtained by the formaldehyde and phenol reaction catalysed by soda ( basic medium ) .

The Methanol and Synthetic Resins plant of Arzew , has a great importance in the development of the petrochemical industry in ALGERIA .

## **HIGH POROSITY ACTIVATED CARBON DERIVED FROM NATURAL FIBERS FOR RESPIRATORY FILTER APPLICATION**

Melike Dizbay-Onat<sup>1,a</sup>, Uday Vaidya<sup>2</sup>, Claudiu Lungu<sup>3</sup>

<sup>1</sup>Doctoral student, Interdisciplinary Eng., <sup>2</sup>Professor, Materials Science & Eng., <sup>3</sup>Associate Professor,  
School of Public Health  
Univ. of Alabama at Birmingham, Birmingham, AL 35294  
a. Corresponding author (melike09@uab.edu)

Due to the advantages of high surface area and low cost; granular activated carbon (GAC) is a common adsorbent in gas and vapor removing respirators. On the other hand a main drawback of GAC is added weight and bulk in respirators. This makes some respirators uncomfortable to wear, resulting in poor compliance in their use. Activated carbon fiber (ACF) is considered as good alternative adsorbents for developing thinner, light-weight and efficient respirators because of their larger surface area and larger adsorption capacities. This study focuses on activated carbons derived from natural fibers (flax, hemp and sisal). The natural fibers are carbonized followed by physical or chemical activation of the fibers with a goal to prepare high efficiency, light weight activated carbon fibers. The efficiency of physical activation and chemical activation is investigated. Ultimate and proximate analysis, SEM images, toluene adsorption isotherms and adsorption capacities are obtained on prepared activated carbons.

This material is based on work supported by the NSF EPSCoR, NSF CREST programs and the Deep South Center, Pilot Project Research Grant.

## **THE STUDY OF THE CORROSION OF ALUMINIUM ALLOYS BY MERCURY IN THE COMPLEX GL1/Z, ARZEW - ALGERIA .**

Latifa Hanafi<sup>1,a</sup>, Menouar Hanafi<sup>2</sup>

<sup>1,a</sup>The Univ. of Science and Technology of Oran, ALGERIA

<sup>2</sup>The Univ. of Science and Technology of Oran, ALGERIA

a. Corresponding author (hanafi.latifa994@yahoo.fr)

Algeria is one of the first exporters of natural gas in the world. The liquefaction of natural gas requires a special technology because it requires special equipment resistant to low temperatures until -162°C. The aluminum alloys are applied, due to their properties in the cryogenic field. The natural gas contains many undesirable elements which disturb the operation of the equipment, in particular CO<sub>2</sub>, H<sub>2</sub>O and metals heavy like mercury. In addition to its harmfulness, mercury is a metal which strongly attacks metals with which it is in contact by forming amalgams. The aluminum alloys are touched by this phenomenon. Mercury exists in several natural gas layers in ALGERIA with different contents. The natural gas of Hassi Rmel in Algeria contains mercury with concentrations between 50 and 100µg/Nm<sup>3</sup>. Mercury causes the corrosion of aluminum and its alloys. The harmful effects of mercury and its compounds, as well corrosion as cracking under tension, are exposed for many metals and alloys, including aluminum. Mercury, in the presence of moisture and of oxygen and under some conditions, amalgamates with aluminum and starts an irremediable reaction of corrosion per cracking in the exchangers of heat. The plant GL1/Z liquefies natural gas, the last stage of the treatment consists in elimination of the mercury which is corrosive in the cryogenic circuits, in the demercurisor R.312 by solid absorbents impregnated with sulphur, the treated natural gas whose mercury content is reduced to 0,01µgr/nm<sup>3</sup> and then filtered in two filters for dust. This process is most convenient for the liquefaction of natural gas, however, the presence of mercury in the load of food can cause very important damages in this type of aluminum alloy exchangers.

## **THE EFFECT OF FLY ASH AND MICRO – SILICA ON CONCRETE QUALITY IN PRODUCTION OF CONCRETE**

Suleyman Uluöz, Selahattin Düzbasan, Erol Yakıt, Tolga Uluöz

a. Corresponding author ([uluozsuleyman@hotmail.com](mailto:uluozsuleyman@hotmail.com))

The use of materials which are thinner than concrete, such as fly ash and micro – silica, in production of it is one of the parameters effect the concrete quality positively. While the disposal of the fly ashes of the output of Steam Power Plants was one the major problems of Plant managers, following a couple of R&D studies, as a result of using the fly ash in concrete production, this waste that was constituting a problem became a desirable construction mean. The benefits of using fly ashes in the concrete production are: The decrease in production costs due to the 33% decrease in the amount of cement used, the increase in concrete quality, and the decrease in CO<sub>2</sub> release through the Cement Plants' smokestacks. Another powder material used in concrete production other than cement is micro silica. As in use of the fly ash in concrete production, the micro silica fills the micro air bubbles in the concrete increasing the unit weight of the concrete, thus preventing the chemicals that are in contact with the concrete to enter into the concrete and effect the concrete quality negatively.

## **STUDY OF ADSORPTION IN DIFFERENT ADSORBENTS WITH NITROGEN COMPOUNDS OF MEDIUM FRACTION OF PETROLEUM**

Marco Figueiredo, Luana Baia, Wallace Souza

a. Corresponding author ([mgaya@uerj.br](mailto:mgaya@uerj.br))

The technique of adsorption has been studied as a promising alternative to be employed in removing nitrogenous compounds existing in medium oil fractions. However, one of its challenges is the proper choice of adsorbent in order to obtain more selectivity and the lowest associated cost.

In view of this, kinetic and isotherm tests were performed to verify, which adsorbent has greater nitrogen compounds selectivity. The following adsorbents were tested: silica-alumina, activated carbons, zeolites, alumina and commercial clays. Two medium fraction oils were used, one with low nitrogen compounds content and another, with high.

In kinetic tests, the USY zeolite and clays were the most promising adsorbents. In the case of the fraction with high content, Family 2 clays stood out, mainly, C clay. In equilibrium studies, it was used only the fraction with high content of nitrogen. The isotherm of A clay of Family 1 was the most favorable isotherm, while C clay of Family 2 showed the worst performance.

From the results, it was found that tested clays performed well in the adsorption of nitrogen. Thus, it would be interesting to invest in fix bed studies for these adsorbents in order to make their use feasible industrially.

## **RECENT DEVELOPMENTS OF HYBRID COMPOSITE/METAL SHIP HULLS FOR MARINE APPLICATIONS**

Burcu Ertuğ

- a. Corresponding author ([burcuertug@gmail.com](mailto:burcuertug@gmail.com))

The application of hybrid composite/metal structures has been gaining momentum over the past several years. An important example can be found in ship structures innovated by U.S. Navy. E-Glass vinyl ester/steel hybrid structural systems have been developed in order to enhance the future naval capabilities. In general glass fiber reinforced plastic composites are utilized in small boat building. However, E-Glass vinyl ester/steel hybrid systems are of particular interest for large ship structures, provided that they can lead to superior hydrodynamic shapes, weight reduction and higher speeds. In addition using composites for the ship hull could help achieve a more stealthy and corrosion resistant structure. The hybrid composite and steel hull provides a fast ship that is cost-effective and offers signature reduction capability. These particular materials have superior strength for sea loads and fatigue strength, and retain these properties following battle damage. Besides, these hybrid structures can result in low maintenance and longer life. It was concluded that composite/metallic joints are the key issue in these hybrid systems regarding the loading conditions, to which these structures have to withstand during the cruise.

## **CRYSTALLIZATION OF SODIUM ORGANIC SALTS PRODUCED IN PARTIAL WET OXIDATION OF BLACK LIQUOR**

Karhan Özdenkci, Jukka Koskinen, Kristian Melin, Kuppa Venkata Sarada, Daniela Villalba de Kokkonen, Raja Hassan Mudassar

- a. Corresponding author ([karhan.ozdenkci@aalto.fi](mailto:karhan.ozdenkci@aalto.fi))

The environmental issues have driven the process industry to energy production from renewable sources, such as through biorefinery of non-edible biomass. Pulp and paper industry has an important biorefinery potential; however, the commercial treatment of black liquor includes recovery boiler, i.e. complete combustion of the organic content. One alternative biorefinery concept involves partial wet oxidation of black liquor to produce organic acids, such as acetic acid, formic acid and lactic acid. The acids neutralize sodium hydroxide to produce the sodium salts of the acid. Then, these salts can be separated from other components such as lignin, sodium bicarbonate etc. by crystallization.

This paper investigates crystallization of the major sodium organic salts produced in partial wet oxidation of black liquor: sodium salts of acetic acid, formic acid, lactic acid, glycolic acid and oxalic acid. As a preliminary investigation, this study demonstrates crystallization of these salts in aqueous solution with respect to temperature and pH. The study involves thermodynamic modeling for equilibrium investigation, crystallization kinetics, simulation and crystallizer design. This study can be the basis of future investigation of recovering these salts from partially wet oxidized black liquor.

## ECO-FRIENDLY PLASTICS AND APPLICATIONS

H. Duygu Ozsoy, Ezgi Bezirhan,

a. Corresponding author ([ozsoyhd@gmail.com](mailto:ozsoyhd@gmail.com))

It is possible to see different applications of plastics everywhere, because of durable, flexible and long-lasting properties of them. In the last decades there has been a significant increase in the amount of plastic wastes all over the world. Increasing environmental concerns/legislative pressure for petroleum-based plastics waste and rapid increases in the cost of petroleum have enabled the development of eco-friendly plastics. "Eco-friendly plastics" or "Bioplastics" are polymers made from renewable sources such as corn, sugars, potatoes, etc. These materials have a wide range of applications in packaging, consumer goods, electronics, transportation, construction, medical and many other fields. Projection of worldwide production capacity of bioplastics is about 1-3 million ton in 2014. Bioplastic technology has still been developing in Turkey and eco-friendly plastics and their products have been produced by only a few plastic suppliers and industries. However, recent AR-GE studies about eco-friendly plastics and their applications are promising.

## SYNTHESIS AND CHARACTERIZATION OF NEW MATERIALS FOR METHANE STORAGE

Fränk Wagener, Klaus Stöwe, Wilhelm F. Maier

a. Corresponding author ([f.wagener@mx.uni-saarland.de](mailto:f.wagener@mx.uni-saarland.de))

An alternative storage method to compressed natural gas for mobile applications is the enhanced adsorption of natural gas through pore condensation. The lower objective for economic methane adsorption is 35 w-% or 180 v/v at 35 bars. Until now, only few active carbons and metal organic frameworks have reached this target. Active carbons and MOFs show poor thermal and long-term stability and thus limiting storage tank applicability. Experimental and theoretical investigations indicate, that the optimal pore diameter for methane condensation is situated between 0.7 and 2 nm, a pore range difficult to characterize reliably by state of the art methods. A pore diameter of 1.045 nm for active carbon was calculated to be the ideal pore diameter for methane storage. Such pores, called supermicropores, are also of interest for catalytic applications. Silica materials are low cost, have a good thermal and long-term stability, can be synthesized easily, and are therefore potential storage materials.

The aim of this work is the synthesis of new supermicroporous silica. We use methane storage capacity as an indicator. Template free as well as template based syntheses are used to produce the materials by solgel chemistry. To determine the pore size and the surface area, nitrogen physisorption measurements are performed. The interpretation of the pore size is attempted by conventional methods such as Saito and Foley and Barrett-Joyner-Hallenda as well as by Non Local Density-Functional-Theory (NLDFT). Methane adsorption is measured with a magnetic suspension balance. These methane adsorption measurements are sequential and slow, therefore a new high-throughput method for a fast screening of a 206 well plate based on detection of heat of adsorptions with emissivity-corrected IR-thermography is being developed.

Active Carbons (AC) and MOFs are also studied for calibration and comparison. In contrast to the latter, silica materials are low cost, have a good thermal and long-term stability, and can be synthesized easily. The synthesis and reliable characterization of silica with pores in the range of 0.7 to 2.0 nm is challenging and potentially important for many catalytic and sorption applications.

## **THE OVERVIEW OF THE ELECTRICAL PROPERTIES OF BARIUM TITANATE**

Burcu Ertuğ

- a. Corresponding author ([burcuertug@gmail.com](mailto:burcuertug@gmail.com))

The perovskite family includes many titanates used in various electroceramic applications, for example, electronic, electro-optical, and electromechanical applications of ceramics. Barium titanate, perovskite structure, is a common ferroelectric material with a high dielectric constant, widely utilized to manufacture electronic components such as multilayer capacitors (MLCs), PTC thermistors, piezoelectric transducers, and a variety of electro-optic devices. Pure barium titanate is an insulator whereas upon doping it transforms into a semiconductor. Besides PTCR properties, semiconductor barium titanate is used in the sensor applications. The ferroelectricity observed in barium titanate is utilized in memory applications, i.e RAMs. The pyroelectricity and piezoelectricity are also used in the passive infrared detectors and Sonars (Sound Navigation and Ranging). In the present study, various electrical properties of barium titanate based ceramics were explained and examples of the relevant applications were given.

## **EFFECTS OF PECTIN ADDITION ON THE MORPHOLOGY OF AAC POROSITY**

A. Dogan Soyal<sup>a</sup>, Taner Kavas

- a. Corresponding author ([dogan.soyal@akg-gazbeton.com](mailto:dogan.soyal@akg-gazbeton.com))

The variation of shape and dimension of pores in AAC body was investigated by the addition of pectin. Specimens with the addition of pectin in proportion of 0, 0.1, 0.5 and 1% wt. to the mix of raw material consist of Portland cement, lime, blended silica, gypsum, aluminum cake and water were prepared. The samples were then kept approximately at 55 °C and 40% humid environment for 6 hours. The formed samples are autoclaved at 200°C with 12 bar pressure for 5.5 hours after obtaining enough cutting hardness. The mechanical properties of autoclaved samples analysed with por morphology and variation techniques as performed at Factor A. As a result, addition of 5% pectin by weight improves pore morphology by providing smaller pores with more steady forms.

## **THE PHOTOCATALYTIC ACTIVITY OF CERIA DOPED TITANIA CATALYSTS IN METHYLENE BLUE DEGRADATION AND GLYCEROL REFORMING**

Mert Tunçer<sup>a</sup>, Emre Demirkaya, Erol Şeker

a. Corresponding author ([merttuncer@iyte.edu.tr](mailto:merttuncer@iyte.edu.tr))

Photocatalytic degradation of methylene blue (MB) and photocatalytic reforming glycerol on ceria doped titania photocatalysts under fluorescent light were investigated by varying the reaction conditions, such as pH of the solution, and the catalyst formulation. CeO<sub>2</sub>/TiO<sub>2</sub> were synthesized via a single step sol-gel method with ceria loadings of 0.5, 1 and 5 wt.%. All the catalysts were characterized using X-Ray Diffraction, N<sub>2</sub> physisorption, photoluminescence spectroscopy and zeta potentials to correlate the photocatalytic activity to the physico-chemical properties of the catalysts.

5% CeO<sub>2</sub>/TiO<sub>2</sub> degraded MB only at pH 4 whereas 0.5% and 1% CeO<sub>2</sub>/TiO<sub>2</sub> had the highest activity at pH 7. Carbon dioxide and hydrogen were the only gas products in glycerol reforming and we found that 0.5% and 1% CeO<sub>2</sub> had higher activity than 5% CeO<sub>2</sub>/TiO<sub>2</sub>. In addition, no new PL emission signals were observed among all the catalysts but 0.5% and 1% wt. CeO<sub>2</sub>/TiO<sub>2</sub> had lower PL intensity than 5% wt CeO<sub>2</sub>/TiO<sub>2</sub>; hence, indicating more non-radiative processes of the photo-generated electrons and holes. It seems that higher the non-radiative processes, higher the photocatalytic activity.

## **POWDER METALURGY PRODUCED BY MELT-STIRRING METHOD**

Niyazi Selçuk CİLASUN<sup>a</sup>, Recep Çalın, Osman BİCAN, Muharrem PUL

a. Corresponding author ([niyazicilasun\\_s@hotmail.com](mailto:niyazicilasun_s@hotmail.com))

In this study, SiC powder and Al2014 alloy were used as reinforcement and matrix respectively. Al- SiC reinforced metal matrix composites (MMCs) of 5%, 10% and 15% reinforcement volume ratios produced by melt-stirring method. MMC under same production condition. Hardness and porosity of composites were measured and microstructure of composite was investigated. It has been found that the hardness and porosity of composites were increased with increasing SiC volume fraction.

## **SIO<sub>2</sub> AND TA<sub>2</sub>O<sub>5</sub> BASED ANTIREFLECTING COATINGS**

Murat AVCI, Oktay UYSAL, Başak YAZGAN, C. Duygu OZTURK SELCUK, Alp Eren Sinan OZHAN, Ender SUVACI, Emel OZEL, Yücel SAHIN

a. Corresponding author ([muratavci@gmail.com](mailto:muratavci@gmail.com))

Antireflecting coatings reduce reflections of the optical lenses or optical devices. Low and / or high refractive index materials with high purity levels (e.g 99.99%) can be used for eliminating reflections for specific wavelengths. These materials with desired chemical and physical properties are synthesized by improved techniques such as sol-gel, hydrothermal, precipitation etc. In this study, SiO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> coating materials were synthesized via such techniques and analysed to prove their properties by characterization techniques such as SEM, XRD, XRF, GD-MS etc. Synthesized materials were used to obtain single layers of thin films which were deposited on glass substrates via plasma assisted e-beam evaporation. Spectral performance of the films over the visible range was investigated using a UV-Vis spectrophotometer. Results of the spectrophotometric measurements were used to determine the optical constants of the thin films. Durability of the coatings in the under salt fog and humid environments as well as their adhesion properties were characterized according to military standards. Our results show that SiO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> coatings manufactured using the evaporation materials synthesized using the aforementioned powder synthesis methods can be suitable for design and manufacturing of electro-optical components such as filters, all dielectric mirrors and AR coatings.

## **CHARACTERISATION OF SOME METAL-DRUG COMPLEXES BY HPLC**

WAHIBA BANBESSA, NASSILA SABBA, ZAKIA HANK

a. Corresponding author ([nassilasabba@yahoo.fr](mailto:nassilasabba@yahoo.fr))

In this work, we reported the synthesis and the characterization of some Cu(II), Pd(II) and Ru(III)\_paracetamol complexes. HPLC was used to confirm complexation process.

The complexes was equally characterized by elemental analyses and several spectral technics, namely IR spectroscopy, UV-visible spectrometry and nuclear magnetic resonance (1H NMR and 13C NMR). The IR spectra of complexes established the coordination modes of the ligands to the metallic centre. The UV-visible spectroscopy revealed the environment of the metallic ion within complexes.

Thermal analysis (TGA & DTA) of complexes shows a multi-step exothermic decomposition pattern. The in-vitro, antibacterial and antifungal activity of the coordination compounds and the ligand were investigated. Certain compounds showed a good antimicrobial activity.

## SYNTHESIS OF HIGHLY POROUS ALUMINA-BASED CATALYSTS

BENJAMIN FAURE, PIERRE ALPHONSE

a. Corresponding author ([faure@chimie.ups-tlse.fr](mailto:faure@chimie.ups-tlse.fr))

Mesoporous alumina can be prepared by the “supramolecular template mechanism”, where the condensation of metal ions and the self-assembly of surfactant molecules occur simultaneously to form a hybrid organic-inorganic mesophase. In this work, we used another approach, the “nanoparticle route”, which consists in introducing the surfactant in a pre-synthesized colloidal sol to ensure the interconnection of nanoparticles in a hybrid network where nanoparticles act as a hard inorganic precursor. During the subsequent thermal treatment, the surfactant was removed leaving a highly porous framework. By combining the addition of both PEO/PPO/PEO triblock copolymers (F127 and P123) (surfactants) and metallic nitrates ( $\text{Al}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Cu}^{2+}$ ) in a boehmite ( $\text{AlOOH}$ ) nanoparticle hydrosol, we synthesized  $\gamma$ -alumina-based catalysts with high porous volume and tunable pore size. The pore size distribution was strongly dependent on the metallic nitrate added and its concentration. By this simple process it was possible to modify the porous volume in the range 0.3 to 2.6 cc/g and the pore diameter in the range 5 to 40 nm. All these materials presented high surface areas in the range 300-500 m<sup>2</sup>

.g-1. The formation of a highly porous network created through the entanglement of nanofibers could be explained both by the adsorption of copolymer onto boehmite nanocrystallites, building fiber-like objects and by the formation of micelles which act as space fillers preventing the compact rearrangement of the nanoparticles during the drying step. It is known [10] that addition of inorganic salts produces an increase in size of the micelles in aqueous solution of triblock copolymers; this could explain the expansion of the pore volume observed on addition of metallic nitrates. Finally, these sols are very stable and can give high quality coatings suitable for catalytic applications.

## A Zn-FERULATE METAL-ORGANIC FRAMEWORK

Selçuk Demir, H. Merve Çepni, Yıldırım Topcu, Małgorzata Hołyńska

a. Corresponding author ([fselcuk.demir@rize.edu.tr](mailto:fselcuk.demir@rize.edu.tr))

Metal-organic frameworks (MOFs) represent a new class of porous and functional materials for which they have very large application areas such as gas storage, catalysis, separation, and molecular sensing. We have synthesized and structurally characterized a Zn-based MOF containing ferulate ions. The structure of Zn-ferulate MOF was characterized by single crystal X-ray diffraction data. As a result of involvement of all carboxylate/methoxy/oxo donor oxygen atoms of the ferulate ion, a Zn-ferulate MOF is formed. The synthesized MOF structure contains canals with considerable diameter of 15.1(1)×17.2(1) Å. The total void volume of the synthesized MOF is ~3517 Å<sup>3</sup> per unit cell (%52).

## THEORETICAL STUDY OF EFFECTS OF EXCHANGEABLE CATIONS ON ELECTRONIC, STRUCTURAL PROPERTIES OF ETS-10

Mehmet Koç, Hande Toffoli, Burcu Akata

a. Corresponding author ([koc.mehmet@metu.edu.tr](mailto:koc.mehmet@metu.edu.tr))

In its most common native form, the -O-Ti-O-Ti-O- wire in ETS-10 is decorated with K<sup>+</sup> or Na<sup>+</sup> species. The electronic properties of ETS-10 can reliably and controllably be altered by exchanging these cations by other ions. In this study, effects of exchangeable cations on ETS-10 properties are investigated theoretically using density functional theory (DFT). Although there are recent works on different ion-exchange studies in ETS-10 investigating the structural changes induced into ETS-10 and their potential applications, there is still limited information about the local distortions occurring in the above mentioned titania chain as a function of varying concentration and type of exchanged cations. Accordingly, geometric, electronic and optical properties of ETS-10 were calculated including partial charge distribution, optimized cation positions, band gap structure, bond length and angle analysis. Preliminary results suggest that structural disorders differ with different exchangeable cations respect to electronegativity, valance electron and atomic size of exchangeable cation.

## MAGNETIC SCAVENGER: RICE HUSK ASH AND Fe<sub>2</sub>O<sub>3</sub> NANOPARTICLES; FOR THE REMOVAL OF INDIGO CARMINE DYE

Ruveyda Demirci, Beste Yavuz, Burcu Seven, Guleren Doner

Istanbul Technical University, Faculty of Science and Letters, Department of Chemistry, Maslak 34469  
Istanbul, Turkey

a. Corresponding author ([doner@itu.edu.tr](mailto:doner@itu.edu.tr))

Dyes are widely used in many industries such as dyestuffs, textiles, food processing, cosmetics, leather, paint, plastic, pharmaceutical, paper, cotton and wood. Even small amounts of dyes in water are highly visible, undesirable and even harmful to human and also aquatic ecosystem. Indigo carmine is considered to be a highly toxic dye and the exposure can cause asthma and also skin and eye irritations to human being. If Indigo carmine (Fig.1) E-132 present in food products it may increase hyperactivity in children.

In this study, the magnetic nano composite (MC) was synthesized using a simple precipitation method. In the presence of Rice Husk Ash (RHA), the aqueous solution of Fe(III) and Fe(II) salts were co-precipitated with sodium hydroxide and used as adsorbent- RHA/Fe<sub>2</sub>O<sub>3</sub>. Supermagnetic property was obtain when the Fe(III) :Fe(II) mole ratio was chosen 2:1. The magnetic property was used to remove the Indigo carmine dye after adsorbed onto the composite by simply using a magnet. The concentration of Indigo carmine in the supernatant was determined by using UV-Vis spectrophotometer. The effect of contact time, initial concentration, pH, dosage, temperature, the adsorption equilibrium and thermodynamic parameters were studied. In addition, the infrared spectrums (FTIR) of the magnetic composite was proved the adsorption of dye with the spectrums obtained before and after the adsorption procedure. All the experimental data will be discuss in details.

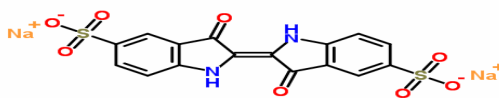


Fig.1. Indigo carmine

## **EFFECT OF SEMI SOLID POWDER PROCESSING ON MICROSTRUCTURAL AND MECHANICAL PROPERTIES OF A357-SiC COMPOSITE PRODUCED USING MECHANICAL ALLOYING**

Alireza Fadavi Boostani, Zhengyi Jiang, Dongbin Wei

School of Mechanical, Materials and Mechatronic Engineering (MMM), University of Wollongong, Wollongong, NSW 2522, Australia

a. Corresponding author ([jiang@uow.edu.au](mailto:jiang@uow.edu.au))

Al-Si alloys reinforced with SiC particles were found extensive applications in automotive, aerospace, and electronic industries because of their high strength, good wear resistance, high thermal conductivity, and low coefficient of thermal expansion. In this paper, semi-solid powder processing (SPP), a fabrication method exploits the unique behavior of a solid-liquid mixture, is used to synthesize SiC particle-reinforced A357 aluminum alloy. Microstructure, tensile strength, and fractographic results were analyzed. Microstructural characterization of samples using scanning electron microscopy (SEM) demonstrated that the ball milling process applied on primary powders has enhanced formation of nano-sized silicon particles (less than 300 nm in diameter size) associated by fracturing of silicon carbide particles resulted to synthesize A357-SiC hybrid composite. The XRD patterns revealed the formation of a nanostructural composite after 40 h of ball milling. Results of mechanical characterization showed that SPP could result in production of A357-SiC composite with high ductility (17%) more than A357-SiC composite produced by conventional methods such as stir casting method (2-3%). Additionally, fractographic examinations have shown that fracture surfaces of A357-SiC composite produced by SPP process contain micro voids with small size as an evidence of ductile fracture for samples with high ductility.

## **CU (II) IONS EXTRACTION USING LIQUID MEMBRANE TECHNIQUE**

Halil CETİŞLİ, Ramazan DONAT, Metin AK, Melike İlknur KIRDÖK

a. Corresponding author ([hcetisli@pau.edu.tr](mailto:hcetisli@pau.edu.tr))

Copper situated as heavy metal pollution in the environment is one of the heavy metal showing toxic effects on the micro-organisms, plants, animals and people[1]. Removal of heavy metals via conventional physical-chemical processes from wastewater that is dissolved heavy metal concentration lower than 100 mg/L are not very efficient and also the cost is very high[2]. The most effective technique for removal and recovery of Cu (II) ion in aqueous solutions is solvent extraction techniques. The liquid membrane technology involves two processes in one single stage extraction of metal ion from the aqueous donor solution to the organic phase containing the carriers molecules (membrane) and re-extraction of this metal ion from the membrane to the aqueous acceptor phase. Nowadays, liquid membrane technique which is one of the alternative techniques of membrane technology has gained much attention.

In experimental studies D2EHPA [bis (2-ethyl Hexyl) phosphate] and TBP (tributyl phosphate) in kerosene solutions (different concentrations in kerosene) used as carrier ligand for transport of the Cu(II) ions. Diluted H<sub>2</sub>SO<sub>4</sub> solution was used for recovery. Transport parameters of the Cu (II) ions in continuous extraction system such as temperature, pH of the donor and acceptor phase, type and concentration of the ligand carrier. Examined and concentration of the carrier ligand, acceptor phase concentration, etc. was examined. According to our results recovery of the Cu(II) ions was realized with percentage of %98. In the process that we used at transport of copper ions, one step extraction and using limited solvent, reduces solvent need and extraction costs.

## **POROUS CERAMICS AS HUMIDITY SENSORS FOR ENVIRONMENTAL MONITORING**

R. M. OLIVEIRA, M. C. A. NONO

a. Corresponding author ([rodmatos@las.inpe.br](mailto:rodmatos@las.inpe.br))

Nowadays, the research and development aimed for the environmental monitoring require sensors and sensory systems more reliable and versatile. Thus, researchers of the Environmental Technologies Group (TECAMB) integrated to the Associate Laboratory of Sensors and Materials (LAS/INPE) have well established themselves, for the last 20 years, in the elaboration of diagnosis techniques, characterization and development of porous ceramic. The development of ceramic materials for applications as sensing elements is an area in full evolution due to unique structure presented by these materials. The control of the microstructure and the suitable chemical composition of ceramics allow to optimize the sensory performance exploring their electric properties and adjusting them to specific requests. In this work, porous ceramic was manufactured from mechanical mixture of ZrO<sub>2</sub> and TiO<sub>2</sub> powders, compacted and sintered at different temperatures, for application as soil water content and air humidity sensing elements in the Project “Development and Application of Network of Geosensors for Environmental Monitoring”, for tropical forests monitoring. The characterization of the sintered ceramics were carried out through measurements of B.E.T., nitrogen and mercury porosimetry, scanning electron microscopy - SEM and X-ray diffraction. The density was determined by Archimedes method. The porous ceramics characterization as moisture and relative humidity sensor element was accomplished through capacitance measurements using a RLC bridge in climatic chamber. The results evidenced that the ceramic sensing elements are very promising ones.

## **NON-DEGRADABLE POROUS POLY(VINYL ALCOHOL) HYDROGELS FOR CARTILAGE TISSUE ENGINEERING**

Hatice Senturk Bodugoz, D Ling, C Gupta, MA Randolph, OK Muratoglu

a. Corresponding author ([hsenturk@partners.org](mailto:hsenturk@partners.org))

Defective cartilage tissue is a major clinical problem. To date, there have been no successful strategies to repair or regenerate cartilaginous tissues with successful long-term outcomes. Current strategies employ degradable polymeric scaffolds to deliver chondrocytes which often suffer from lack of strength of the construct, as well as incomplete matrix production. We propose to use a non- degradable porous hydrogel scaffold that can provide necessary and tailored mechanical strength to cartilage repair constructs seeded with chondrogenic cells. This will allow natural dynamic load transfer to the cells, which has been shown to be a major part of their developmental pathway to produce the correct composition of cartilage. Using theta gelation method in the presence of two competing gelling agents; a high molecular weight polymer such as polyacrylamide (PAAm) and a low molecular weight polymer such as Polyethylene glycol (PEG), we developed a porous polyvinyl alcohol (PVA) hydrogel with interconnected pores and continuous channels large enough to allow chondrocyte infiltration and extracellular matrix (ECM) deposition. The effect of molecular weight (MW) and concentration of gelling agent on physical properties of the hydrogel is reported in this study. These hydrogels enhanced the neocartilage formation in a subcutaneous nude mouse model using swine articular chondrocytes.

**INVESTIGATION OF PROTEIN ADSORPTION ONTO PEGYLATED SURFACES**

Funda Colak, Ece Adivar, Derya Kose, Sevgi Kilic Ozdemir<sup>a</sup>

Izmir Institute of Technology, Dept. of Chemical Engineering, Izmir-Turkey

a. Corresponding author ([sevgikilic@iyte.edu.tr](mailto:sevgikilic@iyte.edu.tr))

Polyethylene glycol (PEG) is the most favorite material for decorating the surfaces of biomaterials to block the adsorption of proteins. Coating the surfaces of biomaterials with PEG layers is known to enhance the stability, compatibility and life-time of the in-vivo injected materials. There are various techniques available to investigate the interactions between proteins and PEGylated surfaces such as surface plasmon resonance (SPR), quartz crystal microbalance (QCM). Compared to these techniques, Langmuir-Blodgett (LB) method is relatively a new method to study adsorption of proteins specifically onto phospholipid surfaces. Besides being inexpensive, and requiring no specific substrate, LB technique offers a good control over molecular arrangement, orientation and composition at the surface. In this study, the DSPC/DSPE-PEG2000 mixed monolayers at two different molar ratios and packing densities were prepared and their protein adsorption behavior was investigated at 20 °C and 38 °C. The results showed that protein repellent property of the surfaces is influenced highly by the conformation of PEG chains, which varies with packing density of PEG chains and temperature.

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