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Graphene oxide (GO), an oxidized version of graphene, has attracted considerable interests as it can be easily synthetized, processed and thermally reduced to graphene-like sheet [1]. R. R. Nair et al. [2] found that graphene oxide sheets were impenetrable for Helium and others gases, but show unimpeded permeation of water molecules. Therefore, GO become extremely interesting candidates for water purification technologies. Since then, the GO membranes have blown a geo-storm in the research field of membrane filtration. Among the big graphene-based family, we can say that GO sheets is arguably the most easily scalable approach for free-standing membranes. However, the GO membranes' mechanical strength as well as the relatively poor thermal and chemical stability are big drawback in terms of the commercial applications. Hence, efforts have been pursued to develop GO-based composite membranes. Various supports such as polymeric and anodic alumina supports have been used in GO membrane as substrate or host matrix [3].

In this study, we fabricated porous reduced-GO (rGO) materials for membrane applications. First, we annealed GO and KOH mixtures between 600 and 900 °C to produce nanopores on the carbon plane. We obtained materials with 0.5-2 nm pores, which have narrow pore size distribution and good potential for nanofiltration applications, e.g. they are permeable to water molecules and can block organic pollutants. The new rGO materials had much better thermal and chemical stability than the pristine GO, but the absence of the oxygen functional groups makes it very difficult to form a scalable and continuous membrane. Then, we added polymer precursors, as allylhydridopolycarbosilane (AHPCS), which also can yield microporous materials upon pyrolysis. Such polymers act as binder holding together rGO laminas after pyrolysis. BET and SEM were used in order to characterize the pore structure of the membrane layers. Permeation tests were carried out to explore potential of the new materials for the applications in membrane filtration.

References

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