Enthalpy relaxation in the Ag3PS4 glass prepared by mechanochemical synthesis
Qiao, A.; Tao, H.Z.; Wang, P.P.; Zhong, C. L.; Yue, Yuanzheng

Publication date: 2015

Document Version
Publisher’s PDF, also known as Version of record

Link to publication from Aalborg University

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Users may download and print one copy of any publication from the public portal for the purpose of private study or research.

Users may not further distribute the material or use it for any profit-making activity or commercial gain

Users may freely distribute the URL identifying the publication in the public portal.

Take down policy
If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from vbn.aau.dk on: december 21, 2018
Enthalpy relaxation in the Ag$_3$PS$_4$ glass prepared by mechanochemical synthesis

Ang Qiao$^a$, Haizheng Tao$^a$, Pengpeng Wang$^a$, Changli Zhong$^a$, Yuanzheng Yue$^{a,b}$

$^a$State Key Laboratory of Silicate Materials for Architectures, Wuhan University of Technology, Wuhan 430070, China
$^b$Section of Chemistry, Aalborg University, 9000 Aalborg, Denmark

Keywords: Enthalpy relaxation; Mechanochemical synthesis; Chalcogenide glass

Mechanical milling can be used to amorphize certain kinds of crystalline materials. The thus-derived glassy materials cannot be synthesized using conventional methods, e.g., melt quenching. Despite some progress in understanding the nature of these milling-generated glasses, several important aspects such as the sub-$T_g$ relaxation, glass formation and glass transition of such glasses are still far from being understood. In this work, we explore these aspects by 1) preparing a new type of glass - the Ag$_3$PS$_4$ glass via a high-energy ball-milling process, 2) by annealing it below $T_g$, and 3) by measuring the thermal responses using differential scanning calorimeter (DSC). The DSC results show an interesting sub-$T_g$ relaxation feature in the as-produced sample, i.e., the occurrence of multiple enthalpy relaxation events below $T_g$ during a dynamic heating protocol. In this work we reveal the origin of these multiple events by analyzing structural heterogeneity, glass formation mechanism, relaxation modes, polymorphism, and surface characteristics. We also discussed the relationship between milling energy and enthalpy relaxation. This study provides insight into the structure-functionality relation in this new type of mechanically amorphized material.

Acknowledgement: NSFC(No. 51372180), NCET(No. NCET-11-0687), NSF of Hubei Province(No. 2013CFA008), the Fundamental Research Funds for the Central Universities (Wuhan University of Technology, No. 155201004) and the key technology innovation project of Hubei Province (No. 2013AEA005).