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Glass formation, structure and ionic conductivity in the AgI-Ag_3PS_4 pseudo-binary system

A. Qiao [1], H.Z. Tao[1], J.J. Ren[2], P.P. Wang [1], Y.Z. Yue[1,3]

[1]State Key Laboratory of Silicate Materials for Architectures,Wuhan University of Technology, Wuhan 430070,China
[2] Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China
[3]Department of Chemistry and Bioscience, Aalborg University, 9220 Aalborg, Denmark
qiaoang@whut.edu.cn

High-energy mechanical milling is a new technique for preparing amorphous materials [1)], especially, used for fabricating superionic conductors with high ionic conductivity and low electronic conductivity. Among these superionic conductors, sulfide glass systems have shown higher ionic conductivity than their oxide counterparts [2)]. In this presentation, we report the glass formation of the xAgI-(1-x)Ag_3PS_4 (x is from 0 to 0.8) system under high-energy ball-milling conditions. These new types of glasses have never been prepared by the conventional melt-quenching technique. By means of Raman spectroscopy and solid-state magic angle spinning-nuclear magnetic resonance (MAS-NMR), we have studied both the short-range and the intermediate-range order structures of these new types of glasses, and their impact on the ionic conductivity. The complex impedance spectra show that the xAgI-(1-x)Ag_3PS_4 glassy system have relatively high room temperature ionic conductivity. It is found that a significant increasing turning in ionic conductivity with increasing x, indicting an intriguing evolution in structure in this series of glassy system. By exploring the short-range and the intermediate-range order structures and their relationship with ionic conductivity in this pseudo-binary glassy system, we reveal the mechanism of formation and evolution of the pathway for Ag^+ ion moving. These glasses can be used as the superionic conductor, which is expected to have promising applications in the field of solid state electrolytes.

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