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Local Structure and Ion Transport in Glassy Poly(ethylene oxide styrene) Copolymers HAN-CHANG YANG, Department of Materials Science and Engineering, University of Pennsylvania, JIMMY MAYS[1], ALEXEI P. SOKOLOV[2], Chemical Sciences Division, Oak Ridge National Laboratory, KAREN I. WINEY, Department of Materials Science and Engineering, University of Pennsylvania — Polymer electrolytes have attracted attention for a wide variety of applications in energy production such as lithium-ion batteries and fuel cells. The concept of free volume provides important information about ion mobility and chain dynamics in the polymer matrix. Researchers have recently demonstrated that ion transport in glassy polymer can be improved by designing a system with high free volume. We have studied the effect of temperature and humidity on the intermolecular correlations of poly(ethylene oxide styrene-*block*-styrene) (PEOSt-*b*-St) block copolymer and poly(ethylene oxide styrene) (PEOSt) homopolymer using *in situ* multi-angle x-ray scattering across a wide range of scattering angles (q = 0.007-1.5 Å^{-1}). An increase in backbone-to-backbone distance is observed, indicating an increase in free volume between different polymer main chains. Structural characterization of the polymer segments will be discussed together with conductivity and dielectric results to better understand the ion transport mechanism in the local environment of the polymer system.

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