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Molecular mobility and cation conduction in sulfonated polyester copolymer ionomers GREGORY TUDRYN, DANIEL KING, Penn State, MICHAEL O'REILLY, KAREN WINEY, UPenn, RALPH COLBY, Penn State
— Poly(ethylene oxide) ionomers are candidate materials for electrolytes in energy storage devices due to the ability of ether oxygen to solvate cations. Copolyester ionomers are synthesized via condensation of sulfonated phthalates with mixtures of PEG and PTMG to make random copolymer ionomers with identical ion content. Variation of the PEG/PTMG composition changes Tg, dielectric constant and ionic aggregation; each with consequences for ion transport. Dielectric spectroscopy is used to determine number density of conducting ions, their mobility and extent of aggregation. Conductivity and mobility show Vogel temperature dependence and increase with PEG content; even though PTMG ionomers have lower Tg. Conducting ion densities show Arrhenius temperature dependence and are nearly identical for polymers containing PEG. SAXS confirms the extent of aggregation and temperature response from dielectric results, and exposes phase separation as PTMG content is increased. The tradeoff between ion-solvation and low Tg in this study provides fundamental understanding of ionic aggregation and ion transport in polymer electrolytes.

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