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Effect of Ion Content on Conductivity and Morphology of Single-Ion Conducting Ionomers JING-HAN HELEN WANG, Department of Chemical Engineering, The Pennsylvania State University, RALPH H. COLBY, Department of Materials Science and Engineering, The Pennsylvania State University —
Ionomers based on short poly(ethylene oxide) side chains and sodium sulfonated styrene are synthesized by reversible addition fragmentation chain transfer (RAFT) polymerization, to systematically study the effect of ion content and counterion species on ionic conductivity. Glass transition temperature increases gradually as ions are incorporated at low ion content then sharply as the ion content reaches 1:4 ions to ether oxygen (EO) ratio. Dielectric relaxation spectroscopy is used to measure the conductivity, dielectric constant and segmental relaxations in these ionomers. The ionomer with 1:80 ions to EO ratio shows highest room temperature conductivity that results from the best combination of number density of simultaneously conducting ions and their mobility, assessed by an electrode polarization model. The micro-phase separation that is anticipated in the ionomers with higher ion contents is probed by x-ray scattering. Sodium counterions are mostly trapped in ionic aggregates while larger counterions, such as tetramethylammonium, exhibit higher conductivity and conducting ion concentration.

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