Abstract Submitted
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Correlating morphology to dc conductivity in polymerized ionic liquids[1] CIPRIAN IACOB, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA 16802 USA, ATSUSHI MATUSMOTO, TADASHI INOUE, Department of Macromolecular Science, Osaka University, Toyonaka, Osaka 560-0043 Japan, JAMES RUNT, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA 16802 USA — Polymerized ionic liquids (PILs) combine the attractive mechanical characteristics of polymers and unique physico-chemical properties of low molecular weight ionic liquids in the same material. PILs have shown remarkable advantages when employed in electrochemical devices such as dye-sensitized solar cells and lithium batteries, among others. Understanding their ionic transport mechanism is the key for designing highly conductive PILs. In the current study, the correlation between morphology and charge transport in two homologous series of PILs with systematic variation of the alkyl chain length and anions is investigated using broadband dielectric spectroscopy, rheology, differential scanning calorimetry and X-ray scattering. As the alkyl chain length increases, the backbone-to-backbone separation increases, and dc-conductivity consequently decreases. The cations dominate structural dynamics since they are attached to the polymer chains, while the anions are smaller and more mobile ionic species thereby controlling the ionic conductivity. Further interpretation of decoupling of dc conductivity from the segmental relaxation enabled the correlation between polymer morphology and dc conductivity.

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