Polymerized ionic liquids (PolyILs) are polymeric materials with high room temperature ionic conductivity and good mechanical properties that are very attractive candidates for practical applications in various solid state electronic devices. In addition to different practical applications of the PolyILs, these materials are excellent model systems for understanding intricate coupling between electrostatics and crowding effects. In this work, we develop and demonstrate experimental studies and predictive theory describing important aspects of PolyILs’ behavior. Delocalization of charges and the larger sizes of ions in PolyILs lead to novel engagement between conductivity and structural properties, which can be significantly different from those observed in conventional polyelectrolytes. Strong electrostatic correlations in PolyILs tend to enhance the effects of ion-pairing and a very small concentration of “free” ions is expected in the absence of electric field. We have also observed significant softening of the PolyIL films beyond certain threshold voltages and the subsequent formation of holes. These findings are important for electrolytes based on PolyILs that target different solid state energy storage applications where strong electric fields are involved.

**Reference**

“Ion transport and softening in a polymerized ionic liquid”


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