Imidazolium-Based Polymer Ionic Liquids with Poly(ethylene glycol) Side Chains as Polyelectrolyte: Synthesis and Characterization

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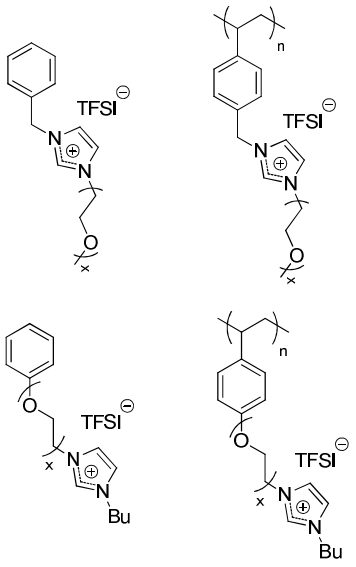
The electrolyte, which functions as the inner charge carrier between electrodes, is a crucial part of batteries or cells. Due to the drawbacks of conventional organic liquid electrolytes, such as leakage, volatility, flammability, and toxicity, the development of solid-sate electrolytes is important. Among all the alternatives, polymer electrolytes, in particular, ionic liquids (ILs) and poly(ionic liquid)s (PILs), offering low vapor pressure, non-flammability, high ionic conductivity, a high electrochemical window, and high stability, are of great interests that attract lots of groups.

In this study, the synthesis and characterization of a novel class of imidazolium based IL model compounds and their corresponding PILs are reported. In order to optimize the glass transition temperatures (T_g) and ionic conductivities, a series of ILs and PILs were synthesized with varied length of poly(ethylene glycol) (PEG) side chains as tethering groups attached to the imidazolium cation. The physical and electrochemical properties, including density, viscosity, conductivity, Tg, melting and decomposition, were characterized in order to investigate the effect of PEG tethering groups.



Scheme 1. Structures of ILs (left) and their corresponding PILs (right) studied in this work

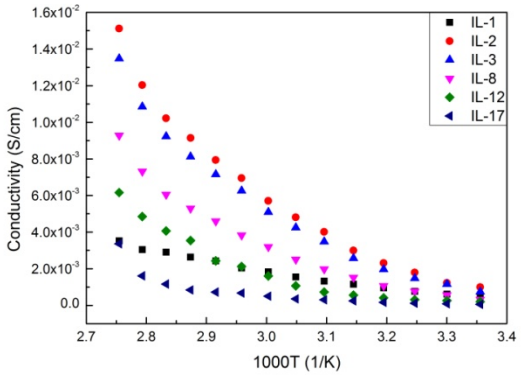


Figure 1. Temperature dependent ionic conductivity results of IL model compounds with altered PEG side chains.

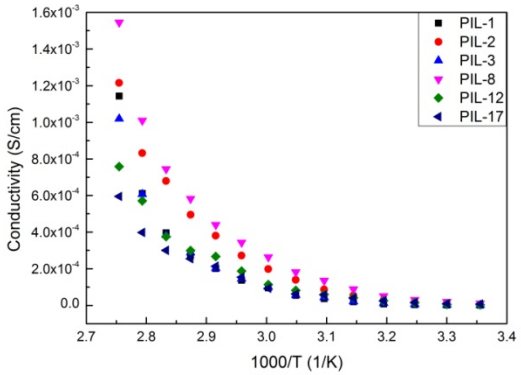


Figure 2. Temperature dependent ionic conductivity results of PILs with altered PEG side chains.

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