The Effect of Molecular Structure on Thermodynamic Properties of Ionic Liquid-Lithium Salt Mixtures

Chaojun Shi [S] and Joan Brennecke [C]

University of Notre Dame, Department of Chemical and Biomolecular Engineering, Notre Dame, IN, U.S.A.

jfb@nd.edu

Ionic liquids (ILs) are nonflammable, have low volatility, and can be used in a wide range of applications, including as electrolytes for lithium-ion batteries. A number of novel ILs based on aprotic heterocyclic anions (AHAs) have been synthesized in this work. Furthermore, densities and dynamic viscosities were measured in a temperature range from 283.15K to 343.15K at ambient pressure. Coulometric Karl Fischer titration was used to determine the sample water content before and after measurement. Densities have a linear relationship with temperature and viscosities values are fitted by the Vogel-Fulcher-Tamman (VFT) equation. We have also measured the electrical conductivities of the neat ILs. The Walden rule has been used to analyze the relationship between conductivity and viscosity. The degree of dissociation of all ILs investigated in this report are independent of temperature since the slopes are almost one. The ILs fall close to the ideal line, which suggests that they exhibit satisfactorily high iconicity and that they may be good candidates as electrolyes. Finally, we have determined the solubilities of lithium (Li) salts in the ILs and measured the electrical conductivities of these IL-Li salt mixtures.