Physical Properties of Substituted Imidazolium Based Ionic Liquids Gel Electrolytes

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The physical properties of solid gel electrolytes of either polyvinylidene difluorohexafluoropropylene or a combination of polyvinylidene hexafluoropropylene and polyacrylic acid, and the molten salts 1-ethyl-3-methylimidazolium tetrafluoroborate, 1,2-dimethyl-3-*n*-propylimidazolium tetrafluoroborate, and the new molten salts 1,2-dimethyl-3-*n*-butylimidazolium tetrafluoroborate, and 1,2-dimethyl-3-*n*-butylimidazolium hexafluorophosphate were characterized by temperature dependent ionic conductivity measurements for both the pure molten salt and of the molten salt with 0.5 M Li^+ present. Ionic conductivity data indicate that for each of the molten salts, the highest concentration of molten salt allowable in a single component polymer gel was 85%, while gels composed of 90% molten salt were possible when using both polyvinylidene hexafluorophosphate and polyacrylic acid. For polymer gel composites prepared using lithium containing ionic liquids, the optimum polymer gel composite consisted of 85% of the 0.5 M Li/ionic liquid, 12.75% polyvinylidene hexafluoropropylene, and 2.25% poly (1-carboxyethylene). The highest ionic conductivity observed was for the gel containing 90% 1-ethyl-3-methyl-imidazolium tetrafluoroborate, 9.08 mS/cm. For the lithium containing ionic liquid gels, their ionic conductivity ranged from 1.45 to 0.05 mS/cm, which is comparable to the value of 0.91 mS/cm, observed for polymer composite gels containing 0.5 M $LiBF_4$ in propylene carbonate.

Key words: Ionic Liquid; Polymer; Electrolyte; Lithium; Composites.