

Studies on the Impedance Spectroscopy and Dielectric Properties of Ionic Liquid (BmimCl) Based Hybrid Gel Polymer Electrolytes

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Abstract

In this present work, gel polymer electrolytes (GPE) based polylactic acid (PLA) and polymethyl methacrylate (PMMA) blend polymer doped lithium bis (trifluoromethanesulfonyl) (LiTFSi) and added with various composition of ionic liquid (IL), 1-Butyl-3-methylimidazolium chloride (BmimCl) were successfully prepared. The electrical conduction properties study was carried out via a.c. impedance spectroscopy analysis and the ionic conductivity was calculated based on the Cole-Cole plot of the imaginary part versus the real part of the complex impedance. The addition of IL into the GPE system was found to increase the ionic conductivity and achieved the optimum value at $1.63 \times 10^{-3} \text{ S cm}^{-1}$ for GPE system containing with 15 wt.% BmimCl. The temperature dependence – ionic conductivity study for (PMMA-PLA-20 wt.% LiTFSI) + wt.% IL were found to be obey to Arrhenius relationship. The dielectric behaviour was investigated using real and imaginary parts of dielectric permittivity (ϵ_r and ϵ_i) and electrical modulus (M_r and M_i). The dielectric properties revealed that the present system follow non-Debye characteristic.

Keywords: Arrhenius behaviour; BmimCl; Dielectric properties; Impedance studies; Hybrid polymer.