Effect EMIMCl on electrochemical properties based PMMA-PLA hybrid gel polymer electrolyte

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ABSTRACT

The formulation of a hybrid gel polymer electrolyte (HGPE) system comprising of polymethyl methacrylate (PMMA) and polylactic acid (PLA) as a hybrid host polymer doped with lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) has been successfully prepared in this study with the introduction of an ionic liquid, namely 1-Ethyl-3-methylimidazolium chloride (EMIMCl). Fourier transform infrared (FTIR) spectroscopy and X-ray diffraction (XRD) were used to investigate the structural features of HGPEs. The FTIR analysis revealed that the complexation changes the peak intensity at region C = O stretching, CH_2 bending, and C-O stretching. Meanwhile, XRD showed that the addition of EMIMCl altered the HGPE properties and formed an amorphous structure. The prepared HGPE sample was examined for ionic conduction properties through electrical impedance spectroscopy (EIS). It shows that by adding an EMIMCl to the PMMA-PLA-LiTFSI HGPE has decreased the activation energy (E_a) and increased the ionic conductivity. The sample containing 15 wt.% has the lowest E_a value of 0.057 eV and the highest ionic conductivity at room temperature of 3.20 10^{-3} S cm^{-1}. The itemperature dependence was studied in the temperature range from 303 K to 393 K, the HGPE systems were found to follow Arrhenius behavior. The effect of EMIMCl content had decreased the viscosity of HGPEs which led to the gel-like type behavior. The potential windows stability analysis revealed that the highest conducting sample was electrochemically stable up to 3.3 V versus Li/Li^+, thus showing that the present electrolytes are promising to be applied as in Li-ions battery.

KEYWORDS

Gel polymer electrolytes; ionic conductivity; permittivity studies; potential window stabilities

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