Ionic transport study of hybrid gel polymer electrolyte based on PMMA‑PLA incorporated with ionic liquid

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ABSTRACT

Hybrid gel polymer electrolytes (HGPEs) based on polymethyl methacrylate (PMMA)-polylactic acid (PLA) doped with LiTFSI and incorporated with 1-butyl-3-methylimidozalium chloride (BmimCl) were successfully prepared. The complexes of the HGPEs with different BmimCl contents were characterized via Fourier transform infrared (FTIR) and X-ray diffraction (XRD) analysis. Based on the impedance spectroscopy analysis, the HGPEs with the composition of 80% PMMA:20% PLA:20 wt.% LiTFSI:15 wt.% BmimCl possessed the highest room-temperature ionic conductivity of 1.63×10^{-3} S cm^{-1}. The Arof-Noor (A-N) method was applied to investigate its transport properties, and it was found that the diffusion coefficient, D, ionic mobility, μ, and number density of ions, η, were the main contributors of ionic conductivity improvement. Meanwhile, the highest conducting electrolyte lithium ion transference number was 0.67. Linear sweep voltammetry (LSV) analysis showed that the electrochemical stability window of the HGPE was 3.4 V vs Li/Li^+. The findings suggest that the HGPE system incorporated with this ionic liquid could be a promising candidate for use as an electrolyte in flexible lithium-ion batteries.

KEYWORDS

Hybrid polymer; Ionic liquid; Lithium transference number; Potential stability

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