Influencing of [EDIMP] TFSI in PMMA-PLA doped LiTFSI based hybrid gel polymer electrolyte on the variation in crystallinity phase and ionic conduction properties

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ABSTRACT

In this study, we explored hybrid polymer complex-based gel polymer electrolytes (HGPEs) comprising poly(methyl methacrylate) (PMMA) and polylactic acid (PLA) as host polymers doped with LiTFSI, incorporating varying amounts of the ionic liquid ethyl-dimethyl-propylammonium bis(trifluoromethylsulfonyl)imide ([EDIMP]TFSI). The structural properties of HGPEs has been assessed using FTIR, XRD, and DSC, observing changes in peak intensity, increased amorphous phases, and lowered glass transition temperatures (T_g) as [EDIMP]TFSI content increased. The room temperature ionic conductivity improved from 1.02×10^{-3} S cm^{-1} to 3.90×10^{-3} S cm^{-1} with [EDIMP]TFSI incorporation. The permittivity spectra were showed to follow the non-Debye characteristic. The Arof-Noor (A-N) method determined ionic mobility, charge carrier concentration, and diffusion coefficient to understand factors influencing ionic conductivity variation. The reduced interfacial resistance between HGPE and lithium metal enhanced contact with the electrode. Sample E-TFSI 20 reveals the t_{Li^+} and electrochemical potential window were respectively 0.79 ± 0.005 and 5 ± 0.5 V.

KEYWORDS

Amorphous phase Gel polymer electrolyte Ionic transportation Lithium ions

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