

Ionic Liquid Based Gel Polymer Electrolyte for Magnesium Ion Batteries

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We present here the synthesis and characterization of ionic liquid incorporated poly (ethylene oxide) (PEO) based Mg^{2+} ion conducting gel polymer electrolyte for magnesium-ion rechargeable batteries. In this work magnesium triflate $Mg(TO)$ was used as the salt in order to facilitate the Mg^{2+} ion conduction and *N-butyl-N-methylpyrrolidinium bis(trifluoromethylsulfonamide)* ($PyR_{14}TFSI$) ionic liquid was used as an additive to increase the transport properties of the electrolyte. The Complex impedance spectroscopy was used in order to measure the ionic conductivity whereas D.C. polarization test was used in order to obtain the transference numbers of the electrolyte. The polymer-ion and ionic liquid-ion interactions were investigated using FT-IR spectroscopy. Our results show that the maximum ionic conductivity ($1.021 \times 10^{-4} \text{ S cm}^{-1}$ at room temperature) can be obtained with the electrolyte having PEO: $Mg(TO)$ is 15:1 molar ratio. The addition of ionic liquid into the parent electrolyte shows the further improvement in ionic conductivity with the highest value of $3.204 \times 10^{-4} \text{ S cm}^{-1}$ for the 20wt.% ionic liquid. The electronic transference number of the electrolyte without ionic liquid is 0.129 and the electrolyte with 10wt.% of ionic liquid is 0.024. Our FTIR results show minor changes of the interactions of PEO and Me when addition of ionic liquid. Thus, this structural modification after addition of ionic liquid has a major influence for the transport properties of the parent polymer electrolyte.

Keywords: Gel polymer electrolyte, Ionic liquid, Poly (ethylene oxide), Magnesium Triflate