

Synthesis and Characterization of Ionic Liquid Based Gel Polymer Electrolyte for Rechargeable Batteries

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In the present battery market, Lithium-ion batteries have appeared as the preferred type due to its high gravimetric and volumetric energy density. However, there is a need to improve the performance of the electrolyte and electrode materials for high-performance of these devices. The objectives of this study are to synthesize a gel polymer electrolyte and analyze the structure to understand ion-polymer and ion-solvent interactions. In this study, *polyethylene oxide* (PEO) based gel electrolytes were synthesized using different amounts of *lithium bis(oxalato borate)* (LiBOB) salt mixed with *propylene carbonate* (PC) and *ethylene carbonate* (EC) (weight ratio of 1:1). The prepared samples were characterized using Fourier-transform infrared spectroscopy (FTIR), in order to study interactions between Li⁺ ions, polymer, and solvent molecules. The FTIR analysis of the binary liquid electrolyte shows that a significant influence on the vibrational modes of the EC and PC molecules. A fixed amount (1g) of *1-Butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl)imide* (PyR14TFSI) ionic liquid was added to the liquid electrolyte system to enhance the electrochemical performance of the systems. The FTIR analysis of the liquid electrolytes with ionic liquid samples exhibits alternations on the vibrational modes of the solvent molecules and the ionic liquid since lithium ion might be coordinate with the polar groups of the system. Finally, gel polymer electrolyte (GPE) was prepared by adding different percentages of PEO (average $M_w \sim 2,000,000$) for each liquid sample. Clear changes can be observed in the vibrational modes of PEO with salt addition confirming that coordination of the lithium ion with polymer matrix. In order to use developed electrolyte in real applications, future studies on ionic conductivity and electrochemical performance will be carried out.

Key word: Gel polymer electrolytes, FTIR, LiBOB, Ionic liquids

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