

PVDF-HFP Based Nanocomposite Gel Polymer Electrolytes Dispersed with ZrO₂ for Li-Ion Batteries

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Abstract : Nanocomposites gel polymer electrolytes are gaining more and more attention among the researchers worldwide due to their possible applications in various electrochemical devices particularly in solid-state Li-ion batteries. In this work we have investigated the effect of nanofibers on the electrical properties of PVDF-HFP based gel electrolytes. The nanocomposites polymer electrolytes have been synthesized by solution casting technique with 10wt% of ZrO₂. By analysis of impedance spectroscopy it has been demonstrated that the incorporation of ZrO₂ into PVDF-HFP-(PC+DEC)-LiClO₄ gel polymer electrolyte system significantly enhances the ionic conductivity of the electrolyte. The enhancement of ionic conductivity seems to be correlated with the fact that the dispersion of ZrO₂ to PVDF-HFP prevents polymer chain reorganization due to the high aspect ratio of ZrO₂, resulting in reduction in polymer crystallinity, which gives rise to an increase in ionic conductivity. The decrease of crystallinity of PVDF-HFP due the addition of ZrO₂ has been confirmed by XRD. The interaction of ZrO₂ with various constituents of polymer electrolytes has been studied by FTIR spectroscopy. TEM results show that the fillers (ZrO₂) has distributed uniformly in the polymer electrolytes. Moreover, ZrO₂ added gel polymer electrolytes offer better thermal stability as compared to that of ZrO₂ free electrolytes as confirmed by TGA analysis.

Keywords : polymer electrolytes, ZrO₂, ionic conductivity, FTIR

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