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Structural, thermal and ion transport properties of radiation grafted lithium conductive polymer electrolytes

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Abstract

Structural, thermal and ion transport properties of lithium conductive polymer electrolytes prepared by radiation-induced grafting of styrene onto poly(vinylidene fluoride) (PVDF) films and subsequent activation with $LiPH_6$/EC/DEC liquid electrolyte were investigated in correlation with the content of the grafted polystyrene (*Y*%). The changes in the structure were studied using Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD) and differential scanning calorimetry (DSC). Thermal gravimetric analysis (TGA) was used to evaluate the thermal stability. The ionic conductivity was measured by means of ac impedance spectroscopy at various temperatures. The polymer electrolytes were found to undergo considerable structural and morphological changes that resulted in a noticeable increase in their ionic conductivity with the increase in *Y*% at various temperatures (25–65 °C). The ionic conductivity achieved a value of 1.61×10^{-3} S cm^{-1} when *Y* of the polymer electrolyte reached 50% and at 25 °C. The polymer electrolytes also showed a multi-step degradation behaviour and thermal stability up to 120 °C, which suits normal lithium battery operation temperature range. The overall results of this work suggest that the structural changes took place in PVDF matrix during the preparation of these polymer electrolytes have a strong impact on their various properties.

Keywords: Polymer electrolyte; Radiation-induced grafting; Lithium battery; PVDF

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