Physical and Charge-Discharge behavior of Facile PVdF-co-HFP Nanocomposite Polymer Electrolyte for Lithium Ion Polymer Batteries

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Abstract

Synthesized wurtzite ZnO nanostructures are incorporated on the poly (vinylidenefluoride-co-hexafluoropropylene) (PVdF-co-HFP) matrix, which improves the thermal behavior of as obtained thin film nanocomposite microporous polymer membrane (nanoCMPM). The nanoCMPM shows a favorable effect on the melting temperature (T_m) 142.9°C. The nanocomposite membranes were characterized by DSC and porosity studies. The nanoCMPM was prepared as a polymer electrolyte in soaking 1.0 M LiClO_4 – DMC+EC (1: 1 v/v ratio) electrolyte solution to get as nanocomposite polymer electrolytes (nanoCMPE). The optimized nanofiller dispersed composite microporous polymer membrane was found to have a high degree of porosity (76%) and excellent film strength than 8-10wt% filler concentration. It shows the ionic conductivity in the order of 10^{-3} S cm^{-1} at room temperature. It has been further evidence from the effect on lithium salt concentration studies. The optimized membrane electrolyte has good compatibility and charge discharge character at 0.5C rate. It has the evidence applicable to perform in lithium ion polymer batteries.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures
Figure 1

DSC curves of nano CMPMs based on PVdF-co-HFP with ZnO nanofiller (wt% = 0%, 2%, 4%, 6%, 8% and 10% ZnO)
Figure 2

FE-SEM images of optimized nanoCMPEs PVdF-co-HFP + 6wt% ZnO + 1M LiClO4 –EC/DMC (a) Top surface (b) bottom surface view
Figure 3

a. XRD patterns of zinc oxide nanoparticles obtained by calcination of the precursor at (a) 350 °C and (b) 500 °C for 2 h (derived from Subramaina. A and G. Vijayakumar [22]) b XRD patterns of a) PVdF-co-HFP and b) optimized nanoCMPE
Figure 4

Porosity of the nanoCMPMs PVdF-co-HFP with dipersoid
Figure 5

Temperature dependence of ionic conductivity of the nanoCMPE
Figure 6

Schematic representation of nanoCMPE for Lithium ion polymer battery [12]
Figure 7

Charge – discharge performance of MCMB/nanoCMPE/LiCoO2 cell

Figure 8
Relative value of discharge capacity as a function of cycle number of MCMB/nanoCMPE/LiCoO2 cell