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# Studies on conductivity, morphology and thermal stability of PMMA-PSAN based Solid Polymer Electrolytes using $SiO_2$ as nanofiller

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**Abstract :** The solid polymer electrolyte (SPE) involving fixed concentration of Poly(methyl methacrylate) (PMMA) and Poly(styrene-co-acrylonitrile) (PSAN) as host polymers with Ethylene carbonate (EC), Propylene carbonate (PC) as plasticizers, Lithium trifluoro methanesulfonate ($LiCF_3SO_3$) as salt and varying concentration of $SiO_2$ as nano-filler were prepared by solution casting technique. The prepared samples were labelled as S0, S1, S2, S3, S4, S5 corresponding to $SiO_2$ nano-filler concentration of 0, 5, 6, 7, 8, 9 in wt%. The functional group interaction and structural reorganisation of SPE S0, S2 and S5 were studied by Fourier transform infrared (FT-IR) technique. X-ray diffraction (XRD) technique is used to study the crystallinity of the SPE S2 and compared with PMMA, PSAN and sample S0. The AC impedance spectroscopy is used to study the ionic conductivity of the prepared samples. Sample S2 shows a maximum conductivity of 6.55 x $10^{-05}$ S $cm^{-1}$ at 70 $^oC$. The temperature dependence of conductivity of the films seems to obey VTF relation. Thermal analysis of the sample S2 was done using Thermo-gravimetric analysis (TGA) and Differential scanning calorimetry (DSC) techniques. TG and derivative TG analysis show thermal stability of the sample S2 up to 278 $^oC$. Glass Transition Temperature (Tg) of sample S2 is compared with pure PMMA, pure PSAN, and sample S0. The morphology of the sample S2 is compared with sample S5 using Scanning electron microscopy (SEM) Analysis. It is found that the nanofiller $SiO_2$ provides extra conduction channels leading to enhanced conductivity in sample S2 which is not observed in S5.
**Key words :** SPE, FT-IR, XRD, AC impedance, TGA, DSC, SEM.



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