THE EFFECT OF MONTMORILLONITE ON CONDUCTIVITY ENHANCEMENT IN THE SYSTEM OF $(PEO)_9LiCF_3SO_3$ POLYMER ELECTROLYTE

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The solid polymer electrolyte, based on poly(ethylene oxide) (PEO) and lithium triflate has been used as an electrolyte medium in secondary energy sources and electrochromic devices. This system shows an enhanced ionic conductivity when a plastisizier is added. In this research work, an attempt was devoted to improve the ionic conductivity of $(PEO)_9LiCF_3SO_3$ polymer electrolyte system by choosing montmorillonite (MMT) as the plastisizer. The ionic conductivity, thermal transitions, crystallinity, and bonding of the complex system of $(PEO)_9LiCF_3SO_3$ + x wt.% MMT were systematically characterized by AC-impedance spectroscopy, Differential Scanning Calorimetry (DSC), X-ray diffraction (XRD)spectroscopy and Fourier Transformed Infrared (FTIR) spectroscopy, respectively.

The AC impedance data reveal that the ionic conductivity of $PEO)_9LiCF_3SO_3$ system is changed with the concentration of MMT, maximum conductivity of 4.14857×10^{-7} S cm^{-1} at room temperature was observed for the system of $(PEO)_9LiCF_3SO_3$ + 5 wt.% MMT. The DSC and XRD data clearly show that the crystalline nature of PEO is reduced when MMT is added. The glass transition temperature and melting temperature of the above system is reduced compared to those of other systems. This contributes to the ionic conductivity enhancement in an amorphous environment.

The comparison of FTIR spectra of MMT, PEO, $(PEO)_9LiCF_3SO_3$, and $(PEO)_9LiCF_3SO_3$ + 5 wt.% MMT clearly shows that the interactions take place between these constituents, as the intensities of typical stretching vibrational modes of 916 cm^{-1} ν(Al–O-H), 1040 cm^{-1} ν(Si-O) and 3300 -3700 cm^{-1} ν(OH) in MMT, and the vibrational modes of CH_2 rocking at 948 and 840 cm^{-1} and C-O stretching at 1149 and 1090 cm^{-1} in PEO are changed. The change of symmetric bending mode of CF_3 [δ_s (CF_3)] at 752 cm^{-1} in lithium triflate has altogether supported the conformation of the electrolyte system and the corresponding conductivity enhancements.

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