Insights in to the β relaxation process of the pure and NaF complexed PEO/PVP polymer blend electrolytes using dielectric relaxation spectra.

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Abstract:

Pristine and various concentrations of NaF salt doped PEO/PVP based polymer blend thin film electrolytes are prepared using a simple solution casting technique. The structural analysis of the samples is done by using X-Ray diffraction (XRD) technique. XRD analysis helped to confirm the semicrystalline nature of the samples and effect of the complexation in the blend polymers. The functional groups correspond to the components of the blend were investigated using Fourier-Transform infrared (FTIR) spectra which evidenced the absorption bands correspond to the C=O functional groups attributable to the side chains of PVP of the samples, in 1750–1550 cm^{-1} region. The characteristic glass transition temperatures of the blend samples are monitored using differential scanning calorimetry (DSC). Finally, the possible relaxation process taking place within the electrolytes is identified and analyzed using dielectric relaxation spectra derived temperature-dependent-tanδ and the glass transition temperatures obtained from DSC studies of the electrolytes. The present polymer blend complexes are confirmed to exhibit β relaxation process as the relaxation peak at low temperatures is found below the glass transition temperatures (T_g). The relaxation peak shifts to higher temperature region with frequency of the applied electric field ensuring a temperature dependent relaxation frequency. The amorphous regions separating the crystalline segments of semicrystalline PEO and the complete amorphous phase of the PEO/PVP blend polymers facilitate a free space for dipoles' (C=O) orientations which results into β relaxation process in the blends.