In present thesis we have discussed about polymer composite and electrolytes which were prepared by using solution casting, based on various grades of host polymers such as Polyvinylidene fluoride (PVDF), Polyvinyl alcohol (PVA), Polyvilylpyrrolidone (PVP), Polyethylene glycol (PEG) and Polyvinyl chloride (PVC) inducted with different organic/inorganic compound such as Nafion, CdCl$_2$, LiOH, BaCl$_2$ and ZnO (nanoparticles). The preliminary studies of different polymer composites have been carried out to obtain the best composite of polymer system subjected to its structural, morphological, thermal and electrical properties. The X-ray diffraction (XRD) technique was implemented to obtain the structural properties of polymer composites. The morphological characterization was carried out by using different techniques which shows the phase variation with respect to different polymeric system. The thermal properties of polymer composite was done by using differential scanning calorimetry (DSC) and Thermogravimetric analysis (TGA) techniques to obtain thermal degradation, glass transition temperature ($T_g$) and melting temperature ($T_m$) of reported polymer composites. The electrical properties of polymer electrolytes were subjected to impedance spectroscopy analysis. The effect of DC-bias, temperature and frequency on dielectric constant and conductivity were evaluated. The electrical properties with respect to different external conditions of these nanocomposites have been investigated over the frequency range of 10 Hz- 35 MHz. The dielectric properties have been studied with respect to the Wagner-Maxwell-Sillars phenomenon in the low frequency region. An overall result describes the proper interfacial interaction between salt and polymers which leads towards an exciting opportunity for the development of electrochemical devices.