Abstract

Poly(vinyl chloride) is a polymer, with very negligible electrical conductivity of the order of 10^{-8} S/cm. In this investigation, PVC has been tried as a host matrix for solvating Li^+ salts. By dissolving PVC with $LiClO_4$, $LiBF_4$ and $LiCF_3SO_3$ in tetrahydrofuran and casting it into thin films, electrical conductivity can be increased by an order of magnitude. Better conducting films can be obtained by increasing the concentration of the lithium salts in the matrix. The film comprising of 70 wt% PVC and 30 wt% salt exhibits the highest room temperature conductivity of 1.63 x 10^{-7} S/cm. A plot of electrical conductivity versus salt concentration shows an increase in conductivity upto a certain salt concentration after which conductivity starts to decrease with salt content. This phenomenon can be attributed to the weak electrolyte theory. Amongst all the salts that were added to PVC, the conductivity was better with $LiClO_4$ because of its good dissociation capability. Further plasticizers such as ethylene carbonate (EC), propylene carbonate (PC) and a combination of both were added to improve the existing value of the conductivity. A value of 3.34 x 10^{-4} was obtained with a concentration of 11.7 wt% PVC, 5 wt% of $LiClO_4$, 13.3 wt% of EC and 70 wt% of PC. Thus the plasticizers provide a pathway for the ions to move in the PVC-salt matrix. A solid state battery was fabricated from the polymer electrolyte film with plasticizers and its characteristics were presented and discussed.