

CHAPTER FIVE

Summary and Conclusions

The FTIR spectroscopy indicated that there was a weak interaction between PEO and Ph_3SnSCN , which was observed from the band shifts of the Sn compound. X-ray diffraction study showed that the polymer electrolytes were semi-amorphous in nature and confirmed the disruption of the crystalline nature of PEO upon interaction with the organotin dopants. The probable reason for the high ionic conductivity in the plasticized polymer electrolyte is that the plasticizer decreased the viscosity of the polymer electrolyte and thereby increasing ionic mobility. The temperature dependent studies for the conductivity showed an Arrhenius pattern. Complex permittivity and electrical modulus studies also support the results of the conductivity studies. The discharge characteristics of the fabricated cells show an open circuit voltage of 0.4V for (Sn/ PEO- Ph_3SnSCN):(EC:PC) ie. 0.90g PEO 0.10g triphenyltin thiocyanate and 0.125g of EC 0.125g PC which gave the highest conductivity.

Alternating current conductivity and studies on the dielectric quantities also seems to support the process of physical diffusion of charged carriers as implied from depressed semicircle in the Cole-Cole plots. The decrease in dielectric constant and losses with frequency also indicate the transport mechanism is due to ion diffusion and polarization.

In the present study of tin complexes Ph_3SnSCN and tetramethyl ammonium dichlorotriphenyl stannate shows VTF nature of the compounds. As the salt is added and its concentration increased, this energy gap seems to decrease inferring that the salt has reduced the energy gap which should facilitate ionic conduction. This is verified from the conductivity versus salt concentration plot, where the conductivity is observed to increase with increasing in salt concentration. On adding more salt, ie. exceeding the amount needed for the maximum conductivity, the conductivity decreases. This has been attributed to the decrease either in mobility or in the number of free charge carriers or both, to the ion-association effect[112] and the increase in crystallinity degree as well.

Almost similar results was obtained for PEO doped with Tetramethyl ammonium dichlorotriphenyl stannate. However, the conductivity was found to be slightly lower than with the other tin compound. X-ray diffraction analysis showed the disruption of the crystalline nature of PEO upon the addition of tetramethyl ammonium dichlorotriphenyl stannate. However from the transference number study it shows the presence of electronic conduction.

Overall, it is seen from the discharge characteristics of batteries fabricated using one of the above polymer electrolytes developed in the present study that their cell capacity is rather low when compared with some current commercial systems. This poor capacity may due to the low ionic conductivity of the polymer electrolyte, high interfacial resistance and the formation of surface layer between the electrode- electrolyte interface. However, further studies are needed to improve the ionic conductivity, and contact at the electrode-electrolyte interface to have a better battery performance. Although the ions are monovalent, doping

with organotin compounds in which tin is incorporated in the cation shows higher conductivity than doping with organotin compounds in which tin is incorporated in the anion.

As a suggestion for further work it might be useful to study the effect of several types of plasticizer with various concentrations on the composition with highest electrical conductivity obtained in this study. By adding the plasticizer, we hope to get higher electrical conductivity at room temperature. This will enable the PEO-salt-plasticizer complexes to be employed sufficiently as a solid electrolyte in the electrochemical cell system. It also suggested to study the effect of cations of similar ionic radius but with different charge as a dopant salt on the electrical conductivity value.