

CHAPTER 9

CONCLUSION AND SUGGESTION FOR FURTHER WORKS

The research work for the present thesis was done with the objective of improving electrical and mechanical stability of solid polymer electrolytes for the applications in lithium ion rechargeable batteries. For this purpose, PEO was chosen to be the host polymer, LiI as the doping salt, Al_2O_3 as fillers and Calix4 arene and Calix6 arenes as organic macromolecules to immobilize the anions. Free-standing solid polymer electrolytes have been successfully developed via the solution casting method. The room temperature conductivity for PEO-LiI system and PEO-LiI- Al_2O_3 system was in the order of $10^{-4} \text{ S cm}^{-1}$. By adding calix arene macromolecules the conductivity decreases to one degree of order due to the complexation of calix arenes with the polymer salt systems. The FTIR, XRD, Impedance measurements, and dielectric studies confirmed the complexation.

From the results of the present work, it can be concluded that;

- ❖ Addition of doping salt LiI and Al_2O_3 inorganic filler enhances the conductivity of PEO polymer electrolyte. This is due to the number density of charge carriers has increased due to the various weight percentages of salt and inorganic fillers.
- ❖ The conductivity of the samples can be affected by amorphousness and crystallinity where the more amorphous and lower crystallinity sample has the higher conductivity and this can be illustrated by XRD and FTIR studies.

- ❖ By adding the Calix4 arenes and Calix6 arenes one at a time, the conductivity value decreases to one order magnitude. The decrease in conductivity of the membrane is due to the decrease in charge carriers concentration due to anion trapping .
- ❖ The complexation of calix4 and calix6 arenes with the PEO-LiI is confirmed by FTIR and XRD studies.

For the future work, the conductivity of the polymer electrolyte should be enhanced as high as 10^{-2} to 10^{-1} S cm⁻¹. There are few ways to follow, in order to make it possible,

- ❖ By introducing a suitable filler to the electrolyte
- Fillers can also increase conductivity and also mechanical strength. Plasticizers reduce mechanical strength. A good combination may lead to high to high conductivity and good mechanical strength.
- ❖ Adding the macromolecules like Calix arenes.

In this study have shown that by adding supra molecular additives like calix arenes immobilize the cations there by improve the electrical properties of solid polymer electrolytes.

For the further studies, the better compatibility of the calix arenes with the polymer host can be attributed to the presence of identical structural units in its molecule leading through the structural modification. Thus, the electrochemical stability of the newly introduced receptor should be analyzed together with the studies of the conducting properties of the obtained membranes.