In association with the rapid progress in size and thickness reduction of electronic devices and development of multimedia industries in recent years, demand has been increasing for small-size electronic devices. Today, it is almost universally accepted that such combination of size and thickness can only be obtained by using non-conventional electrodes and electrolyte materials and that the most promising choices are those based on lithium operating systems. With this situation as the background the small battery market, in terms of lithium systems has grown explosively. The successful achievement of this goal relies on the availability of advanced electrode and electrolyte materials. It is hoped that the polymer battery may reach a stage of development in terms of performance and cost, such that it may replace the common dry cells and Nickel-Cadmium batteries. Thus, the need for a polymer electrolyte has been recognized. Solid-state electrolytes based on the organic polymers can offer the advantage of well-known inorganic systems such as improved redox stability, temperature range, selectivity, absence of leak and dendritic re-crystallization. Another advantage of polymer organic materials is that they can easily accommodate the geometrical variations of the electrode assembly. Poly(ethylene oxide) based complexes were the first solvent free polymer electrolytes to be reported and have therefore received the maximum attention. Due to the search for improved performance, especially with regard to conductivity at room temperature, new complexing polymers have been synthesized. However, a limited number of studies have been made on PVdC-AN based polymer electrolytes. Therefore, the present work is mainly focused on the preparation and characterisation of PVdC-AN based polymer blend electrolytes.
The outline of the present work is summarized in the following chapters.

**Chapter I** provides the general and significant information about polymer electrolytes, theory of ionic conduction and properties of polymer electrolyte constituents. **Chapter II** gives an overview of the status of research in lithium batteries and various types of polymer electrolyte systems. An outline of the scope of the present investigation is provided towards the end of this chapter.

In **Chapter III** material properties, experimental aspects, different methods of preparation of polymer complexes, and characterization studies such as EIS, XRD, FT-IR, TG/DTA, etc. are explained.

**Chapter IV** explains the compositional effect of Poly(vinylidene chloride-co-acrylonitrile) PVdC-AN and Poly(methyl methacrylate) (PMMA) polymers in the presence of Lithium perchlorate. Among various compositions, 50:50 wt.% PVdC-AN:PMMA based electrolyte fulfils the expected properties in the electrochemical point of view.

A detailed description about the comparison of the effect of plasticizer (Ethylene Carbonate) on PVdC-AN and PVdC-AN/PMMA polymer membranes is provided in **Chapter V**. High dielectric constant plasticizer results better dissociation of the salt in the polymer matrix, which increases the number of mobile charge carriers. The better ionic conductivity value has been achieved for the membranes with 80 wt.% of EC into PVdC-AN, and with 60 wt.% of EC into PVdC-AN/PMMA blend.

**Chapter VI** presents about the role of various lithium salts on PVdC-AN/PMMA/EC system. From the electrochemical analysis, the maximum ionic conduction was found for the membrane containing LiAsF$_6$. **Chapter VII** deals with the effects of various plasticizers on PVdC-AN/PMMA/LiClO$_4$ based polymer
complex to identify the suitable plasticizer in terms of high ionic conductivity and thermal stability. The highest room temperature ionic conductivity is achieved for the membrane containing plasticizers, EC and gBL in the PVdC-AN/PMMA/LiClO$_4$ system. The studies showed that the presence of the oxygen group in the plasticizers helps to produce more free ions for conduction and the gel medium provides an extra conduction channel that further enhanced the conduction factor of the polymer electrolyte.

Finally, the summary of the findings on the topic of investigation in a proper perspective is given in Chapter VIII. Further scope to synthesize a new, highly conducting composite polymer electrolyte is also elucidated.