PREFACE

The available energy efficient technology has become more compact for the society because of the readily available energy sources. The battery research has been inspired due to their potential use. Lithium based battery provides high energy density, flexibility and environmental benignity. Even though the employment of polymer electrolytes has been found to know the past three decades, the progress and improvement in technology without environment hazardless is slow. Polymer electrolytes are preferred owing to their high ionic conductivity, mechanical, thermal as well as electrochemical stability.

The poly (vinylidenefluoride-co-hexafluoropropylene) P(VdF-co-HFP) was widely investigated polymer. It has high dielectric constant ($\varepsilon = 8.4$) and semi crystalline in nature. The crystallinity in the polymer backbone provides adequate mechanical strength and amorphous phase provides sufficient conducting nature. Other than this PVdF- co-HFP retains larger quantity of electrolyte solutions.

The recent lithium ion technologies focus on ionic liquids as excellent electrolyte medium. The room temperature ionic liquids are liquid in nature and low melting point solution. Sulfonium cation containing ionic liquids received great attention due to their low viscosity, high conductivity and electrochemical stability. Phosphonium cation based ionic liquids are preferable because of their negligible vapor pressure, high thermal capacity, and wide liquid range.

This thesis is based on the preparation and characterization of polymer electrolytes based on PVdF-co-HFP polymer. Three different cations are used; they are Lithium cation, Sulfonium and Phosphonium cation. The philosophy of this work is summarized in the following chapters.
Chapter 1: This chapter provides clear information about the battery electrolytes. It describes about the fundamental types of battery electrolytes and ionic liquids. This chapter also includes the review of literature, which contain the recent status in the development of polymer electrolytes for the application of lithium batteries. The physical and chemical properties of individual materials used in this thesis are also summarized. Finally, the focused objectives and scope of the research has also been given.

Chapter 2: This chapter briefly pronounces about the preparation of polymer electrolyte using solution casting method. The theory for characterization techniques used in this thesis has also been discussed in detail. The fabrication of coin cell and electrochemical characterization techniques are briefly discussed.
Chapter 3: This chapter encompasses the preparation of metallic salt based polymer electrolyte. Solid gel and composite polymer electrolytes are prepared using the traditional and simple solution casting technique. The physical and electrochemical characterization techniques have been performed and the results are discussed in detail.

Chapter 4: The sulfonium cation based ionic liquid has selected for the preparation of polymer electrolyte in this chapter. This chapter has been divided into three main categories, the first work started with optimization of polymer and ionic liquid, to improve the ionic conductivity performance plasticizers are added in the second work, the third work has been focused on composite polymer electrolyte based on TiO$_2$ dispersoid.

Chapter 5: This chapter discusses about the preparation and characterization of polymer electrolytes based on phosphonium ionic liquids. This chapter has been divided into two parts, the first work was focused on comparison of solid and gel polymer electrolyte. The second part proceeds with TiO$_2$ inorganic filler based composite polymer electrolytes. The obtained results are discussed in detail. The physical and surface morphological and electrochemical performances are presented in a scientific manner.

Chapter 6: This chapter summarizes the results and findings obtained from the experiments and justify the topic of investigation.