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Characterization of PVC/PEMA Based Polymer Blend Electrolytes

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Polymer electrolyte membranes comprising of poly (ethyl methacrylate)/ poly (vinyl chloride), propylene carbonate (PC) as plasticizer and $LiClO_4$ as salt were prepared by solvent casting technique. XRD, FTIR and SEM studies have been made to investigate the structural, complexation and variation in film morphology of the polymer electrolyte. The maximum ionic conductivity value 3.454×10^{-3} S/cm has been observed for PVC (5)-PEMA (20)-PC (67) - $LiClO_4$ (8 wt %) system at 303K using ac impedance spectroscopic technique. Also, the TG/DTA studies showed the thermal stability of the film.

Keywords: Polymer blend; FTIR; XRD; Thermal and conductivity studies

1. INTRODUCTION

In the recent years, there has been a tremendous interest in the preparation of polymer electrolytes with high ionic conductivity, good mechanical strength and thermal stabilities because these polymer electrolytes play a major role in solid-state batteries, electrochromic windows, sensors, fuel cells etc., [1]. Earlier, solution type electrolytes consisted of polymers such as PEO and PPO or their blend complexes with suitable salts ($LiClO_4$, $LiCF_3SO_3$, etc) [2]. However they showed poor room temperature conductivity ($\approx 10^{-8}$ Scm^{-1}). In the past two decades different polymer hosts, such as PMMA [3], PAN [4], PVC [5], PVdF [6] had been studied as the gel-forming polymer matrix. Comparing with other polymer electrolytes, this plasticized or gelled polymer electrolytes possess higher room temperature ionic conductivity of about 10^{-3} Scm^{-1} and could be useful for lithium and lithium-ion battery application.

Poly (vinyl chloride) (PVC) can act as a mechanical stiffener in the electrolyte due to its immiscibility with the plasticizer. A PVC-based polymer electrolyte system plasticized with ethylene carbonate and propylene carbonate has been reported [7] to be applicable to lithium metal and lithium-