

**ELECTRICAL CONDUCTIVITY STUDIES ON PLASTICIZED PEO-
BASED PROTON CONDUCTING ELECTROLYTES**

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ABSTRACT

ELECTRICAL CONDUCTIVITY STUDIES ON PLASTICIZED PEO-BASED PROTON CONDUCTING ELECTROLYTES

In this study, PEO (polyethylene oxide) containing different weight percent of ammonium nitrate (NH_4NO_3) salt were prepared by using solution casting technique. Impedance spectroscopy (IS) technique was carried out to determine the electrical conductivity of the samples. The highest value of electrical conductivity for the optimum weight percent salt of the sample was determined. The highest conductivity for PEO + 5wt% NH_4NO_3 was $1.18 \times 10^{-6} \text{ Scm}^{-1}$. This conductivity was computed using the bulk resistance value which can be retrieved from the complex impedance plot in frequency range between 100Hz and 1MHz. Polyethylene glycol (PEG_{600}), used as plasticizer has been added in different weight percent to PEO- NH_4NO_3 film. Plasticizer was used to enhance the conductivity of the sample by assisting the rate of ion dissociation. The conductivity of the highest conducting sample of plasticized PEO + 5wt% NH_4NO_3 at room temperature was $4.56 \times 10^{-5} \text{ S cm}^{-1}$. The Impedance spectroscopy technique was repeated in for temperature-dependence conductivity using the highest conducting plasticized sample. The highest conductivity of the plasticized PEO + 5wt% NH_4NO_3 obtained was $1.37 \times 10^{-3} \text{ Scm}^{-1}$, measured at 333K.

CHAPTER I

INTRODUCTION

1.1 Background

Electrolyte is a medium that transport ions (electricity) between the positive and negative electrodes in a battery system. In this paper, solid polymer electrolyte was used as the medium between anode and cathode. Polymer electrolyte is a polymer that consists of inorganic salt dissolved in polymer matrixes which can enable ionic conduction in the bulk. The mobile species comes from the inorganic salt detached into cation and anion which play a role in the ionic conductivity. In recent years, solid polymer electrolytes (SPE) have attracted a lot of attention due to their applications as electrolytes in secondary lithium batteries, solid state electrochemical devices like electrochemical sensors and display devices (Wang *et. al*, 2005). Polymer salt complexes have gained technological importance as electrolyte materials for the solid state electrochemical devices such as batteries, fuel cells, electrochromic windows and supercapacitors. Solid polymer electrolyte is good in mechanical strength and ductility, it has high ionic conductivity due to transport of cation and anion charge carriers in a polymer matrix, the membranes were stable for a wide temperature range and it exhibits excellent thermal and mechanical properties. In polymer electrolyte, ionic conductivity is the most crucial factor. Higher ionic conductivity results in higher performance of the polymer electrolyte. Many researches have been done to enhance the ionic conductivity of SPE. Previous