

**CHARACTERIZATION OF PLASTICIZED PEO-BASED PROTON  
CONDUCTING ELECTROLYTES**

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**MAY 2008**

## ACKNOWLEDGEMENT

Alhamdulillah, first of all, I would like to thank Allah S.W.T because with His permission and help, I finally completed my Final Year Project's Thesis, PHY 690, and has successfully submitted on time as planned.

I also would like to express my deepest appreciation to my beloved supervisor, Dr. Muhd. Zu Azhan Yahya for supervising me and his generosity in sharing all his knowledge has help me so much in completing this research thesis.

Not forgotten, thanks to my co-supervisor, En Ab. Malik Marwan Ali, for his constant support, guidance and encouragement in the duration of this study until it is completely done.

I am also fortunate to all my classmates especially my very close and supportive friends, Rashidah Binti Jamaludin, Shafeeza Binti Mohamad Zon, Mas Fiza Binti Mustafa, Ella Yusliana Binti Mohd Yatim and my laboratory members, Tunku Ishak Al-Irsyad Tunku Kudin, Irma and others for their help, full support, idea sharing and co-operation. Without them, this thesis may could not be completed on time.

Besides that, I would like to express my sincere gratitude to my truly loving and caring parents and family members for their advices and motivation during the completion of my 3 years study in UiTM.

Last but not least, a million thanks to all individuals those have helped me directly or indirectly in completing my thesis as scheduled.

Thank you.

NOOR FARADILLA BINTI BUJANG

## ABSTRACT

In this study, polyethylene oxide (PEO) was used as the host polymer with ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) salt as the electrolyte and ethylene carbonate (EC) as the plasticizer. Films of PEO- $\text{NH}_4\text{NO}_3$  and EC plasticized PEO- $\text{NH}_4\text{NO}_3$  were prepared at room temperature. The electrical conductivity of the samples was measured using impedance spectroscopy (IS) and calculated using the bulk resistance obtained from the impedance plot in frequency range of 100Hz and 1 MHz. The film with the highest conductivity has then been conducted temperature dependence studies. In this study, it was found that, the conductivity value of the PEO- $\text{NH}_4\text{NO}_3$  film is  $1.18 \times 10^{-6} \text{ Scm}^{-1}$  at room temperature and this value has increased to  $6.54 \times 10^{-5} \text{ Scm}^{-1}$  when 35wt% of EC plasticizer was added to the film.

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## CHAPTER 1: INTRODUCTION

### 1.1 BACKGROUND

The solid polymer electrolytes are widely used in many electrochemical devices, cells and batteries. They are characterized by high ionic conductivity at room temperature. Preferred polymer electrolytes are cationic conductor, which is flexible, non-tacky and lends itself to economical manufacture in very thin films form.

The solid polymer electrolyte specifically used in this project is polyethylene oxide (PEO), ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) salt dissolved in methanol and ethylene carbonate (EC) as the plasticizer that were added accordingly. The EC is used as the plasticizer to increase the conductivity value of the proton batteries. This study is carried out on the PEO- $\text{NH}_4\text{NO}_3$ -EC system and then being potentially applied to zinc battery.

These thin films prepared were studied on their electrical properties using impedance spectroscopy (IS).

For this present work PEO was chosen as the polymer host, ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) as the salt, methanol as the solvent and EC as the plasticizer. For the proton battery, zinc (Zn) as the anode electrode while manganese (IV) oxide ( $\text{MnO}_2$ ) have been utilized as the cathode electrode.