PREPARATION AND CHARACTERISATION BY IMPEDANCE SPECTROSCOPY OF SiO_2 FILLED PVC-BASED POLYMER ELECTROLYTE SYSTEM

NOR HAZLIZAAINI BINTI BASRI

BACHELOR OF SCIENCE (Hons.) PHYSICS
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

MAY 2007

ACKNOWLEDGMENT

Thankful to all the mighty ALLAH S.W.T, for the blessing all time as I'm try to complete this project assignment. I would like to state on record here in the compilation of this project that I have taken some operation, advice, some portion of writing and reference from many of sources. If due acknowledgment has not been made, I sincerely regret the omission and apologize for the oversight.

I would like to share this happiness with people whose help me all the time and try giving support to me. Firstly I would like to thankful to my Supervisor Pn. Asiah Bt. Mohd Nor and Co-Supervisor Dr. Ri Hanum Bt. Yahaya Subban that be considerations, kindness, thoughtfulness and understanding to me in giving guideline to my proposal which entitle **'Preparation and Characterization by Impedance Spectroscopy of SiO_2 Filled PVC-Based Polymer Electrolyte System'**. They has gives me ideas, guidelines, and advises during the process of completing this project paper. This project attracts my interest to know more about polymer electrolyte.

Secondly, thanks to Research Assistance Cik Rozila Bt. Yusoff who has instructed and taught me in understand the procedure in used equipments in the laboratory. She is also very kindness in providing me the necessary information. I also thank to my friend Norhafiza Bt. Muda whose has same supervisor with me for her good corporation and helps in giving ideals. Last but not least, I'm also want to thank to all that helped and give support to me which directly or indirectly.

CONTENTS

ABSTRACT

Nano-composite polymer electrolyte with PVC as host polymer, Lithium triflate, $LiCF_3SO_3$ as doping salt and silicon dioxide, SiO_2 as filler was studied. Impedance Spectroscopy was used to determine the ionic conductivity at room temperature. The ionic conductivity of pure PVC was 1.04×10^{-10} Scm^{-1}. The addition of $LiCF_3SO_3$ significantly improved the ionic conductivity of PVC. The film with 40 wt% of $LiCF_3SO_3$ showed the highest ionic conductivity of 1.017×10^{-7} Scm^{-1}. The polymer salt composition with the highest conductivity was added with filler, SiO_2 with a various percentage of weight. The ionic conductivity of PVC + $LiCF_3SO_3$ + SiO_2 increased from 10^{-7} to 10^{-5} Scm^{-1}. PVC + $LiCF_3SO_3$ films with 8 wt% of SiO_2 showed the highest ionic conductivity value of 1.070×10^{-5} Scm^{-1}.

CHAPTER 1

INTRODUCTION

1.0 Introduction

Electrolyte is generally regarded as a liquid which contain ions, which can deliver the ions between anode and cathode. In the past there was no objection to this, and there was no need to develop other types of electrolyte. However as electronic devices industry develops very fast, the size of devices are getting smaller and smaller and the power source of these devices; the rechargeable batteries should also develop accordingly. From 1980 there was much effort to develop new batteries which can satisfy the demands of the industry. One of this works is to develop polymer electrolyte suitable for use in rechargeable lithium batteries.

Lithium batteries is widely use nowadays because of its advantages. Some of the advantages are: more stable, long life characteristics and high capacity. Compared with other power sources such as fuel cell and Ni-metal hydrite cell etc, they are turn and compact and not bulky. Furthermore, due to the energy crisis, the demand for renewable energy sources is becoming a national issue due to the ever increasing price of fuel. Solar system had been introduced into world. This technology can reduce dependence on fuel. But the problem is it requires a large space, high cost, and limited usage. Hydroelectric system is another alternative however it depends on high speed of water to