

**IONIC CONDUCTIVITY OF LITHIUM GEL POLYMER ELECTROLYTE  
BASED POLY (METHYL METHACRYLATE) GRAFTED NATURAL  
RUBBER ( MG49 )**

**NUR SABIRAH BINTI AHMAD**

**Final Year Project Report Submitted in  
Partial Fulfillment of the Requirements for the  
Degree of Bachelor of Science (Hons.) Physics  
in the Faculty Applied Sciences  
Universiti Teknologi MARA**

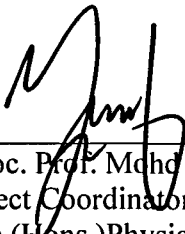
**JULY 2012**

This Final Year Project Report entitled “**Ionic conductivity of Lithium Gel Polymer Electrolyte Based Poly(methylmethacrylate) Grafted Natural Rubber (MG49)**” was submitted by Nur Sabirah Ahmad, in partial fulfillment of the requirements for the Degree of Bachelor of Science (Hons.) Physics, in the Faculty of Applied Science, and was approved by



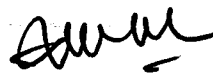
---

Prof Madya Dr Ab Malik Marwan bin Ali  
Supervisor  
B.Sc.(Hons.) Physics  
Faculty Applied Science  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor



---

Assoc. Prof. Mdhd Yusof Theeran  
Project Coordinator  
B.Sc.(Hons.) Physics  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor



---

Prof Madya Dr Ab Malik Marwan bin Ali  
Supervisor  
B.Sc. (Hons.) Physics  
Faculty Applied Science  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor

20 JUL 2012

Date : \_\_\_\_\_

## TABLE OF CONTENTS

	PAGE
ACKNOWLEDGEMENTS	i
TABLE OF CONTENTS	ii
LIST OF TABLES	iv
LIST OF FIGURES	v
LIST OF ABBREVIATIONS	vi
ABSTRACT	vii
ABSTRAK	viii
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem Statement	4
1.3 Objectives	4
1.4 Significance Study	5
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>6</b>
2.1 Polymer	6
2.2 Polymer Electrolytes	6
2.3 Classifications of Polymer Electrolytes	8
2.3.1 Dry Polymer Electrolytes	8
2.3.2 Gel Polymer Electrolytes	9
2.3.3 Composite Polymer Electrolytes	9
2.4 Solid Polymer Electrolytes(SPEs)	10
2.5 Poly(methyl methacrylate)	11
2.6 Plasticizer	13
2.7 Ethylene Carbonate(EC)	14
2.8 Characterization of Gel Polymer Electrolytes	15
2.8.1 Ionic Conductivity	16
<b>CHAPTER 3 METHODOLOGY</b>	<b>17</b>
3.1 Materials	17
3.2 Equipments	17
3.3 Method	17
3.3.1 Preparations of the Sample	17
3.3.2 Preparations of Plasticized Polymer Electrolytes	19
3.4 Experimentation Method	20

3.4.1	Impedance Spectroscopy	20
3.4.2	Fourier Transformation Infrared Spectroscopy	23
3.5	Flowchart of Methodology	24
 <b>CHAPTER 4 RESULT AND DISCUSSIONS</b>		<b>25</b>
4.1	Impedance Spectroscopy Study	25
4.2	Ionic conductivity measurement for Solid Polymer Electrolyte	26
4.2.1	Impedance Spectroscopy on MG49+Lithium Carbonate	28
4.3	Ionic Conductivity for Gel Polymer Electrolytes	29
4.3.1	Impedance Spectroscopy on MG49+Lithium Carbonate+ EC	31
4.4	Fourier Transformation Infrared Spectroscopy	32
4.4.1	Introduction	32
4.4.2	The infrared spectrum of salt Lithium Carbonate	33
4.4.3	The infrared spectrum of pure MG49	34
4.4.4	The infrared spectrum of MG49 –Salt	35
4.4.5	The infrared spectrum of MG49 + Li <sub>2</sub> CO <sub>3</sub> +EC	36
 <b>CHAPTER 5 CONCLUSION AND RECOMMENDATION</b>		<b>38</b>
5.1	Conclusion	38
5.2	Recommendation	39
 <b>REFERENCES</b>		<b>40</b>
<b>APPENDICES</b>		<b>42</b>
<b>CURRICULUM VITAE</b>		<b>47</b>

## ABSTRACT

### **IONIC CONDUCTIVITY OF LITHIUM GEL POLYMER ELECTROLYTE BASED POLY (METHYL METHACRYLATE) GRAFTED NATURAL RUBBER ( MG49 )**

MG49 is a natural rubber grafted with 49% poly (methyl methacrylate). Gel polymer electrolytes containing MG49-  $\text{Li}_2\text{CO}_3$  -EC were prepared by solution cast technique. Alternating current electrochemical impedances spectroscopy was employed to investigate the ionic conductivity of the electrolytes film at 27°C and the analysis showed that the addition of EC plasticizer has increased the ionic conductivity up to  $5.84 \times 10^{-8}$  S/cm. The polymer-salt complexes were investigated using Fourier Transformed Infrared Spectroscopy to study the interactions between lithium ions and MG49 polymer host. The representation of infrared spectra of pure MG49 and MG49-salt complexes with various concentrations of salted can be observed that when lithium carbonate was added to MG49, Vibrational spectra data reveals that symmetrical carbonyl group (C=O) in MG49 – salt stretch at  $1727.45 \text{ cm}^{-1}$ .