

**INVESTIGATION ON ELECTROCHEMICAL PROPERTIES OF
CARBON NANOTUBES-GRAPHITE COMPOSITE AS ANODE
MATERIAL IN LITHIUM ION BATTERY**

DZULIEZA HALIB

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

NOVEMBER 2008

ACKNOWLEDGEMENTS

Assalamualaikum w.b.t

In the name of Allah, the Most Merciful and the Almighty.

Thanks to Allah S.W.T for giving me strength and good health to finish this study on time in order to fulfill the requirement for this course. Upon completion of this project, I would like to express my thankfulness to many parties who helped me a lot in carrying out this project. My gratitude goes to my dedicated supervisor, Dr. Muhd Zu Azhan Yahya and my co-supervisor, Dr. Ab. Malik Marwan Ali for their guidance and kindness in coaching me throughout this project. Without their guide and encouragement, I believed this study could not be completed.

Special thanks to Tunku Ishak Al-Irsyad Tunku Kudin and Kevin Alvin Eswar who are very kind in teaching and guiding me to complete this project. Not to forget, to my beloved parents who continually giving me morale supports in many ways. Last but not least, I also want to thank all my friends for their helping and supporting.

Finally, thank you to whoever involved directly and indirectly throughout finishing this project. I am thankful and blessed.

Dzulieza Halib

TABLE OF CONTENTS

	Page
TITLE PAGE	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	ix
ABSTRACT	x
ABSTRAK	xi
CHAPTER 1 INTRODUCTION	
1.1 Background	1
1.2 Objectives of Study	2
1.4 Significances of Study	3
CHAPTER 2 LITERATURE REVIEW	
2.1 Lithium Batteries	4
2.1.1 Concepts of Lithium Ion Battery	5
2.2 Components in Lithium Ion Batteries	6
2.2.1 Anode Materials	6
2.2.2 Cathode Materials	7
2.2.3 Electrolyte Materials	11
2.3 Graphite Composites as Anode Materials	14
2.3.1 Graphite-Si Composites	14
2.3.2 Graphite-Sn Composites	16
2.3.3 Graphite-CNT-Si Composites	17
CHAPTER 3 METHODOLOGY	
3.1 Materials and Equipments	20
3.1.1 The lists of chemicals used	20
3.1.2 The lists of materials used	20
3.1.3 Equipments	20
3.2 Experimental Procedures	21
3.3 Preparation of Samples	21

ABSTRACT

ELECTROCHEMICAL PROPERTIES OF CARBON NANOTUBES-GRAPHITE COMPOSITE AS ANODE MATERIAL IN LITHIUM ION BATTERY

CNTs-graphite composite is used as an active anode material in lithium ion battery. The electrochemical properties of the anode material are characterized by variety of techniques. A literature review summarizes the findings of anode, cathode and electrolyte materials in lithium ion battery. The composite is prepared by method of ball milling. For battery fabrication, we use a method of coin cell assembly. A few apparatus and techniques need to be operated in order to determine the electrochemical characteristic of the composite including the cyclic voltammetry and charge discharge cycle. This composite shows a good cycling performance with also good cycle ability. Almost all the samples showed the capacity at the first cycle of 400 mAh/g. However, the average capacity is quite low while the capacity lost was a bit high.

CHAPTER 1

INTRODUCTION

1.1 Background

Lithium ion (Li-ion) battery is one of many types of battery. It is a rechargeable battery where lithium ion intercalates from the anode to the cathode during discharge and from the cathode to the anode when charging. Li-ion battery has good energy-to-weight ratios, no memory effect, and a slow loss of charge when not in use. The three primary functional components of a lithium ion battery are the anode, cathode, and electrolyte. Those components may use variety of materials. The voltage, capacity, life and safety of a lithium ion battery can be change depending on the material for those components.

Lithium ion batteries have an anode material into which lithium inserts. Many researchers reported on various new materials for electrochemical lithium insertion properties. The most popular material for the anode in lithium ion battery is graphite because it has good compatibility with most electrolyte solvents and desirable potential profile for Li-ion intercalation. Graphite also provides good cycle life, safety as well as much cheaper. However, the lithium ion battery based of graphitic anode provides a low capacity at 372 Ah/kg (based on the weight, 339 Ah/kg, referring to LiC_6) which is below the required capacity as compared to the high demand of high energy and power density.