

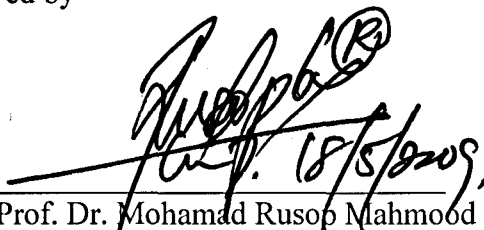
**SURFACE MORPHOLOGY STUDIES OF CARBON  
NANOTUBES PREPARED BY THERMAL-CVD OF PALM OIL**

**HELENA LIMBANG**

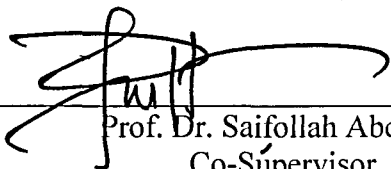
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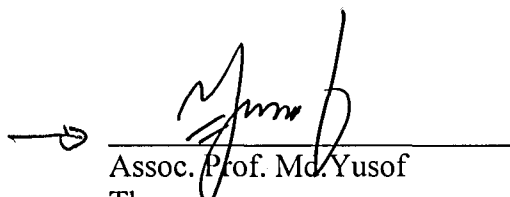
This Final Year Project Report entitled "Surface Morphology of Carbon Nanotubes Prepared by Thermal-CVD of Palm Oil" was submitted by Helena Anak Limbang, in partial fulfillment of the requirements for the Degree of Bachelor of Science (Hons.) Physics in the Faculty of Applied Sciences and was approved by



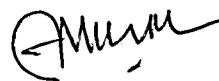
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## TABLE OF CONTENTS

	<b>Page</b>
<b>ACKNOWLEDGEMENT</b>	<i>iii</i>
<b>TABLE OF CONTENTS</b>	iv
<b>LIST OF FIGURES</b>	vii
<b>LIST OF ABBREVIATIONS</b>	x
<b>ABSTRACT</b>	xi
<b>ABSTRAK</b>	xii
<b>CHAPTER 1 INTRODUCTION</b>	
1.1 Background	1
1.2 Properties of Carbon Nanotubes( CNTs)	
1.2.1.1 Electrical Conductivity	3
1.2.1.2 Strength and Elasticity	4
1.2.1.3 Thermal Conductivity and Expansion	4
1.2.1.4 High Aspect Ratio	5
1.3 Application of CNTs	5
1.4 Significant of study	6
1.5 Objective of study	7
1.6 Problem statement	7

## ABSTRACT

### SURFACE MORPHOLOGY STUDIES OF CARBON NANOTUBES PREPARED BY THERMAL-CVD OF PALM OIL

Carbon nanotubes (CNTs) were produced on silicon (Si) substrate prepared by Thermal-CVD method using  $C_{55}H_{96}O_6$  (Palm Oil) as a starting material. Catalyst has been prepared by dissolving Nickel (II) nitrate,  $Ni(NO_3)_2 \cdot 6H_2O$  and ethyl alcohol,  $C_2H_5OH$ . Then, the catalyst was stir using magnetic stirrer for one day to dissolve the mixture. Mixture was drop on silicon by using spin coater. The parameter of the catalyst is different temperature. By using Thermal-CVD, samples were penetrated using  $NH_3$  (argon) gas at a temperature  $700-900^\circ C$  for catalyst and  $450^\circ C$  for palm oil. CNTs product were also characterized by using Field Emission Scanning Electron Microscopy (FESEM) and Fourier Transform Infrared Spectroscopy (FTIR). The size and type of catalysts will affect the morphology and yields of CNTs. CNTs growths were depending on the location of catalyst on Si substrate. FESEM was used to study the surface morphology and uniformity of CNTs while FTIR used to study the chemical properties. Based on FESEM measurement, at the lower temperature, CNTs were found in form of clusters. At the higher temperature of  $800$  to  $900^\circ C$ , there was yielded amorphous carbon surrounding CNTs and CNTs were not fully growth on Si substrate. Most uniform CNTs were found at temperature  $700^\circ C$ . The range of FTIR analysis is  $450$  to  $4500cm^{-1}$ . FTIR analysis shows that the characteristic vibrational modes of CNT,  $C=C$  apparent at peak  $1451$  to  $1599cm^{-1}$ . Peak at  $1109 cm^{-1}$  is consistent with  $C-N$  stretching vibrations due to catalyst. A study was observed that the CNTs were produced at peak  $1451cm^{-1}$ .