

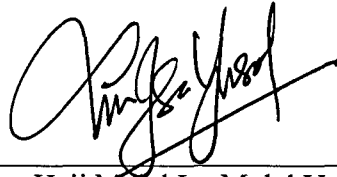
**SYNTHESIS AND CHARACTERISATION OF THE CERAMIC
SUPERCONDUCTOR IN THE $(\text{Ti,Cu})(\text{Sr,Yb})_2\text{CaCu}_2\text{O}_{7-\delta}$ SYSTEM**

NOOR SYARWANA BINTI ZAKARIA

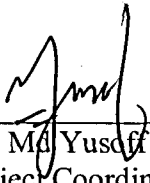
**Final Year Project Report Submitted in Partial Fulfilment of the
Requirements for the Degree of Bachelor of Science (Hons.) Physics
in the Faculty of Applied Sciences Universiti Teknologi MARA**

MAY 2008

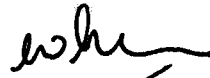
This Final Year Project Report entitled “Synthesis and Characterisation of the Ceramic Superconductor in the $(\text{Tl,Cu})(\text{Sr,Yb})_2\text{CaCu}_2\text{O}_{7.8}$ System” was submitted by Noor Syarwana binti Zakaria, in partial fulfillment of the requirements for the Degree of Bachelor of Science (Hons.) Physics, in the Faculty of Applied Sciences, and was approved by



Tuan Haji Mohd Isa Mohd Yusof
Supervisor
B.Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
40450 Shah Alam
Selangor



PM Md Yusoff Theeran
Project Coordinator
B.Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
40450 Shah Alam
Selangor



Dr. Muhd Zu Azhan Yahya
Head of Programme
B.Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
40450 Shah Alam
Selangor

Date: 22/5/08

ACKNOWLEDGEMENTS

Special praises and blessing to the Almighty ALLAH s.w.t, for the guidance, strength and courage from HIM in the accomplishment of this final year project. During this time, there were many barriers and difficulties that I had to face. Nevertheless, with the cooperation and support from the people around me, I could finally accomplish my final year project successfully.

First of all I would like to express my gratitude to my supervisor, Tuan Haji Mohd Isa Mohd Yusof for giving me this opportunity to do my final year project on superconductor. I would like to thank Master's student, Nurulhuda binti Ahmad who had taught and help me a lot during the completion of my project.

I would also like to take this opportunity to thank to my family and my friends who gave me a lot of support. Not to forget special thanks to the laboratory assistants at the laboratory material engineering, Faculty of Mechanical Engineering and Faculty of Chemical Engineering.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	xi
ABSTRACT	xii
ABSTRAK	xiii
CHAPTER 1 INTRODUCTION	
1.1 Background and problem statement	1
1.2 Significance of study	3
1.3 Objectives of study	4
CHAPTER 2 LITERATURE REVIEW	
2.1 The History of Superconductor	5
2.2 The Theory of Superconductor	7
2.3 Properties of superconductors	9
2.3.1 Critical temperature	9
2.3.2 Meissner Effect	11
2.3.3 Critical magnetic field	13
2.3.4 Critical current density, J_c	13
2.4 Types of Superconductors	14
2.4.1 Type I Superconductor	14
2.4.2 Type II Superconductor	16
2.5 Applications of Superconductors	17
CHAPTER 3 METHODOLOGY	
3.1 Samples preparation	19
3.1.1 Preparation of the precursor $(\text{Sr}_{1.8}\text{Yb}_{0.2})\text{CaCu}_2\text{O}_{7.8}$	19
3.1.2 Preparation of the superconductor pellets	20
3.2 Samples Characterization Methods	23
3.2.1 The critical temperature, T_c	23
3.2.2 The resistivity at room temperature	24
3.2.3 X-ray Diffractometer (XRD)	24
3.2.4 Scanning Electron Microscope	24
3.3 The Apparatus and Equipments	25

ABSTRACT

SYNTHESIS AND CHARACTERISATION OF THE CERAMIC SUPERCONDUCTOR IN THE $(\text{Tl,Cu})(\text{Sr,Yb})_2\text{CaCu}_2\text{O}_{7-\delta}$ SYSTEM

Samples with compositions of $(\text{Tl}_{1-y}\text{Cu}_y)(\text{Sr}_{1.8}\text{Yb}_{0.2})\text{CaCu}_2\text{O}_{7-\delta}$ ($y=0.0$ to 0.6) have been prepared and characterized using conventional solid-state synthesis method. Results of critical temperature (T_c) measurements, room-temperature resistivity measurements, powder X-ray diffraction (XRD) analysis, and microstructure investigation using scanning electron microscope (SEM) are presented. Temperature dependent electric resistance measurements on the series showed that the normal state behavior and superconducting properties can be controlled by adjusting Cu concentration. For the series, normal state resistance changes from metallic behavior ($y=0.0-0.4$) to semi-metallic behavior ($y=0.5$) and insulating behavior ($y=0.6$). $T_{c\text{ zero}}$ gradually increased from 53.9 K ($y=0.0$) to a maximum value of 83.6 K at $y=0.4$ before decreasing with further Cu substitution. Powder X-ray diffraction patterns showed all samples consists of major 1212 phase and minor 1201 phase. The effects of Cu substitutions are discussed in terms of T_c , T11212 phase formation and the concept of average copper valence.