

EFFECT OF ANNEALING TEMPERATURE ON COPPER OXIDE THIN FILMS USING
SOL-GEL METHOD AND SPIN COATING TECHNIQUE

This thesis is presented in partial fulfilment for the award of the
Bachelor of Engineering (Hons) Electronics Engineering
UNIVERSITI TEKNOLOGI MARA
MALAYSIA



SITI FARHANIZA BINTI ABD SAMAT (2010640198)
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR, MALAYSIA

ACKNOWLEDGMENT

Bismillahirrahmanirrahim...

Alhamdulillah and all praises to Allah S.W.T, The Most Merciful and The Most Merciful for the strength and giving me an opportunity to complete my final year project and the entire research.

First of all, I would like to take this opportunity to acknowledge on the contribution to those who played the important role in helping me to fulfill the entire requirement and completing this project. Without their assist, this final year project cannot be complete in the given of time.

The most appreciation that I would like to express my gratitude is my supervisor, Dr Hashimah bt Hashim and not to forget Pn Shafinaz Sobihana Bt Sharifudin who is kindly and patiently guided me from the beginning until the end. Their opinions, suggestions and advices are most important things that always improve my performance in this project. All the assist from them are deeply appreciated.

Besides, I also want to sincerely thanks to all my lecturers at Faculty of Electrical Engineering for their full effort, patience, and guidance in teaching me during my learning process at Universiti Teknologi Mara (UiTM).

I also would like to express my greatest appreciation to all my friends and family especially my father Abd Samat bin Abd Rahman and my mother, who have supported in giving ideas and suggestions for this project. Lastly, for those who have directly or indirectly contributed in this project, thank you so much

ABSTRACT

Copper (II) Oxide or Cupric Oxide (CuO) is the higher oxide of copper. As mineral, it was known as tenorite. This thesis was studied the effect of annealing temperature on CuO thin films. The measurement was performed on electrical properties, optical properties and its surface topology. The CuO solution was prepared by using sol-gel method. Meanwhile, the deposition process of thin films using spin coating technique. Then, the thin films were synthesized at various temperatures in the range of 500°C until 700°C deposited onto the quartz substrates in a hot chamber furnace. The time taken for the process was about 45 minutes at a time. The general appearances of the thin films were uniform and brownish black in color after they were annealed. The measurements were performed by atomic force microscopy (AFM), photoluminescence (PL), surface profiler (SP), two point probe technique and Ultraviolet-visible (UV-Vis-NIR) spectrometer. The equipments of AFM, PL, SP, two point probe and UV-Vis was measured the surface topology, the emission of energy, the thickness of the thin films, the electrical properties and the optical properties respectively. According to the results of the overall research, the electrical properties was measured that the electrical conductivity increasing with the increasing annealing temperatures. All the experimental works were conducted according to the proposed procedure. Besides, the documented data proved all the expectations and theories related to the objectives.

TABLE OF CONTENTS

DECLARATION.....	iii
ACKNOWLEDGEMENT.....	iv
ABSTRACT.....	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	ix
LIST OF TABLES	xi
LIST OF ABREAVIATIONS	xii
1.0 INTRODUCTION.....	1
1.1 BACKGROUND RESEARCH.....	1
1.2 PROBLEM STATEMENT	3
1.3 OBJECTIVE	4
1.4 SCOPE OF WORK.....	5
1.5 SIGNIFICANT OF WORK	5
1.6 THESIS ORGANIZATION.....	6
2.0 LITERATURE REVIEW	7
2.1 NANOTECHNOLOGY.....	7
2.2 MATERIAL.....	9
2.2.1 COPPER OXIDE	9
2.2.2 (POLY)ETHELENE GLYCOL	11
2.3 SOL-GEL METHOD.....	11
2.4 THIN FILM DEPOSITION METHOD.....	14
2.4.1 SPIN COATING TECHNIQUE.....	15
3.0 EXPERIMENTAL METHOD.....	18
3.1 INTRODUCTION.....	18
3.2 SUBSTRATE PREPARATION	18

CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

Nanotechnology is defined as the study to make and use of structures between one nanometer and 100 nanometers in size. Nanotechnology shortened to “nanotech” is the study of atoms and a molecular structure [1]. It involves physics, chemistry and biology as well as engineering. A nanostructure is an object of intermediate size between molecular and microscopic structures [1-3].

The differentiation between the numbers of dimensions on the nanoscale is the way to described nanostructure. The main theme that characterizes the nanotechnology is the control of matter on a scale smaller than one micrometer as well as the fabrication of such particles [4]. The particles at this stage exhibit change in the properties which include greater material strength, enhanced reactivity and high conductivity.

Copper oxide thin films are semiconductor which is used as an active layer in various types of solar cells and a passive layer in solar selective surfaces [1]. Copper forms two well known oxides; cuprous oxide (Cu_2O) and tenorite (CuO) [2]. The investigation of the variation of annealing temperature of CuO thin film by sol-gel method can be used many different methods for preparation of copper oxide thin films like dip coating, spin coating, chemical vapor deposition, electrochemical deposition, sputtering, and spray pyrolysis [5].