

THE CHARACTERIZATION OF COPPER OXIDE (CuO) WITH
DIFFERENT MOLAR CONCENTRATION USING SOL-GEL
SPIN-COATING METHOD

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ABSTRACT

In this research, the Copper oxide (CuO) thin films were deposited on 500um quartz substrates. The CuO thin films widely used in technological field such as sensors, solar cell fabrication, and electrochemical devices. The objectives of this research were to deposit the CuO thin films using spin-coating technique and to study the effects of different molar concentration of the CuO thin films on the structural, thickness, optical and electrical properties. The molar concentration of CuO solutions used were 0.3M, 0.35M, 0.4M, 0.45M and 0.5M that prepared using sol-gel method. These solutions were formed by dissolving copper acetate in isopropanol, diethanolamine and polyethyleneglycol. Then, the solutions were stirred using a hot plate stirrer for ten minutes before deposition process. The CuO solutions with different concentration were formed in the dark blue. The samples were deposited by spinning the quartz substrate on spin coater by dropping the CuO solution. All samples were annealed at 600°C for 1 hour in a furnace. The electrical properties were measured to check their resistivity by two point probe technique. The electrical measurements showed that current increase when the concentration increase. High electrical conductivity of 0.07S/m of CuO thin films were performed at molar concentration of 0.5M. The high concentration can conduct more electricity in the electronic devices. The minimum resistivity about 12.76Ω.m has been obtained at molar concentration of 0.5M. The thicknesses were performed using the surface profiler while the surfaces morphology were characterized using Field Emission Scanning Electron Microscopy (FESEM). The films surfaces were smooth and uniformly distributed grains. The optical transmittances were measured using UV-Vis spectrometer and they decrease as their concentration increase. The optical band gap of the CuO thin films were measured to be between 1.51eV and 1.9eV. The molar concentration of thin film should be taken into consideration in order to get the best thin films for the devices.

TABLE OF CONTENT

TITLE	ii
APPROVAL	iii
DECLARATION	iv
ACKNOWLEDGEMENT.....	v
ABSTRACT	vi
TABLE OF CONTENT.....	vii
LIST OF FIGURES	x
LIST OF TABLE	xii
LIST OF ABBREVIATIONS	xiii
Chapter 1.....	1
1.1 Background Study	1
1.2 Problem Statement.....	2
1.3 Objectives.....	2
1.4 Scope Of Work And Limitation.....	3
1.5 Significant Of Study	3
1.6 Thesis Overview	4
Chapter 2.....	5
2.1 Cuo Thin Film.....	5
2.1.1 Structure Of Cuo	6
2.1.2 Thin Films.....	6
2.2 Cuo Deposition Method	7
2.2.1 Spin Coating	7

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND STUDY

In the past decades, CuO thin films widely used in many technological fields to investigate their potential applications such as solar cell fabrication [1], semiconducting sensor [2, 3], electrochemical devices [4] and photovoltaic material [5]. CuO is I-IV compound semiconductor in periodic table and it is important because of high in optical absorption [6, 7], high electrical conductivity [8], non toxic environment [9] and less cost production. CuO is a p-type semiconductor with band gaps between 1.21 and 2.1eV. The possibility of low cost production methods and the good electrochemical properties make CuO to be one of the best materials for electrical, optical, sensing and so forth. Optical thin films have recently attracted significant interest because of their potential applications in electronics, optics, and photonics.

Recently, many methods were reported to fabricate the CuO thin films. CuO thin films were prepared using several deposition techniques including chemical vapor deposition [10], RF magnetron sputtering [11], spray-pyrolysis [12], vacuum evaporation [13], electro-deposition [14] and etc. In this research, sol-gel method was used as technique to fabricate CuO thin film. The spin-coating method was chosen to fabricate CuO thin film because of it easily to use and inexpensive [15].