

**SPUTTERING PRESSURE AND OXYGEN RATIO DEPENDENCE
OF ZINC OXIDE THIN FILMS DEPOSITED ON TEFLON
SUBSTRATE**

**Thesis presented in partial fulfilment for the award of the
Bachelor of Engineering (Hons) Electronic
Of
UNIVERSITI TEKNOLOGI MARA**



**MUHAMMAD SANUSI BIN ADNAN
FACULTY OF ELECTRICAL ENGINEERING
40450 SHAH ALAM, SELANGOR DARUL EHSAN
MALAYSIA
JULY 2012**

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim, in the name of Allah s.w.t, the Most Merciful and the Most Beneficent.

Alhamdulillah. Thanks to Allah s.w.t. for the strength and blessing through the entire time until to complete this Final Year Project which is title Sputtering Pressure Dependence of Zinc Oxide Thin Films Deposited on Teflon Substrate.

Firstly, I would like to express a special gratitude to my supervisor, Dr. Sukreen Hana Binti Herman for the valuable information, suggestions and guidance in the compilation and preparation this project.

Acknowledgement is extended to my senior, Pn. Nur Sa'adah Binti Muhamad SaukiI for her constant help, support and advice provided to me throughout the study for the completion and success of this project. Then I would like to take this opportunity to express my appreciation the laboratory facilities that provided by Faculty of Electrical Engineering and Institute of Science, Universiti Teknologi MARA, Shah Alam.

Deepest thanks and appreciation to our parents, family, and others for their cooperation, encouragement, constructive suggestion and full of support for the report completion, from the beginning till the end. Also thanks to all of our friends and everyone, those have been contributed by supporting my work and help myself during the thesis writing till it is fully completed.

Last but not least, we would also like to thank our classmates who have helped us in prepare this thesis. Their generosity and assistance are greatly appreciated.

ABSTRACT

This project studied on the characteristics of the Zinc Oxide (ZnO) thin films deposited onto polytetrafluoroethylene (teflon) substrate by using radio frequency (RF) magnetron sputtering technique. The effects of deposition pressure and percentage of oxygen, O₂ ratio on the structural, optical and electrical properties of ZnO thin film were investigated. The sputtering pressure was varied from 5, 10, 13, to 15 mTorr and the O₂ ratio 0 %, 10 %, 20 %, and 30 %. The structural, optical, and electrical properties of the film were investigated by Field Emission Scanning Electron Microscopy (FESEM) and X-ray Diffraction (XRD) with *CuK α* radiation, JASCO UV-VIS/NIR Spectrophotometer, and Current Voltage (I-V) Measurement respectively. The surface morphology reveals that deposited ZnO consists of nanoparticles. The thickness and deposition rates of thin films were decreased with increasing pressure and O₂ ratio. The crystal structure at 0 % of O₂ ratio has the highest peak compared to others percentage of oxygen. Also, the thin films showed the optical transmittance between range 45 % to 85 %. Optical measurements indicate the existence of band gap allowed optical transition with corresponding energy gap in the range of 3.28 - 3.34 eV. The deposition of ZnO thin films at different percentage of O₂ gave more effects compared to the deposited ZnO thin films as shown in the results observed.

TABLE OF CONTENTS

DECLARATION	iii
DEDICATION	iv
ACKNOWLEDGEMENT	v
ABSTRACT	vi
TABLE OF CONTENTS	vii
LIST OF FIGURES	x
LIST OF TABLES	xii
LIST OF ABBREVIATIONS	xiii
CHAPTER 1	1
INTRODUCTION	1
1.1 BACKGROUND OF STUDY	1
1.2 PROBLEM STATEMENT	3
1.3 OBJECTIVE	3
1.4 SCOPE OF WORK	3
1.5 ORGANIZATION OF THESIS	4
CHAPTER 2	5
LITERATURE REVIEW	5
2.1 ZINC OXIDE (ZNO)	5
2.2 PROPERTIES OF ZNO	6
2.2.1 Structural and Physical Properties	6
2.2.1.1 Crystal Structure	6
2.2.1.2 Direct and Wide Band Gap	7
2.2.2 Optical Properties	8
2.2.2.1 Large Exciton Binding Energy	8
2.2.2.2 Strong Luminescence	8
2.2.3 Electrical Properties	9

CHAPTER 1

INTRODUCTION

This chapter describes about the overview of this project. There are five sections within this chapter. First section is about the background of study for this project. Section two discusses about the problem statement and followed by the third section which is the objectives that are related to this project. The scope of work for this project was explained in the fourth section. Lastly, the organization of thesis is described in the last section of this chapter.

1.1 BACKGROUND OF STUDY

Zinc oxide (ZnO) is naturally an n-type compound semiconductor with wide direct band gap (3.37eV) [1, 2] of the II-VI semiconductor group with a hexagonal wurtzite crystal structure [3]. It has large exciton binding energy (60meV) at room temperature [2-4] larger compared to Zinc Sulfide (ZnS) and Gallium Nitride (GaN) which is 20meV [5] and 26meV [6] respectively. The advantage of ZnO over GaN is availability of high bulk single crystal and the ability to allow the devices work at and above room temperature [7]. Recently, ZnO thin films have many remarkable characteristics and are attracting great attentions. ZnO is a semiconductor that has several properties including good transparency, high electron mobility, and strong room temperature luminescence [8, 9].

Generally, ZnO thin films deposited on flexible substrate have some qualities including more rugged, thinner, and light weight. In particular, it is also easy to bend and high resistant to impact damage which is for favorable optical and electrical qualities [4,