

UNIVERSITI TEKNOLOGI MARA

**DEPOSITION AND
CHARACTERIZATION OF ZnO THIN
FILMS ON TEFLON SUBSTRATES**

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ABSTRACT

Although zinc oxide has been researched extensively for a wide variety of applications, studies on ZnO thin films deposition on polymer substrates are rarely reported. On the other hand, migrations of electronic devices from silicon and glass substrates to wearable and flexible polymer are extensively progressing, thus there is a need to study extensively the deposition of ZnO on polymer substrates. In our work, exploration of deposition methods of ZnO on Teflon substrate has been investigated. The thin film depositions have been carried out by using three methods, which are sol-gel spin coating method, sol-gel dip coating method and RF magnetron sputtering method. The physical structures of the thin films were observed by using field emission scanning electron microscope (FESEM), and X-ray diffractometer (XRD) was used to investigate the crystallinity of the thin film. The electrical properties were examined using 2-point probe current-voltage (I-V) measurement, and the optical properties were studied by using UV-Vis-NIR spectrophotometer for transmittance and photoluminescence (PL) spectrometer to investigate the luminescence properties. Through the investigations, we found that the ZnO thin films deposited by sputtering method gave the best results compared to the sol-gel methods, suggesting that RF magnetron sputtering is the suitable method to deposit ZnO thin films on the Teflon substrate. Further investigation on the optimization of sputtering parameters has been done. From the characterization results, it was found that the ZnO thin films deposited at 200 W and 5 mTorr of sputtering pressure shows the best electrical properties. The deposited ZnO thin films at optimum parameter show the highest conductivity, $4.41 \times 10^{-2} \text{ Sm}^{-1}$ and lowest resistivity, $2.27 \times 10^1 \text{ }\Omega\text{m}$. This was supported by the crystalline quality of the films from the XRD results. The ZnO thin films deposited at the optimum parameters was tested for humidity and gas sensor applications using ammonia gas and humidity chamber. It was found that the thin film deposited in this work was more sensitive to ammonia gas compared to the humidity.

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TABLE OF CONTENTS

	Page
AUTHOR'S DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	xi
LIST OF ABBREVIATIONS	xiv
CHAPTER ONE: INTRODUCTION	
1.1 Research Overview	1
1.2 Problem Statements	2
1.3 Objectives	3
1.4 Scope of Works	3
1.5 Organization of Thesis	4
CHAPTER TWO: LITERATURE REVIEW	
2.1 Introduction	5
2.2 Zinc Oxide	5
2.3 Deposition Methods	7
2.3.1 Sol-gel Method	7
2.3.2 Sputtering Method	9
2.4 Chapter Summary	10
CHAPTER THREE: METHODOLOGY	
3.1 Introduction	12
3.2 Teflon Substrates Cleaning Technique	12
3.3 Deposition of ZnO Thin Films by Sol-gel Method	13
3.3.1 Preparation of ZnO Sol-gel Solution	14

3.3.2	Deposition of ZnO Films by Sol-gel Spin Coating Method	15
3.3.3	Deposition of ZnO Films by Sol-gel Dip Coating Method	15
3.4	Deposition of ZnO by RF Magnetron Sputtering	17
3.5	Characterizations of ZnO Thin Films	19
3.5.1	Structural Properties	19
3.5.1.1	X-Ray Diffractometer (XRD)	19
3.5.1.2	Crystallite Size Calculation	21
3.5.1.3	Strain and Stress	21
3.5.1.4	Surface Morphology Characterization	22
3.5.2	Electrical Properties	23
3.5.2.1	Resistivity and Conductivity	24
3.5.2.2	Film Thickness	25
3.5.3	Optical Properties	25
3.5.3.1	Optical Transmittance	25
3.5.3.2	Photoluminescence (PL) Spectrofluorometer	26
3.6	Characterization Related To The Applications of Deposited ZnO Thin Films	27
3.6.1	Humidity Sensor Measurements	27
3.6.2	NH ₃ Measurement	27
3.7	Chapter Summary	27

CHAPTER FOUR: GROWTH OF ZnO THIN FILM ON TEFLON SUBSTRATE

4.1	Introduction	29
4.2	Deposition of ZnO Film on Teflon Substrate by Sol-gel Spin Coating Method	29
4.2.1	Structural Properties	30
4.2.1.1	Thickness	30
4.2.1.2	Surface Morphology	31
4.2.1.3	XRD Patterns	33
4.2.2	Electrical Properties	34
4.2.3	Optical Properties	36
4.2.3.1	Optical Transmittance	36