

	<i>page</i>
Abstract	i
Acknowledgements	iii
Contents	v
List of Figures	vii
List of Tables	ix
List of Symbols	x
List of Abbreviations	xi

Chapter 1: INTRODUCTION

1.1	Multifunctional Materials and Devices	1
1.2	Multifunctional Binary Metal Oxides	2
1.3	Multifunctional Ternary Metal Oxides	3
1.4	Motivation	5
1.5	Objective	5
1.6	Thesis Layout	6

Chapter 2: Literature Review

2.1	ZnO: A Multifunctional Material	7
	2.1.1 Crystal Structure	7
	2.1.2 Mechanical and Electrical Properties of ZnO	9
	2.2.3 Defects	9
	2.1.4 Optical Properties	13
	2.1.5 Deposition Techniques	14
	2.1.6 Nanostructures	18
	2.1.7 Devices	20
2.2	BiFeO ₃	23
	2.2.1 Crystal Structure and General Information	23
	2.2.2 Properties	24
	2.2.3 BFO Structures and Deposition Techniques	26
	2.2.4 Devices	31
	2.2.5 BFO Based RRAM	36
2.3	Characterization Techniques	37
	2.3.1 X-Ray Diffraction (XRD) Technique	37
	2.3.2 Scanning Electron Microscopy (SEM)	38
	2.3.3 Energy Dispersive X-Ray Spectroscopy (EDS)	38
	2.3.4 Atomic Force Microscope (AFM)	39
	2.3.5 UV-Vis Spectrophotometer	39
	2.3.6 Raman Spectroscopy	40
	2.3.7 Photoluminescence (PL)	40
	2.3.8 Electrical and Impedance Characterization	41

Chapter 3: Identified Issues/Gaps and Possible Solutions

3.1	Issues/Gaps of ZnO	43
3.2	Issues/Gaps of BFO	46
3.3	Approach	46

Chapter 4: Zn Interstitial Defects and Their Contribution as Efficient Light Blue Emitters in Zn Rich ZnO Thin Films

4.1	Introduction	47
4.2	Experiments	48
4.3	Results and Discussions	49
	4.3.1 Structural and Microstructural	49

4.3.2	Optical Analysis	52
4.3.3	Electrical Characterization	54
4.4	Conclusion	56
Chapter 5: Improved Rectification Behavior of ZnO Nanorods Homojunctions by Suppressing Li Donor Defects Using Li-Ni Co-doping		
5.1	Introduction	57
5.2	Experiment	58
5.2.1	Seed Layer Deposition	59
5.2.2	Preparation of Zn _{0.98} Li _{0.02} O And Zn _{0.96} Li _{0.02} Ni _{0.02} O Nanorods	59
5.2.3	Synthesis of Homojunctions Structures	59
5.3	Result And Discussion	59
5.3.1	Structural and Microstructural Characterization of Nanorods and Homojunctions	60
5.3.2	Optical Characterization	61
5.3.3	Electrical Characterization of Homojunctions	62
5.4	Conclusion	67
Chapter 6: Light Emitting Diode and UV Photodetector Characteristics of Solution Processed n-ZnO nanorods/p-Si Heterostructure		
6.1	Introduction	69
6.2	Experimental Details	70
6.3	Result and Discussion	70
6.3.1	Structural and Microstructural Properties	70
6.3.2	Optical Properties	71
6.3.3	Current –Voltage Characteristics	72
6.4	Conclusion	73
Chapter 7: Robust and Non-volatile Bipolar Resistive Switching in Sol-gel Derived BiFeO₃ Thin Films		
7.1	Introduction	75
7.2	Experimental Details	76
7.3	Results and Discussion of The Fresh Device	76
7.3.1	Structural and Microstructural Analysis	76
7.3.2	Optical Analysis	77
7.3.3	Electrical Analysis	77
7.4	Conclusion	81
Chapter 8: Interfacial Layer Assisted, Forming Free, and Reliable Bipolar Resistive Switching in Solution Processed Al/BiFeO₃/FTO		
8.1	Introduction	83
8.2	Experiment	83
8.3	Results and Discussion	84
8.3.1	Structural Aand Microstructural	84
8.3.2	Optical Characterization	85
8.3.3	Electrical Characterization	85
8.4	Conclusion	90
Chapter 9: Conclusion and Future Aspects		
	References	93