

Contents

<u>Acknowledgements</u>	VII
<u>Content</u>	IX
<u>List of Figures</u>	XIII
<u>List of Tables</u>	XVII
<u>Abbreviations</u>	XIX
<u>PREFACE</u>	XXI
Chapter 1:Introduction and Literature Review	
1.1 Introduction.....	1
1.2 Different application Area of low operating voltage TFT.....	2
1.3 Important components of TFT.....	4
1.4 Different Device architectures of TFT.....	5
1.5 Working Principle of TFT.....	7
1.6 TFT Characterization and Extraction of important parameters.....	8
1.6.1 Mobility of TFT Devices.....	11
1.6.2 On/Off ratio of TFT Device.....	12
1.6.3 Subthreshold swing of TFT Device.....	12
1.6.4 Threshold voltage of TFT Device.....	13
1.7 High-k dielectric for low operating voltage TFT.....	13
1.8 Selection paradigm of High-k Dielectric.....	16
1.9 Oxide Perovskite as Gate Dielectric for Thin-Film Transistors.....	18
1.10 Metal Oxide Semiconductors.....	21
1.10.1 N-Type Oxide Semiconductors.....	22
1.11 Solution-Processed Thin Film Transistors.....	28
1.12 Scope and Objective of Present Work.....	35
Chapter 2:Experimental Section: Material Synthesis & Characterization, Device Fabrication and characterization.	
2.1 Material preparation.....	41
2.1.1 Preparation of Pb _{0.8} Ba _{0.2} ZrO ₃ Dielectric.....	42
2.1.2Preparation of SrTiO ₃ Dielectric-.....	42
2.1.3 Preparation of BaTiO ₃ Dielectric.....	43
2.1.4 Preparation of Li ₂ SnO ₃ Dielectric.....	43
2.1.5 Preparation of bilayer TiO ₂ /Li ₂ SnO ₃ bilayer Dielectric.....	44
2.2 Preparation of IZO Semiconductor.....	44

2.2.1 Preparation of SnO ₂ Semiconductor.....	45
2.3 Fabrication of TFT Device.....	45
2.3.1 Fabrication of IZO TFTs with Pb _{0.8} Ba _{0.2} ZrO ₃ as a dielectric.....	47
2.3.2 Fabrication of SnO ₂ TFTs with SrTiO ₃ as a dielectric.....	47
2.3.3 Fabrication of SnO ₂ TFTs with BaTiO ₃ as a dielectric.....	48
2.3.4 Fabrication of SnO ₂ TFTs with bilayer TiO ₂ /Li ₂ SnO ₃ as a dielectric.....	49
2.4 Material Characterization.....	50
2.4.1 Thermal Gravimetric Analysis (TGA).....	50
2.4.2 XRD Analysis.....	51
2.4.3 UV-Visible Spectroscopy for optical Analysis.....	51
2.4.4 Atomic force microscopy for surface roughness analysis.....	52
2.4.5 Leakage current density measurement.....	52
2.4.6 Capacitance-frequency (C-f) measurements.....	53
2.4.7 Thin film transistor characterizations.....	54
Chapter 3: Solution-processed Pb _{0.8} Ba _{0.2} ZrO ₃ as a gate dielectric for low-voltage metal-oxide thin-film transistor	
3.1 Introduction.....	57
3.2 Results and Discussion.....	59
3.2.1 Thermal Analysis.....	59
3.2.2 Structural properties of the powder of (Pb _{0.8} Ba _{0.2})ZrO ₃	60
3.2.3 Optical properties of (Pb _{0.8} Ba _{0.2})ZrO ₃ thin films.....	61
3.2.4 Surface Morphology.....	61
3.3 Device characterization.....	62
3.4 Conclusion.....	67
Chapter 4: Solution-processed SrTiO ₃ thin film as Gate dielectric of SnO ₂ thin film transistor	
4.1 Introduction.....	71
4.2 Thin film transistor (TFT) Fabrication.....	72
4.3 Result and Discussion.....	74

4.3.1 Thermal Analysis.....	74
4.3.2 Structural Analysis of the Thin Film and Powder of STO Dielectric	75
4.3.3 Optical Properties of Dielectric SrTiO ₃ Thin Films.....	76
4.3.4 Surface Morphology of SrTiO ₃ and SrTiO ₃ /SnO ₂ Thin Films.....	77
4.3.5 Capacitance and Electrical Measurements of SrTiO ₃ Thin Film.....	78
4.4 Thin Film Transistor Characterization.....	80
4.5 Conclusion.....	82

Chapter 5: Application of sol-gel derived BaTiO₃ thin film as gate dielectric of SnO₂ thin film transistor

5.1 Introduction.....	87
5.2 Device Fabrication.....	88
5.3 Result and Discussion.....	89
5.3.1 Thermal analysis.....	89
5.3.2 Structural properties of BaTiO ₃ powder.....	90
5.3.3 Optical Properties of Dielectric BaTiO ₃ Thin Films.....	91
5.3.4 Surface morphology.....	92
5.4 Device characterization.....	93
5.5 Conclusion.....	96

Chapter 6: Solution-processed low operating voltage SnO₂ thin film transistor by using Li₂SnO₃ gate dielectric.

6.1 Introduction.....	99
6.2 Thin film device fabrication.....	100
6.3 Result and discussion.....	102
6.3.1 Thermal analysis.....	102
6.3.2 Structural analysis.....	103
6.3.3 Optical properties of dielectric thin films.....	104
6.3.4 Dielectric and Electrical Characterizations.....	105
6.4 Thin Film Device characterization.....	107

6.5 Conclusion.....	111
Chapter 7: Conclusion and scope for Future work	
7.1 Conclusion.....	115
7.2 Scope for Future Work.....	117
References.....	119
List of Publications.....	131