

## Table of Contents

Dedication.....	iii
Acknowledgements.....	iv
Deceleration .....	vi
Abstract.....	vii
List of Figures .....	xiii
Chapter 1 Introduction.....	1
1.1 Aternate Energy Sources.....	1
1.2 Thermoelectricity .....	2
1.3 Organic Semiconductors .....	3
1.4 Motivation to the Present Work .....	4
1.5 Dissertation Objectives .....	4
1.6 Dissertation Outline.....	5
1.7 References .....	7
Chapter 2 Theory and Literature Survey .....	8
2.1 Introduction to Thermoelectricity .....	8
2.1.1 Seebeck Effect .....	8
2.1.2 Peltier Effect .....	10
2.1.3 Thomson Effect.....	11
2.2 Thermoelectric Measurements .....	13
2.3 Improvement of $ZT$ .....	15
2.4 Organic Semiconductors .....	17
2.4.1 Charge Transport in Organic Semiconductors.....	17
2.5 Junction Diodes .....	17
2.5.1 Thermionic Emission Theory .....	18
2.6 References .....	21
Chapter 3 Materials and Methods.....	23
3.1 Materials.....	23
3.2 Film Preparation.....	23

3.3	Characterization Techniques .....	24
3.3.1	Scanning Electron Microscopy .....	24
3.3.2	UV-Visible NIR Spectroscopy .....	26
3.3.3	Fourier Transform Infra-red Spectroscopy .....	26
3.3.4	Raman Spectroscopy.....	27
3.3.5	Four-point Probe Method.....	28
3.3.6	Seebeck Measurement Setup .....	30
3.4	Device Fabrication .....	31
3.4.1	Vacuum Thermal Evaporator.....	31
3.5	Current-Voltage Characteristics.....	33
3.6	References .....	35
Chapter 4	High Seebeck Coefficient in Solution-Grown PbS Films.....	36
4.1	Introduction .....	36
4.2	Experimental .....	37
4.2.1	Film Preparation.....	37
4.2.2	Characterization .....	38
4.3	Results and Discussions .....	38
4.3.1	Scanning Electron Microscopy.....	38
4.3.2	UV-Vis NIR Spectroscopy .....	40
4.3.3	Estimation of Optical Band gap.....	41
4.3.4	Sheet Resistance and Electrical Conductivity.....	43
4.3.5	Thermoelectric Power or Seebeck Coefficient .....	43
4.4	Conclusions .....	45
4.5	References .....	46
Chapter 5	Thermoelectric properties of CNT/ PEDOT:PSS system.....	49
5.1	Introduction .....	49
5.2	Experimental .....	51
5.2.1	Film Preparation.....	51

5.2.2	Characterization .....	51
5.3	Results and Discussions .....	52
5.3.1	Scanning Electron Microscopy .....	52
5.3.2	Raman Spectroscopy.....	53
5.3.3	UV-Vis NIR Spectroscopy .....	55
5.3.4	Sheet resistance .....	55
5.3.5	Seebeck coefficient .....	56
5.4	Conclusions .....	57
5.5	References .....	58
Chapter 6	Electrical Characterization of Al/CoPc/p-Si/Al Heterojunction.....	60
6.1	Introduction .....	60
6.2	Experimental .....	61
6.2.1	Synthesis .....	61
6.2.2	Device Fabrication and Characterization.....	62
6.3	Results and Discussion.....	63
6.3.1	UV-Vis NIR Spectroscopy .....	63
6.3.2	Estimation of Optical Band gap.....	64
6.3.3	Current-Voltage Characteristics.....	65
6.3.4	Cheungs' Function Method.....	69
6.3.5	Norde's Function Method .....	71
6.3.6	Mobility Measurement.....	73
6.4	Conclusions .....	75
6.5	References .....	76
Chapter 7	Electrical characterization of Al/CoPc/n-Si/Al heterojunction.....	81
7.1	Introduction .....	81
7.2	Experimental .....	82
7.2.1	Synthesis .....	82
7.2.2	Device Fabrication and Characterization.....	83

7.3	Results and Discussions .....	84
7.3.1	Atomic Force Microscopy .....	84
7.3.2	Current-Voltage Characteristics.....	86
7.3.3	Cheungs' Function Method.....	89
7.3.4	Mobility Measurement.....	92
7.3.5	Effect of Light on Current-Voltage Characteristics.....	94
7.3.6	Comparison of Results With Literature .....	95
7.4	Conclusion.....	96
7.5	References .....	97
	Conclusions.....	101
	Future Work .....	102