

CONTENTS

List of Figures	i-ii
List of Tables	iii

Chapter 1	Page No
Introduction	1.1-1.14
1.1 Dye-sensitized solar cell	1.1
1.1.1 Structure and working principles	1.2
1.1.2 Details of different parts of Dye-sensitized solar cell	1.3
1.1.3 Advantages and applications of DSC	1.5
1.2 Solid state Dye-sensitized solar cell	1.6
1.2.1 Working principles	1.6
1.2.2 Advantages and applications of SDSC	1.8
1.3 Nanomaterials	1.8
1.3.1 Titanium dioxide	1.8
1.3.2 Zinc oxide	1.9
1.3.3 TiO ₂ -ZnO composite	1.11
1.3.4 Polyaniline (PANI)	1.11
1.4 Objective and Research plan	1.12
1.4.1 Objective	1.12
1.4.2 Research plan	1.13
Chapter 2	
Experimental	2.1-2.10
2.1 Introduction	2.1
2.2 Methods for synthesis of TiO ₂ nano-material	2.1
2.3 Sol-gel method	2.2
2.4 Materials	2.5
2.5 Synthesis route	2.5
2.5.1 Preparation of titania nanomaterials	2.5
2.5.2 Preparation of zinc-oxide nanoparticles	2.5
2.5.3 Preparation of TiO ₂ -ZnO composite nanomaterials	2.6
2.6 Synthesis of polyaniline (PANI)	2.7
2.6.1 Methods for PANI synthesis	2.8
2.6.1.1 Chemical synthesis	2.8
2.6.1.2 Electrochemical synthesis	2.8
2.7 Materials	2.9
2.8 Synthesis of PANI	2.9
2.9 Conclusion	2.10

Chapter 3

Characterization of materials	3.1-3.18
3.1 Introduction	3.1
3.2 Characterization techniques	3.1
3.2.1 X-ray diffraction(XRD)	3.1
3.2.2 Scanning electron microscopy (SEM)	3.3
3.2.3 UV-Vis diffuse reflectance spectra (UVDRS)	3.4
3.2.4 Energy dispersive X-ray analysis (EDAX)	3.5
3.2.5 Photoluminance (PL)	3.6
3.2.6 Fourier Transform Infrared Spectroscopy (FTIR)	3.9
3.3 Results and discussion	3.10
3.4 Conclusion	3.19

Chapter 4

Fabrication and Testing of Solar Cell	4.1-4.11
4.1 Introduction	4.1
4.2 Materials	4.1
4.3 Fabrication procedure	4.2
4.4 Proposed cell structure	4.5
4.5 Characterization	4.5
4.6 Testing	4.7
4.6.1 Results and discussion	4.7
4.7 Conclusion	4.11

Chapter 5

Conclusion	5.1-5.1
5.1 Conclusion	5.1
5.2 Future Scope	5.1

References

APPENDIXES

List of Figures

Figure No.	Title	Page No.
Figure: 1.1	Different layers of dye-sensitized solar cell	1.2
Figure: 1.2	Principle of operation of DSC	1.3
Figure: 1.3	Structure of solid state dye-sensitized nanocrystalline TiO ₂ solar cells	1.7
Figure: 1.4	Structures of (a) anatase, (b) rutile and (c) brookite	1.9
Figure: 1.5	Structure of (a) cubic rocksalt, (b) cubic zinc blende, and (c) hexagonal wurtzite. Shaded gray and black spheres denote Zn and O atoms, respectively	1.10
Figure: 1.6	Leucoemeraldine base	1.12
Figure: 1.7	Pernigraniline base	1.12
Figure: 1.8	Emeraldine base	1.12
Figure: 1.9	Overview of research plan	1.13
Figure: 1.10	Schematic representation of the work plan using PERT diagram	1.14
Figure: 2.1	Flow diagram of a typical sol-gel process	2.4
Figure: 2.2	Flow chart of preparation of ZnO	2.6
Figure: 2.3	Flow chart of preparation of ZnO-TiO ₂	2.7
Figure: 2.4	Flow chart of preparation of PANI	2.10
Figure: 3.1	Diffraction of the X-ray from consecutive layers of atomic crystal	3.2
Figure: 3.2	Principle of EDX	3.6
Figure: 3.3	Depiction of the mechanism of production of photoluminescence spectra	3.8
Figure: 3.4	XRD of TiO ₂	3.10
Figure: 3.5	XRD of ZnO	3.11
Figure: 3.6	XRD of TiO ₂ -ZnO (10:1)	3.11
Figure: 3.7	XRD of PANI	3.12
Figure: 3.8	SEM micrograph of TiO ₂	3.13
Figure: 3.9	SEM micrograph of ZnO	3.13
Figure: 3.10	SEM micrograph of TiO ₂ -ZnO	3.13
Figure: 3.11	SEM micrograph of PANI	3.13

Figure: 3.12	UV-DRS spectra and Optical band gap calculation of TiO ₂	3.13
Figure: 3.13	UV-DRS spectra and optical band gap calculation of ZnO	3.14
Figure: 3.14	UV-DRS spectra and optical band-gap calculation of TiO ₂ -ZnO (10:1)	3.14
Figure: 3.15	UV-DRS spectra and Optical band gap calculation of PANI	3.15
Figure: 3.16	EDAX spectra of ZnO	3.16
Figure: 3.17	EDAX spectra of TiO ₂ -ZnO (10:1) nano-composite	3.16
Figure: 3.18	EDAX spectra of PANI	3.16
Figure: 3.19	PL spectra of different samples at an excitation wavelength of 350nm	3.17
Figure: 3.20	FTIR spectrum of TiO ₂ , ZnO and Ti-Zn nano-composite	3.18
Figure: 3.21	FTIR spectrum of PANI	3.19
Figure: 4.1	Chemical Structure of N719 dye	4.1
Figure: 4.2	Absorption spectrum of the dye	4.1
Figure: 4.3	Absorption spectrum of TiO ₂ film	4.2
Figure: 4.4	Absorption spectrum of TiO ₂ -ZnO film	4.2
Figure: 4.5	Absorption spectrum of TiO ₂ film before and after loading dye	4.3
Figure: 4.6	Absorption spectrum of TiO ₂ -ZnO film before and after loading dye	4.3
Figure: 4.7	Absorption spectrum of PANI film	4.4
Figure: 4.8	Fabricated Solid-state dye sensitized solar cell	4.5
Figure: 4.9	Current-Voltage characteristics of a Solar Cell	4.6
Figure: 4.10	I-V characteristic of Solar Cell 1	4.7
Figure: 4.11	I-V characteristic of Solar Cell 2	4.8
Figure: 4.12	I-V characteristic of Solar Cell 3	4.9
Figure: 4.13	I-V characteristic of Solar Cell 4	4.10

List of Tables

Table No.	Title	Page No.
Table: 3.1	Crystalline size of the synthesized material	3.12
Table: 3.2	Band gap of the synthesized materials	3.15
Table: 4.1	Proposed architecture of Solar Cells	4.4
Table: 4.2	Characteristics of different fabricated Solar Cell	4.10