CONTENTS

CHAPTER - I

General Introduction and Motivation 1 - 24

1.1 Introduction 1

1.2 Thin solid films and nanomaterials 4

(a) Thin solid films 4

(b) Nanomaterials 6

1.3 II-VI Semiconductor and its importance 8

1.4 Importance of Cadmium Telluride and Cadmium Sulphide as a material and their review 10

(a) Cadmium Telluride (CdTe) 10

(b) Cadmium Sulphide (CdS) 11

1.5 Motivation of the present investigation 13

References 16

CHAPTER - II

Various methods of film deposition and characterization 25 - 58

2.1 Introduction 25

2.2 Various methods of deposition of thin film 28

Chemical deposition 29

Physical deposition 29

Examples of physical deposition other deposition processes 29

2.3 Methods of deposition of nanomaterials 32

2.4 Substrate selection and substrate cleaning 34

2.5 Various characterization methods 36

2.5 (a) Optoelectronic technique 36

2.5 (b) Structural characterization and size determination by X-ray optics 39

Introduction 39

Theoretical Consideration of Determination of Structural Parameters 41

Lattice Parameters 42

Grain size 44
(a) For Thin Film
(b) For nanocrystalline film

2.5 (c) Characterization by optical absorption spectroscopy
2.5 (d) Characterization by Optical emission spectroscopy
   (Photoluminescence)
2.5 (e) Characterization by Fourier Transform Infrared
   Spectroscopy (FTIR)
2.5 (f) Morphological characterization by SEM and AFM

References

CHAPTER - III
Optoelectronic characterization of CdTe thin films
3.1 Introduction
3.2 Experimental
3.3 Results and Discussion
  3.3.1 Spectral Response
  3.3.2 Variation of photosensitivity with ambient temperature
  3.3.3 Transient photoconductivity
3.4 Conclusion
  References

CHAPTER - IV
Growth and optical characterization of CdS thin films
4.1 Introduction
4.2 Growth of CdS thin film by chemical bath
  4.2.1 Chemical Bath Deposition
  4.2.2 Etching of the films
  4.2.3 Adhesion test
  4.2.4 Thickness measurements
4.3 Various characterization methods
  4.3.(a) Characterization by X-ray optics
     1. Grain size
     2. Lattice parameters and density

References
4.3.(b) Characterization by optical absorption spectroscopy
(Optical absorption and band gap estimation) 97

4.3.(c) Characterization by optical emission spectroscopy
(Photoluminescence) 102

4.3.(d) Morphological characterization 103

4.4 Conclusion 107

References 109

CHAPTER - V
Synthesis and characterization of nanocrystalline CdS thin film
embedded in PVA matrix. 113-163

5.1 Introduction 113

5.2 Synthesis of nanocrystalline CdS/PVA solution and thin film 114
5.2.1 Solution preparation 114
5.2.2 Film preparation 119

5.3 Various characterization methods 119
5.3 (a) Characterization by x-ray optics 119
5.3 (a).1 Phase Identification 119
5.3 (a).2 Lattice constant 123
5.3 (a).3 Grain size 126

5.3 (b) Characterization by optical absorption spectroscopy 129
5.3 (b).1 Optical absorption studies 129
5.3 (b).2 Band gap estimation 133
5.3 (b).3 Size calculation from Noninteracting particle model 136

5.3 (c) Characterization by optical emission spectroscopy
(Photoluminescence) 138

5.3 (d) Characterization by Fourier Transform Infrared Spectroscopy (FTIR). 143

5.3 (e) Morphological Characterization - by SEM and AFM 146
SEM Observation 146
AFM Observation 149
5.4 Role of substrate in formation of nanocrystalline CdS film 150
5.4(a) Introduction and Experimental 150
5.4(b) XRD Observation 151
5.4(c) Optical absorption studies 153
5.4(d) Morphological characterization 155

5.5 Conclusion 157
References 160

CHAPTER - VI
General conclusion and scope for future works 164-167

List of paper presentation, publication and workshop attended