

PREFACE

Among the II-VI group of semiconductors, CdSe, is considered as an important material for the development of different optoelectronic devices. In recent years much importance has been given to the investigation of optoelectronic and structural properties of II-VI family of semiconductors including CdSe to explore their device applicability potentials. The present research work includes an in depth experimental study on the optoelectronic properties and corresponding structural characterization of thermally evaporated thin polycrystalline CdSe thin films under different ambient conditions. The complete research work is presented in five different chapters.

Chapter I. General Introduction

This chapter includes

- (i) a brief discussion on thin semiconductor films and their optoelectronic properties with special emphasis on CdSe thin films.
- (ii) a brief outline of different methods for deposition of thin films with some essentials of physical vapour deposition - thermal evaporation technique.
- (iii) a brief review of the some of the works done so far by different workers on CdSe thin films.
- (iv) the motivation of the present research work on CdSe thin films.

Chapter II. Equipments used and Details of the Experimentals

The method followed and different equipments used, for preparation and analysis of CdSe thin films are elaborated in this chapter. The chapter includes

- (i) an outline of deposition technique of CdSe thin films and suitable electrodes in order to obtain a gap type cell configuration.
- (ii) a brief description of the vacuum coating unit, cleaning process of substrates, preparation of mask and the way of thickness measurement.

(iii) the description of the photoconductivity measurement equipments, noise minimizing setup and a brief outline for the arrangement for XRD, XRF, SEM, EDAX and spectro-photometric studies of CdSe thin films.

Chapter III. Structural Characterization of CdSe Thin Films

In polycrystalline CdSe thin films different structural parameters like grain size, lattice constant etc of the films are quite dependent of different deposition parameters like substrate temperature, thickness etc. Besides these, there are other micro structural imperfections in polycrystalline CdSe thin film samples, which influence the optoelectronic properties of the films to large extent. Therefore the structural characterization of the films becomes very important. This chapter includes

(i) the details of the X-Ray Diffraction (XRD) technique used for the structural analysis of CdSe thin films deposited at different substrate temperatures. .

(ii) studied report of the variation of the some of the structural parameters like lattice constant, grain size, average strain etc in the CdSe thin films deposited at different substrate temperatures.

(iii) reports of XRF, SEM and EDAX analysis on the CdSe thin films.

Chapter IV. Optoelectronic Properties of CdSe Thin Films

Indepth experimental study of the optoelectronic properties is presented in this chapter. The following studies are under taken for this purpose.

(i) The nature of thin film and electrode contact was confirmed both under dark and monochromatic as well as white light illuminations, considering their I-V characteristics curves.

(ii) The conduction mechanism was found to be ohmic at low field regions and of Poole-Frenkel type at high field regions. In this case the experimentally observed corresponding Poole-Frenkel coefficients were larger than their theoretical values.

(iii) In order to asses the contribution of the defects to the photoconduction mechanism of the CdSe thin films, the variation of photocurrent was observed with the intensity of illuminations for both monochromatic as well as white light.

(iv) From the study of temperature dependence of conductivity both at dark and under illuminations of monochromatic as well as white light, the transport mechanism for the considered CdSe thin films, was found to be a double activated process

Chapter V. Spectral Response, Rise and Decay of Photocurrents and Optical Properties

The results of the following studies are reported in this chapter.

(i) For different CdSe thin film samples variation of photocurrent versus wavelength of monochromatic light was observed which yields the spectral response characteristics curves.

(ii) The rise and decay curves for photocurrents were studied and from the photocurrent decay curves under white and monochromatic illuminations of different intensities trap depth analysis of CdSe thin films were undertaken.

(iii) In polycrystalline CdSe thin films mobility activation process of photo generated carriers were studied and it was found that grain boundary potential barriers were modified by intensity of illuminations.

(iv) From transmittance and absorbance spectra, the study of optical properties of the CdSe thin film samples were under taken. From the analysis of this study some of the optical parameters (absorption coefficient, refractive index and extinction coefficient) are reported in this chapter.

A list of related references is included at the end of each of the chapters.

Kangkan Sarmah
31.01.08

(Kangkan Sarmah)
Department of Physics,
Gauhati University,
January, 2008