X-Ray Diffraction of Multilayer CdS/Polyaniline Thin Films

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Abstract— *In the present investigation, the films of Cadmium Sulphide and Polyaniline have been prepared by vacuum Evaporation Technique. The growth and characterization of single layer and multilayer films have been done. In this paper, the study of X-Ray diffraction of multilayer CdS/Polyaniline thin films has been done.*

Keywords— *Polyaniline, Cadmium sulphide, X-ray diffraction,*

I. INTRODUCTION

The sulphide semiconductors are one of the most extensively investigated semiconductor in thin film form and a large variety of deposition techniques have been utilized to obtain solar cells. The Cadmium sulphide films grown by vacuum evaporation technique has been used as gas sensors for detection of oxygen and with a direct band gap it serve as a window material for heterojunction solar cells.

Sharma, R.P. et al, [2,3] showed that CdS / polyaniline composite thin films can form tunable band gap hetero structure with vacuum evaporation CdS thin film on to glass substrate. Jayachandran, M. et al,[4] prepared Polyaniline layers onto porous structure by in-situ electro-deposition and showed photoluminescence at room temperature with a maximum current density 20 mA/Cm^2, a possibility of Polyaniline as ohmiccontact.Schlamp, M.C. et al, [5] demonstrated improved efficiency in LED's made with CdS and CdSe core / shell type nanocrystal incorporated in semiconducting polymers. Advincula, R.C et al, [1] reported improvement in performance of LED's which incorporated Polyaniline coated on to ITO glass polyelectrolyte layer for heterostructure.N.F. Foster et al,[6] prepared the polycrystalline CdS films and found that the structural, electrical and optical properties of vacuum coated thin films of Cadmium Sulphide are very sensitive to the deposition conditions e.g. the degree of vacuum, the rate of deposition, the substrate temperature and the subsequent heat treatment. He also found that the CdS films have excess of Cadmium owing to the dissociation of CdS during evaporation, and concluded that the stoichiometry can be restored by code positing Sulphur together with CdS.

The Porous structure was prepared on P-Si single crystal wafers by anodizing route at low current densities. They also gave the X-R-D studies which indicate that an optimum pore size is found at this anodizing condition and the crystal structure is cubic. They observed porous structure using SEM Hitachi 530011. The (I-V) study also gives both porous silicon surface and porous silicon surface coated with Polyaniline. The result shows the polyaniline incorporation into the pores which is capable of making good electrical contact for device applications.

II. SAMPLE PREPARATION OF CDS

The film of CdS was prepared on to highly cleaned glass as well metallic substrate held at room temperature in a vacuum of order of 10^{-5}torr, using vacuum evaporation technique & CdS powder (99.99% purity) was evaporated at about 200°C from a deep narrow mouthed molybdenum boat. The glass substrate was cleaned in aquaregia washed in distilled water and isopropyl alcohol (IPA). The substrate was kept in a closed box with accuracy to avoid the dust particle on surface.

III. STRUCTURAL PROPERTIES

X-Ray Diffraction:-

The X-ray-diffraction of the sample gives the valuable information about the nature and structure of the film.The X-ray diffractogram of different samples have been used to characterize the sample of vacuum deposited CdS on glass and Pani on to same CdS/Glass as shown in fig. (1) and fig. (2). of the sample CdS/Glass indicates the amorphosity of the film with occasional crystallization.

It can also be illustrated from the fig. (1) that for CdS/Glass sample X-ray intensity of the hexagonal (100) reflection peak is stronger in comparison to (110) reflection. The thin film of CdS has a high degree of preferred crystallographic orientation. The characteristics strong peak at (2θ = 24.9°) correspond to the (100) plane, other peak can be seen at ($2\ \theta$ = 44°) correspond to p hexagonal (110) reflection.

IV. CHARACTERIZATION OF CDS AND PANI ON CDS FILM

The prepared films have been subjected for different characterization;In this paper structural properties.

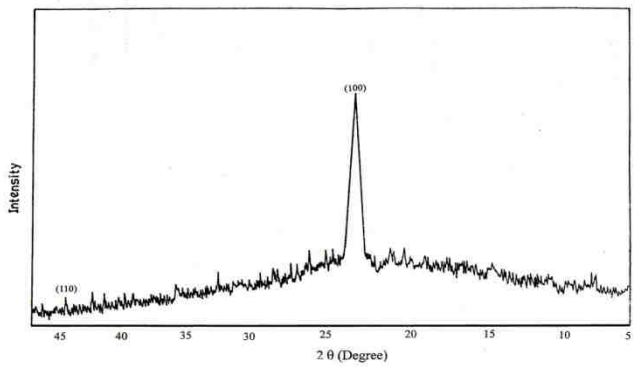

Fig.1 X-Ray diffraction pattern of CdS/Glass thin films

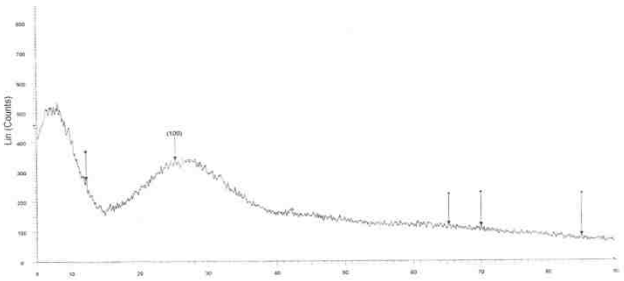

Fig.2 X-Ray diffraction pattern of Pani/CdS/Glass multilayer thin films

V. RESULT AND DISCUSSION

In the present work the thin film of CdS has a high degree of preferred crystallographic orientation. The sample of CdS on glass substrate exhibits preferred orientation correspond to (100) reflection, while in case of Pani/CdS/Glass, the preferred orientation with The X-R-D of the sample gives the valuable information about the nature and structure of the film. The X-R-D pattern indicates the preferred orientation which is important part in structural characterization. Hexagonal wurtzitestructure.The XRD pattern of CdS on glass indicates the amorphosity of the film with occasional crystallization.

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