"Optical and photoconductivity properties of $Cd_xPb_{1-x}S$ thin films"

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Abstract:
In present work $Cd_xPb_{1-x}S$ thin films were grown by simple solution growth technique. Prepared thin films were analyzed by different techniques. The effect of x composition on the d optical band gap studied were conducted using UV spectroscopy. The results are discussed and interpreted.

Keywords: $Cd_xPb_{1-x}S$ thin films**,** chemical bath deposition and electrical properties.

1 Introduction

The $Cd_xPb_{1-x}S$ thin films were prepared on glass substrates using chemical bath deposition techniques. This heterostructure of firmly adherent films is useful for solar absorbers solar devices control and other important applications. The chemical bath deposition is relatively inexpensive, simple, convenient for large area deposition. Various semiconducting materials have been prepared by the solution growth technique [1-3]. Since the exact measurement can give the accurate value of p^H of solution.

Cadmium lead sulphide (CdPbS) is a semiconducting material. Several researchers have been reported on it. In the present study, we have prepared $Cd_xPb_{1-x}S$ thin films with varying concentration on a glass substrate by chemical bath deposition (CBD) technique in an alkaline medium.

2. Preparation of $Cd_xPb_{1-x}S$ thin films

First 0.5M solution of Cadmium sulphate, 1M solution of Lead acetate, 0.5M solution of Thiourea was prepared.After preparing the solution, cadmium sulphate (0.5M) was taken in beaker.After lead acetate (1M) solution was added in that beaker. The solution was stirred and 2-4 ml of triethanolamine was added into the beaker.The solution was stirred continuously by using stirrer for few minutes and subsequently added the liquor ammonia until the solution was cleared. The solution of Thiourea (0.5M) was then added into a beaker. The resultant solution was stirred for few minutes. The beaker was placed in to the constant temperature bath.The pH was measured and it was in between 9.8 to 10.30.

As synthesized $Cd_xPb_{1-x}S$ thin films were annealed in vacuum at 225^0C for 1hr and referred as sample D1, D2 and D3.Solution composition of Cadmium sulphate,Lead acetate and Thiourea were tabulated in table 1.

Table 1: Measurement of chemical composition of Cadmium sulphate, Lead acetate and Thiourea.

Sample No.	Cadmium sulphate (ml)	Lead acetate (ml)	Thiourea (ml)	Composition
D1	9	1	10	$Cd_{0.9}Pb_{0.1}S$
D2	5	5	10	$Cd_{0.5}Pb_{0.5}S$
D3	1	9	10	. $Cd_{0.1}Pb_{0.9}S$

3 Characterization of $Cd_xPb_{1-x}S$ Thin Films

3.1 X-ray Diffractrometry Studies

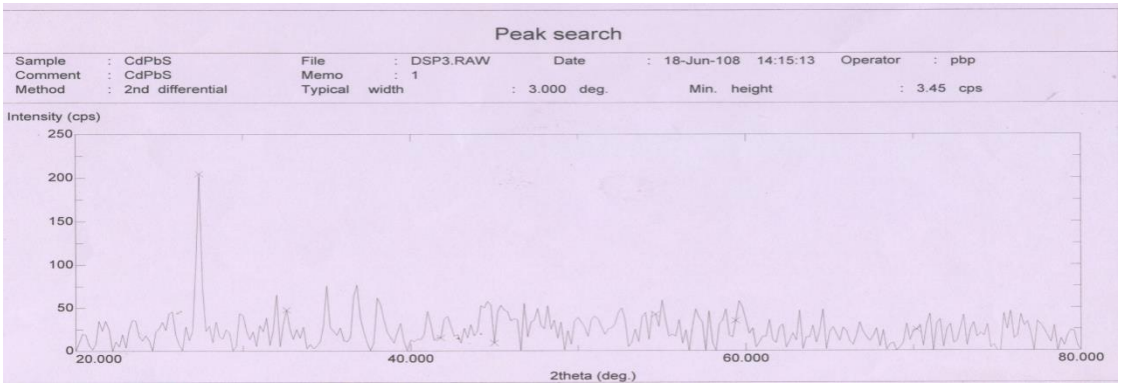

Figure 1 : X-ray diffractogram of $Cd_xPb_{1-x}S$ thin film.

The crystal structure of films was analyzed with X-ray diffractometer (Miniflex Model, Rigaku, Japan, Advanced D8) by using Cu-Kα lines (λ= 1.542Å). Structural identification of $Cd_xPb_{1-x}S$ thin films was carried out with X-ray diffractometer in the range of angle 2θ between 20^0 to 80^0.

3.2 UV- Spectroscopy Studies

(a) Band gap energy as a function of % Pb Contents

For obtaining the absorption spectra of the samples was measured at room temperature by using UV-VIS spectrophotometer, thin films of $Cd_xPb_{1-x}S$ ($Cd_{0.9}Pb_{0.1}$ S, $Cd_{0.5}Pb_{0.5}$ S, $Cd_{0.1}Pb_{0.9}$ S) of approximately 632 nm, 673 nm, and 752 nm thickness were prepared by chemical bath deposition technique.

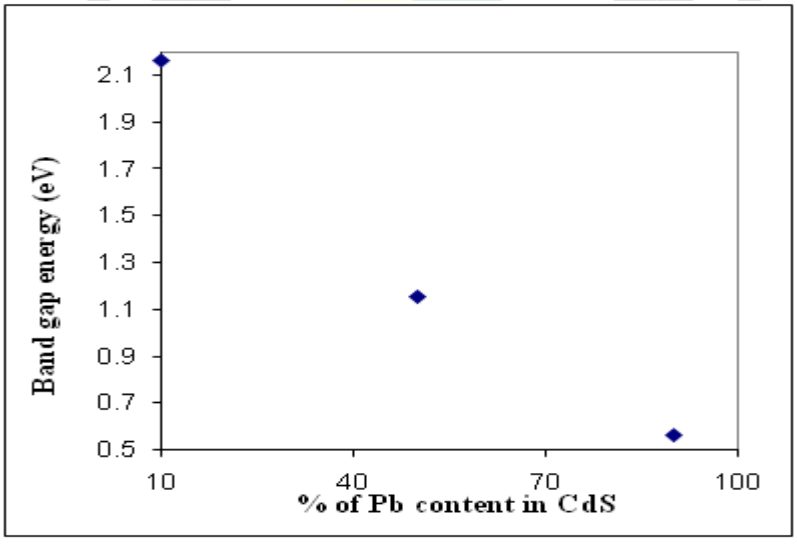

Figure 2 : Effect of Pb content on band gap energy

3.3 Study of Photo sensing Properties

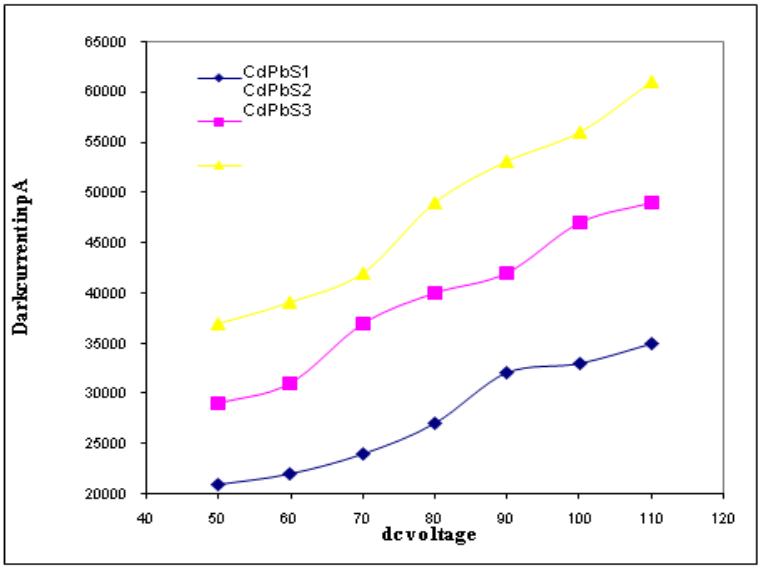

Figure 3: Variation of dark current with dc voltage for $Cd_xPb_{1-x}S$ thin films

To study photocurrent- voltage characteristics of $Cd_xPb_{1-x}S$ thin films, variation of photocurrent with applied dc voltage was recorded. Figure 4.8 shows photocurrent- voltage characteristic of $Cd_xPb_{1-x}S$ thin films [4-5].

4. Summary and conclusions

$Cd_xPb_{1-x}S$ thin films, those were grown on glass substrate by chemical bath deposition at 50^0C showed good optical properties and adhered well to the substrate.X-ray diffraction pattern of $Cd_xPb_{1-x}S$ thin films were obtained. Energy band gap value were found decreasing with the increasing Pb content of the films.$Cd_xPb_{1-x}S$ thin films showed higher photosensitivity but it was lower than CdS thin film

5. References

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