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# OPTICAL PROPERTIES OF CdS THIN FILMS

***C. T. Londhe[1*], K. N. Sivalkar[1], M. M. Betkar[2], G. D. Bagde[1]***

[1] Physics Research Centre, Mahatma Gandhi Mahavidyalaya Ahmedpur, Dist. Latur (MS)-India.
[2]Shri. Kumarswami Mahavidyalaya Ausa, Dist. Latur (MS)-India

*Corresponding Author: e-mail: londhect@gmail.com

## ABSTRACT:

The Cadmium Sulphide thin films were deposited by using chemical bath deposition technique with different bath temperatures. The synthesized CdS films were optically characterized by UV-visible spectrophotometer. The variation of optical energy band gap with changing concentration of $CdCl_2$ confirmed the interaction between photon energies and material properties of CdS thin films.

***KEY WORDS*:** CBD, Thin films, CdS, $CdCl_2$, optical band gap.

## 1. INTRODUCTION:

CdS is an important semiconductor material plays vital role on the photovoltaic technique. It has been used as a parameter of several types of thin film solar cells such as CdTe, CdS has suitable energy band gap along with high absorption coefficient and considerable energy conversion efficiency. [1-5]

The various deposition methods have been used for preparation of semiconducting thin films. One of the suitable and non-vacuum methods is Chemical bath deposition (CBD). It is due to its simplicity, low cost and large area coatings. The technique has been widely used to deposit different verity of semiconducting materials [6]. Although other techniques have been used in deposition of CdS, Chemical bath deposition is known to enhance the performance of Cadmium Sulphide window, used in solar cell applications [7]

The optically important characteristics of CdS thin films varied with the wavelength and the photon energy. Study of optical conductance and band gap conforms the transmission within visible range [8]. The synthesis of CdS films using CBD is based on slow release of $Cd^{2+}$ ions and $S^{2+}$ ions in an aqueous alkaline bath and the subsequent condensation of these ions on the substrate suitably dipped in bath. The slow release of $Cd^{2+}$ ions, achieved by adding a complexing agent to the Cd salt, to form cadmium complex species, upon dissociation results in the release of $Cd^{2+}$ ions. The $S^{2+}$ ions are supplied by decomposition of $(NH_2)_2CS$. [9-10]

In the present work, CdS films are deposited at different reaction temperatures using CBD technique. The optical properties of CdS deposited thin films are investigated.

## 2. EXPERIMENTAL :

Cadmium Sulphide thin films were synthesized using chemical bath deposition technique on clean bare glass substrates. The increasing reaction temperatures were 70, 75, 80, 85 and 90 $^0$C was optimized for deposition. The solutions with 1M $(NH_2)_2CS$ , 5M $NH_4OH$ of $CdCl_2$ were prepared. The PH of the solution was optimized to 11 by slowly adding the aqueous $NH_3$.

Bare glass substrate were previously immersed in chromosulphuric acid for 24 hr, and cleaned with acetone, rinsed with double distilled water and dried in Oven. Such cleaned glass substrates were gently mounted on substrate holder and immersed in reaction bath. The speed rotation of substrate holder was maintained at 55 rpm by means of DC geared motor for 30 minutes. The reaction beaker was kept in sand bath. Synthesized CdS thin films were optically analyzed with absorption spectra in the vicinity of absorption edge were recorded, using UV visible spectrophotometer.

## 3. OPTICAL CHARACTERIZATION:

The optical absorption of the Cadmium sulphide thin films have been used to evaluate the absorption coefficient (α), energy band gap ($E_g$ ) and nature of transition involved.

The spectra shows that the absorption edges are blue shifted. Blue shifting of the absorption edge confirmed that the films deposited are composed of CdS nanocrystals. The plot of $(\alpha h\nu)^2$ as a function of hν was shown in figure1.

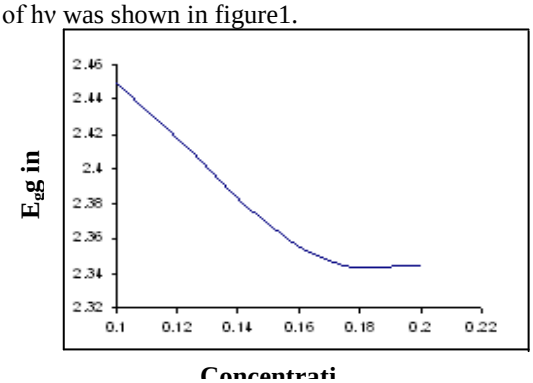


**Fig.1** *Plot of optical energy band gap versus concentration of $CdCl_2$*

The variation of optical band gap with concentration of $CdCl_2$ shows the interaction between the photon energies and material properties such as film thickness, crystalline size, concentration of $Cd^{2+}$ ions of the CdS films.

## 4. CONCLUSION:

CdS films were deposited using CBD technique at different concentration of $CdCl_2$ at optimized different temperatures. The optical absorption shows the blue shift of the absorption edges which showed that the prepared films are composed of CdS nano crystals. The drastic variation of optical energy band gap with concentration of $CdCl_2$ doping showed that the interaction between photon energies and structural and material properties of CdS thin films.

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