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EFFECTS OF ANNEALING TEMPERATURE AND SUBSTRATE ROTATION ON THE PROPERTIES OF CdS THIN FILMS

K.I.H. Senevirathne[1], W.G.C. Kumarage[1, 2], V.A. Seneviratne[1], C.P. Jayalath[1] and B.S. Dassanayake[1]*

[1]Department of Physics, Faculty of Science, University of Peradeniya, Sri Lanka
[2]Postgraduate Institute of Science, University of Peradeniya, Sri Lanka
**buddhid@gmail.com*

CdS thin films are of considerable interest to their use in the fabrication of heterojunction solar cells and other optoelectronic devices. In CdS/CdTe heterojunction solar cells, these thin films are used as window layer materials in order to achieve high absorption at the CdTe layer. This work deals with deposition of CdS thin films using chemical bath deposition (CBD) technique which is simple and inexpensive, and characterization them to investigate effects of annealing temperature and rotation of substrate on quality of CdS thin films. The morphological and optical properties were analyzed by SEM analysis and UV-visible spectrometry. All the films were deposited in a reaction vessel containing aqueous solutions of 10 ml of 0.2 M cadmium sulfate ($CdSO_4$, 99% purity), 10 ml of 0.4 M thiourea ($CS[NH_2]_2$, 99% purity) as cadmium and sulfur sources, 25% w/w ammonia solution (NH_3) volume of 1.1 ml and 118.9 ml of DI water. The thermal annealing of resulting films formed on substrate placed at 45° angle in the bath was carried out at temperatures from 100 to 500 ℃ in an electric furnace for 1 hour. The morphological analysis indicates that cluster size increases with annealing temperature suggesting that relative decrease in band gap with increasing annealing temperature. It was concluded that 200 ℃ is the optimum annealing temperature to anneal the CdS thin film successfully, which showed appreciable transmittance greater than 80%. In order to study the effect of substrate rotation, the CdS films were fabricated under rpm values of 300, 360, 420, 480 and 540. The obtained thickness and band gap values were found to be within the experimental uncertainties. Even though more pronounced deviations could be expected at higher substrate rotation speeds, turbulent effects at higher speeds restricted the optimum possible rpm value.

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