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Research Article

PRODUCTION AND STRUCTURAL PROPERTIES OF CADMIUM SULFIDE THIN LAYERS PRODUCED BY CBD METHOD

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ABSTRACT
Cadmium Sulfide thin films were produced by chemical bath deposition methodat different time 15, 25 and 45 minutes. Aqueous solution temperature for synthesis was about 75ºC and kept at 10 Ph and substrate was glass. Crystalline structures were investigated by XRD and SEManalysis. By increasing time deposition CdS grains and clusters produced and then resorption happened. Also by increasing time of deposition layers got more crystalline.

Keywords*: Cadmium Sulfide; Thin Films; Time Deposition; Chemical Bath Deposition*

INTRODUCTION
Cadmium sulfide (CdS) is known to be an excellent hetero junction partner of p-type cadmium telluride (CdTe) orp-type copper indium dieseline (CuInSe2) due essentially to its high electron affinity (Power *et al.*, 1981). A semiconducting direct energy band gap value of 2.42 eV and the ease of fabrication in thin film geometry make the CdS an ideal candidate to be used as a buffer layer on the solar cell thin film hetero structures (Rios –Flores *et al.*, 2012). CdS thin films are commonly used as optical barriers for the solar radiation with wavelength below 515 nm. Different techniques could be used for CdS thin films preparation such as: chemical bath deposition, sputtering, chemical vapour deposition or electro deposition (Brien and Saeed, 1996). Among them, chemical bath deposition (CBD) is a low-cost and a scalable technique for thedeposition of high quality CdS films. High film homogeneity, low electrical resistivity and high transparency in the visible region are required characteristics for the materials intended to be used as window layers for solar cells applications (Kim *et al.*, 2012). These properties are strongly dependent on film characteristics determined by the deposition process such as the grain size and the surface roughness.The aim of this work is to produced CdS thin layer in different deposition times and investigated about there structure and crystalline properties by SEM and XRD analysis.

Experimental Details
Cadmium sulfide layers were produced by chemical bath deposited on glass substrates. Prior to deposition, the platelets (50mm x 25mm x 1mm) were ultrasonically cleaned with acetone and then alcohol and dried. CdS films were formed in many successively deposition steps that always were performed in renewed chemical bath (CB) prepared from cadmium acetate, NH_3 aqueous solution, thiourea and distilled water. The deposition bath was continuously stirred, heated and kept at 75ºC. The substrates were immersed into the deposition bath, by vertically suspending them around the stirrer. The substrates were taken out after 15, 25 and 45 minutes. Deposition parameters were: [cadmium acetate] = $3x10^{-3}$M; [NH_3] = $3x10^{-1}$ M; [thiourea] = 5.10^{-2} M; pH = 10; All samples were annealed in air, at 400ºC. Cadmium sulfide thin films were characterised by crystalline structure, SEM and XRD analysis.

RESULTS AND DISCUSSION
Figure 1-3 show scanning electron microscopy of cadmium sulfide on glass thin layers produced by CBD method at 75 ºCfor 15 min, 25 min and 45 minutes deposition times, respectively. As it can be seen from figure 1, CdS grains are produced on glass substrate and nucleation and Growth processes happens.When time of deposition increases to 25 minutes, as it can be seen from figure 2, we are encounter with coalescence of grains and CdS clusters configure on substrate along with holes between them. By increasing the time of deposition to 45 min at 75 ºC temperature, energy of grains increases, correlation energy between grains also increases and overcome to correlation energy between grain and substrate,

there for resorption of grains happens and there are less grains along with more voids on surface (Figure 3).

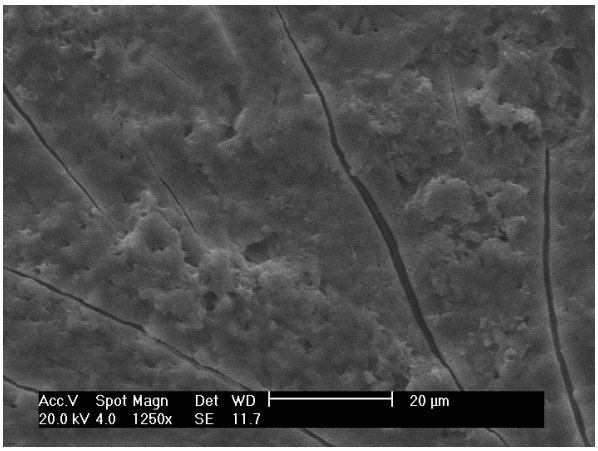

Figure 1: Scanning electron microscopy of cadmium sulfide on glass thin layers for 15 min time deposition

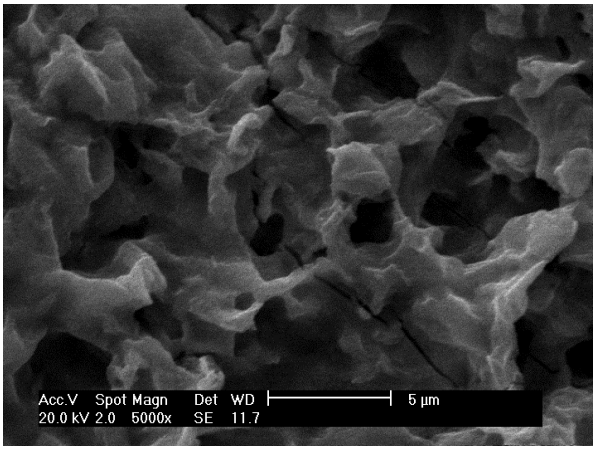

Figure 2: Scanning electron microscopy of cadmium sulfide on glass thin layers for 25 min time deposition

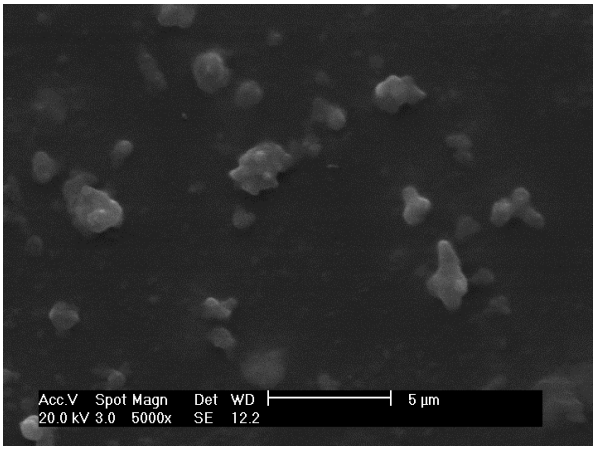

Figure 3: Scanning electron microscopy of cadmium sulfide on glass thin layers for 45 min time deposition

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Figure 4 show, the XRD pattern of the CdS thin film on glass substrate prepared by CBD method at different time deposition 15 min (figure 4a), 25 min (figure 4b) and 45 min (figure 4c). All film are cubic in structure. The film CdS is cubic with a main reflection (111), confirmed that cubic structure. The different peak around 25ɵ-30ɵ indicates the films are crystalline with the cubic structure. The film prepared at 15 min (figure 4a) shows an amorphous nature. There is some crystalline appeared at 25 min (figure 4b). A good crystalline film is obtained at 45 min (figure 4c). This can be observed in the XRD peak by increase in the time deposition, the intensity of the peaks are increased.

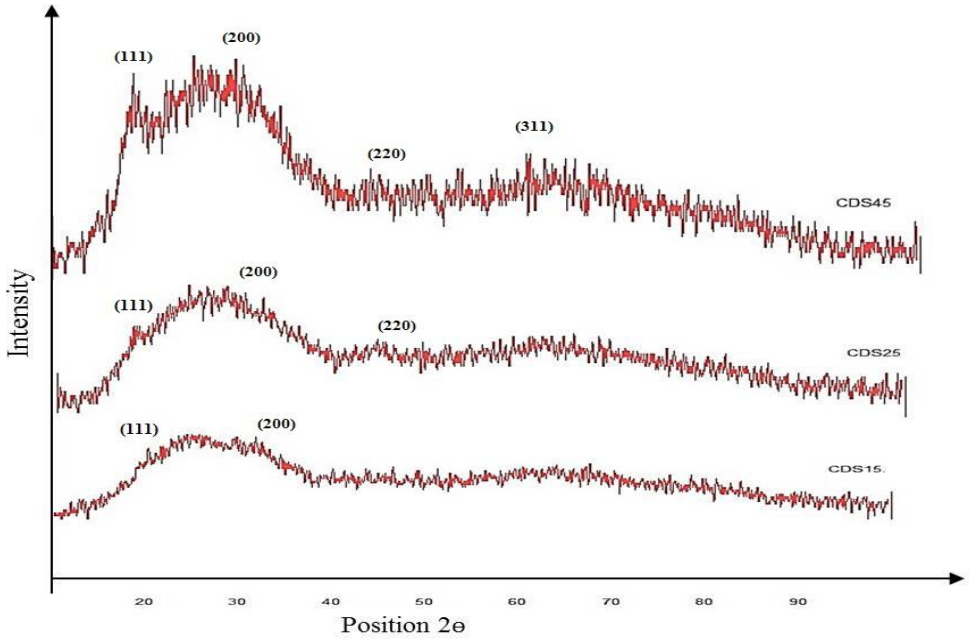

Figure 4: XRD pattern of CdS films grown at three different time deposition.

Conclusions

Cadmium Sulfide thin films were produced by chemical bath deposition method at different time 15, 25 and 45 minutes. Crystalline structure were investigated by XRD and SEM analysis.By increasing the time of deposition to 45 min at 75 ºC temperature, energy of grains increases and layers got more crystalline.

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