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EFFECT OF DEPOSITION PERIOD ON THE PROPERTIES OF CADMIUM SELENIDE THIN FILMS

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ABSTRACT

Polycrystalline thin films of CdSe were prepared by the electrochemical method by using CdCI2, EDTA and Na_2Se03 on titanium substrate and the deposition was carried out at different deposition period. The influences of deposition period, towards the photo response activity of the sample were evaluated. The samples were characterized using x-ray diffractometry

Key words : Thin Films, CdSe and EDTA

INTRODUCTION

The electrochemical deposition method is very simple and efficient'.This method is cost-effective and non-pollution (waste less and technologically). The material costs, handing costs, equipment costs and energy costs can be reduced using this method. The films can be deposited to the desired areas of the substrate [2,3]. CdSe is a ll-VI compounds semiconductor suitable for photovoltaic and photo electrochemical systems[1,4]. Complexing agent such as ethylendiaminetetraacetate acid has the capacity to improve the longevity of the deposition bath and make thin films has good adhesion on titanium substrate[5].

Preparation of thin films

The electrolyte bath consisted of $CdCI_2$. EDTA and Na_2Se0_3. All the solution were prepared in deionized distilled water. Deposition was carried out potentiostatically in a standard three- electrode cell. Ag/AgCl was employed as reference electrode and platinum as counter electrode, respectively. The working electrode was made from titanium (99.9%) with an exposed area of about 1.00 cm^2. The electrochemical cell was connected to a EG & G Princeton Applied Research (PAR) potentiostat driven by model 270 Electrochemical Analysis System software. To study the effect of varying deposition period towards the samples, deposition was carried out at different deposition time at a potential of -0.06 V. (15,30,45,60,75 and 90 min).

Characterization of thin films

X-ray diffractometry (XRD) was carried out using Philips PM 1730 diffractometer with Cu K-α(γ = 1.54 A). The XRD was recored for 20range from 2° to 60°. The obtained XRD

Table 1 : Comparison of the experimental and standard data for CdSe.

Potential	2	d-spacing, A		Structure
V	e	Observed value	JCPDS data	
-0.40	44.6°	2.0	2.0	Hexagonal
-0.50	44.6°	2.0	2.0	Hexagonal
-0.60	44.6°	2.0	2.0	Hexagonal
-0.70	44.6°	2.0	2.0	Hexagonal
-0.80	44.6"	2.0	2.0	Hexagonal
-0.90	44.6°	2.0	2.0	Hexagonal

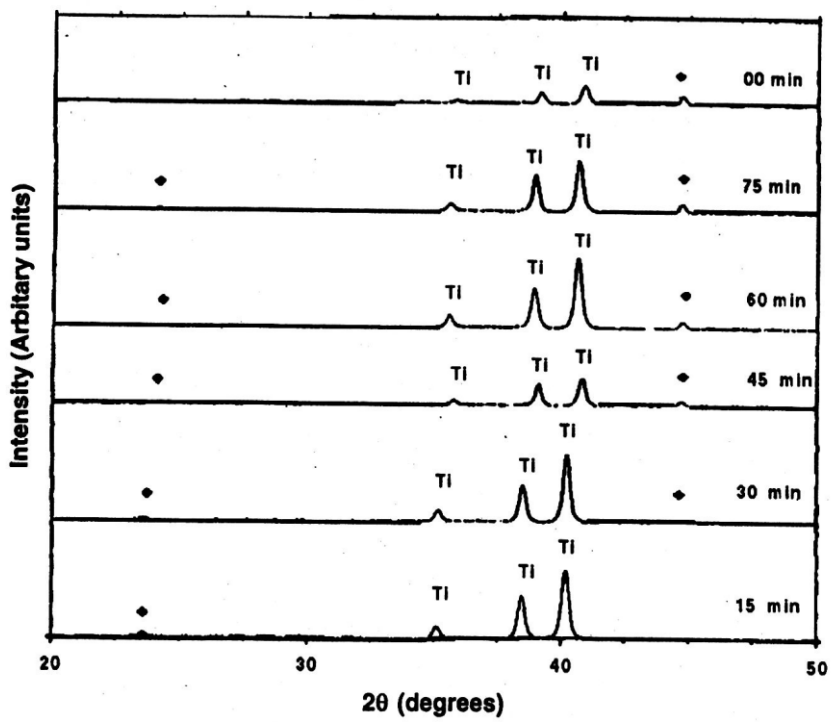

Fig. 1. XRD pattern of the samples prepared at various deposition CdSe

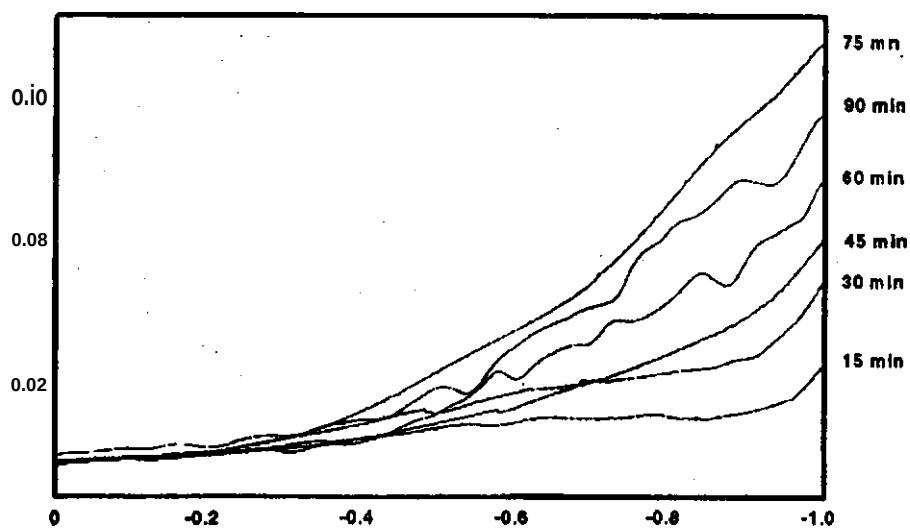

Fig. 2. PEC comparison of various deposition periods of samples illuminated by using halogen lamp

matched with JCPDS data [File No: 08-0459]. Photo electrophemical experiments were performed by running linear sweep voltammetry (LSV) between two potential limits (0.00 to -1.00V) in the electrolytic bath containing 0.02 M $Na_2S_20_3$. An EG & G Princeton Applied Research (PAR) versa tat driven by model 270 Electrochemical Analysis System software was employed in the PEC experiment. The sequence of constant illumination from tungsten lamp (100W) and dark period were performed on the PEC cell to study the photo activity behavior of the CdSe compounds.

Fig.1. shows a comparison XRD pattern of the samples prepared at different time. The films that were deposited for 30 min and above show two peak corresponding to CdSe. However, the films deposited for 15 min and 90 min show only one peak respectively. These peak are in good correlation with the standard JCPDS data. However, the intensity of the peak at 29 = 44.7° was increased as the deposition period was increased (Table 2). The figure also indicates that CdSe thin films that was deposited for 15 min prefer the (100) orientation but changed to (103) plane as the deposition time was increased. The optimum deposition period was found to be 75 min.

Fig.2 Shows the different the photocurrent (Ip) and drakcurrent (Id) for the films that was prepared at different deposition period. The photo activity of the sample increased as the deposition period was increased. The reason for the increase in the photo activity could be explained in the term of the grain size, the size of the grain decreases and was more uniform. This causes the grain boundaries of the polycrystalline material to increase when the deposition periods was increased which causes the increase in the photo response. The large crystallites inhibit photo-carrier losses due to grain boundary recombination, and the hexagunal phase as higher photo absorptance and provides much-needed stability against corrosive electrolytes in PEC cells6. Generally, the samples deposited at higher deposition time show better performance against the samples deposited at lower deposition time. We concluded that CdSe films with good surface coverage, adhesion and higher photo response could be obtained from the samples deposited for 75 min at potential - 0.06 V.

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