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Potentiostatic electrosynthesis and characterization of Te containing CdSe thin film

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ABSTRACT

The Te containg CdSe thin film were prepapred by electrochemical codepotion under potentiostatic control to study their current voltage behaviour, capacitance, charge density. Current - voltage measurement have also been carried out for the construction of Tafel plots to determine the exchange current density and corrosion rates. Electro synthesis of Te containing CdSe films have been electrosynthesized at - 0.600v Vs SCE (Saturated Calomal Electrode) on titanium subtract from Aqueous solution. The corrosion characteristics of the film have been studied by polarization techniques. This is study to investigate the effect of tellurium concentration on the composition, capacitance and corrosion parameters of CdSe films electro synthesis by electrochemical co-deposition. This is the study to investigate the effect of tellurium concentration on the composition, Capacitance, morphology and corrosion parameters of the CdSe Te thin films electrosynthesis by eletrodeposition.

Key words : Electrosynthesis, patentiostatic, electrodeposition, electrochemical , capacitance.

INTRODUCTION

CdSe are among the most studied material for photo electrodes in photo electro chemical cells. Electro chemical codeposition considered to be an attractive technique for the formation of Tellurium doped CdSe thin films. The electrochemical co-deposition method prepared CdSe at different concentration by using limited current at -6.00 v Vs SCE. Capacitance measurement have carried out for estimation of charge carried densities. The current - voltage behaviour in the form of Tafel plots has been studied. Kinetic behaviour of the deposition process has also been examined.

In this paper we will report our work on electrochemical preparation and characterization of Te doped CdSe thin film on the basis of electrochemical codeposition, corrosion, compositional and morphological analysis.

EXPERIMENTAL

Te containing CdSe films were prepared by electrochemical codeposition method potentiostically from Aqueous solution on titanium electrodes. for the deposition of Cadmium Selenide Semicoductor thin film, a three electrode set-up was used. Titanium sheet (1×1cm) were used as working and counter electrodes. The saturated Calomel electrodes (SCE) was used as a reference electrode. The deposition of CdSe & Te at -0.600 v were allowed for 1 hour. The power supply (systronics) was used for application of the potential for deposition. The deposition solution of thin film of Cd, Se & Te were shown. For capacitance measurement a digital (LCR meter) was used. For corrosion measurement three electrode set-up was used. Anodic and Cathodic polarization was carried out for Tafel plots and estimation of corrosion parameters.

RESULT AND DISCUSSION

Reduction of Te ions starts at about –0.6 V v/s SCE, the composition of the synthesis both for the CdSe and Te was approximated in order to obtain cadmium as the base components and the other two metals representing less.

The current as a function of time for the deposition of thin film on a titanium electrode at the –0.600v/SCE potential. It can be noticed initially a decreases of the very fast and is current correlated with the formation of the growth. Variation of current with time for CdSe & Te containing CdSe films are given in figure 1.

When we change the composition by varying the Te concentration in electrolyte containing CdSe, initial and steady state current increase which is summarized. Fig 2 shows the concentration of Te inclusion in the films as a function of initially and steady state current density.

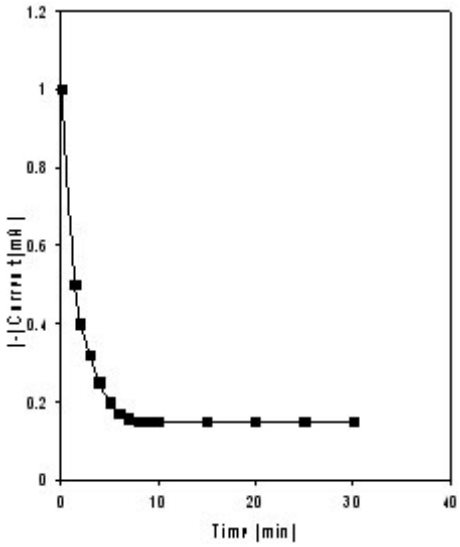


Fig. 1: variation of current with time

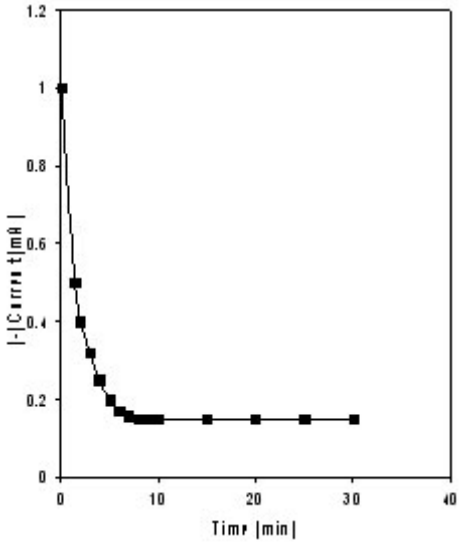


Fig. 2: variation of current with Te Concentration

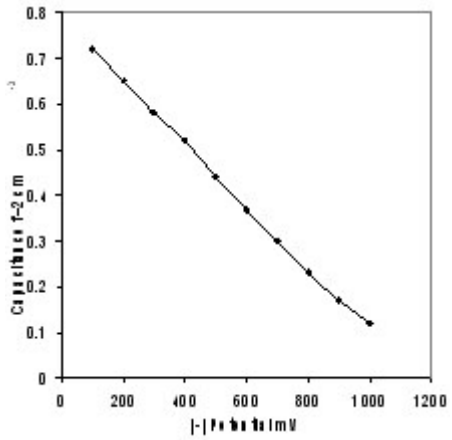


Fig. 3: The Mott-Schottky Plots of CdSe Te

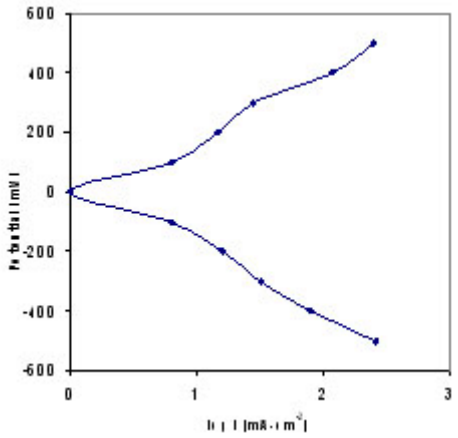


Fig. 4: A typical Tafel Plot

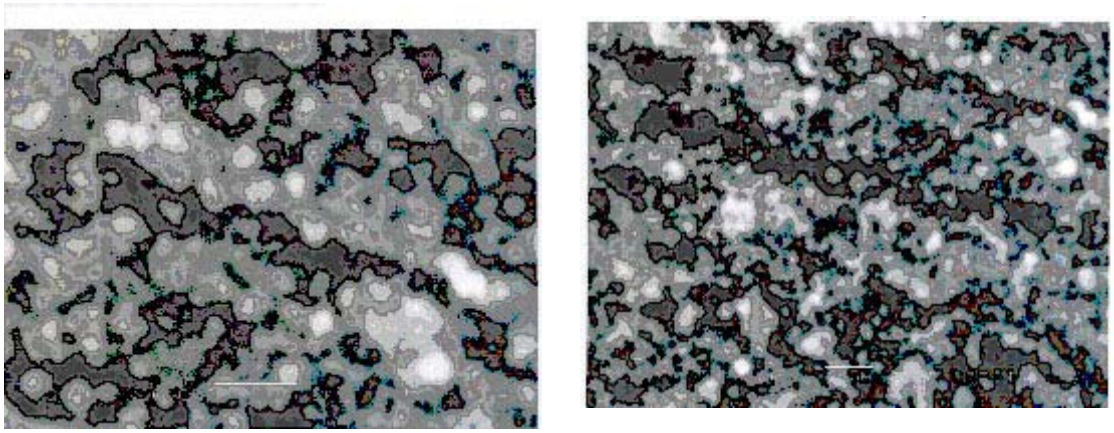
When the Te content increases in the electroplating solution from 0.00025 M to 0.0010 M with an increase in current density from -0.162mA to -0.310 mA

The thickness values of the films are estimated from the quantity of charge passed thorough the electrolyte and is given. Capacitance measurements have been studied for the charaterisation of deposited films.

The slopes are used to evaluate charge carrier density, flat band potentials are also comes from the intersection of curve at potential axis. Figure shows the variation of capacitance with applied potential for different concentration of Te containing CdSe electrodes.

The tafel plot carried out at room temperature in I_2/I^- redox solution both anodic and catholic tafel plots in each case shifted towards higher polarization level.

The corrosion rates of the electrosynthesis film were calculated with the help of equation.



(A) **(B)**

Fig. 5: SEM of (A) 0.0004 M Te containing CdSe& (B) 0.0010 M Te containing CdSe

$$CR = 0.13\ I\ carr.\ (Ew)/d$$

Where,
Ew = equivalut weight
d-density of deposited materials

The corrosion rate values are given. The corrosion current decreases with addition of Te concentration and also corrosion rate decreases. The tafel plats for 0.0004 M Te containing CdSe is given.

Scanning electron micrograph of Te doped CdSe thin films. These micrographs shows that the deposition is homogenous and continues. The morphology of the films affected with addition of Te concentration. The typical plot of EDAX of the CdSe film have been taken. The a EDAX studies reveals that the inclusion of Te in electroplating solution, increases of Te content in deposited films also.

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