

FTOP-18

Electrodeposition of CdTe

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Abstract

In this work, we produced CdTe thin films via electrodeposition method. During the deposition, 26% diluted HCl was used like 4 drops and 2 drops. When we used 4 drops HCl, the only tellure was precipitated but when we used 2 drops HCl CdTe thin film was deposited on the ITO coated glass substrates. XRD result showed that CdTe crystals were deposited successfully. It is estimated from the absorbance measurement that E_g is 1.51 eV.

Keywords : CdTe ; Cadmium tellurite ; Electrodeposition ; Thin Film

1. Introduction

Cadmium Telluride (CdTe) is well-known materials for II-VI narrow bandgap binary compound semiconductor and it has a high solar energy conversion efficiency [1]. For photoelectrochemical and photovoltaics cells, it is widely used because of its optimum energy gap ($E_g = 1.44$ eV) and high absorption coefficient. There are a variety of methods for producing CdTe thin films such as metal-organic chemical vapor deposition, vacuum evaporation, anodic and cathodic deposition etc [1]. Electrodeposition is chosen due to its comparative advantage in terms of its low cost as a semiconductor accumulation technique, its continuity of the deposition process, its scalability and other advantages, as well as its reduction of wastes containing Cd [2].

1. Experimental Details

In this work, we produced CdTe thin films on to ITO coated glass substrates by using electrodeposition technique. Galvanostat/potentiostat with three electrodes was used in the experiments. Chronoamperometry method was chosen. 1.0M CdCl₂ and 0.02

M Na₂TeO₃ were dissolved in 100 mL deionized water. The bath temperatures were chosen to be 80 °C. The experiments were completed in 2000 seconds.

To estimating band gaps of the films absorbance measurements recorded by JASCO V-530 were used. PANalytical empyrean X-ray diffractometer was employed to determine the structural properties of the films.

3. Results and Discussion**3.1. CdTe thin film's structural properties**

When 4 drops of HCl were added to the solution, only Te was formed and on the other hand, 2 drops of HCl was used to produce CdTe. When 4 drops of HCl were added to the solution,

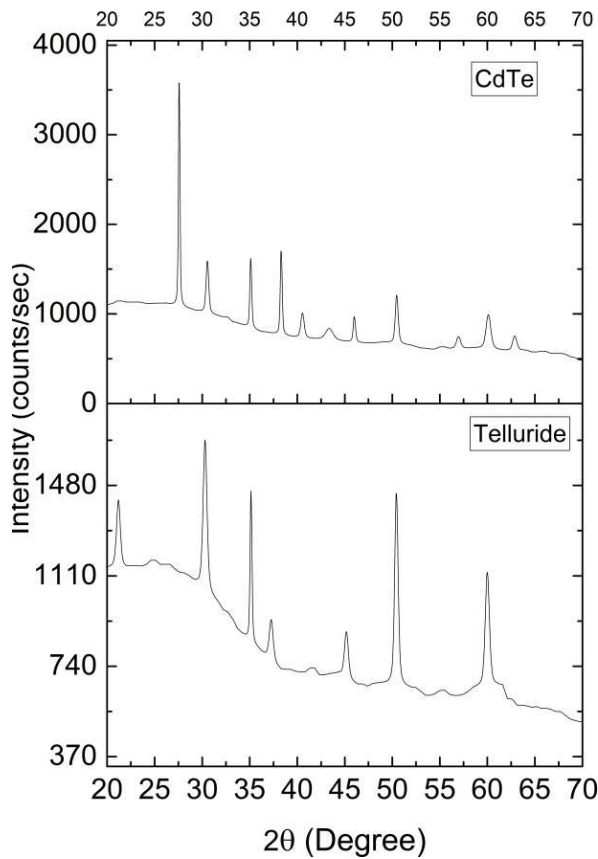


Figure 1. XRD pattern of the films

the pH of the medium was measured to be 2. When 2 drops of HCl was added to the solution, the pH of the medium was measured as 4. As the pH of the solution decreases, the number of free Te ions in the solution increases. Thus, it is understood that why Te ions precipitated. CdTe was formed in cubic crystal structures.

3.2. Optical properties of ZnO films

The absorbance measurements versus wavelength were given in Fig.2. Fig.3. shows the Tauc plot and estimated

band gap. According to this plot, the band gap of the CdTe film was 1.51 eV. This value matches very well with the literature.

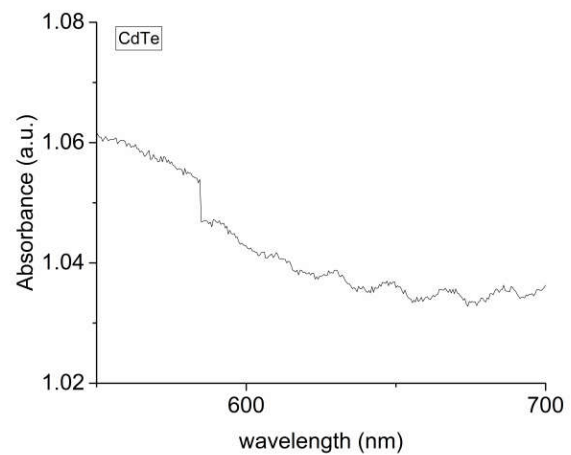


Figure 2. Absorbance measurements of CdTe

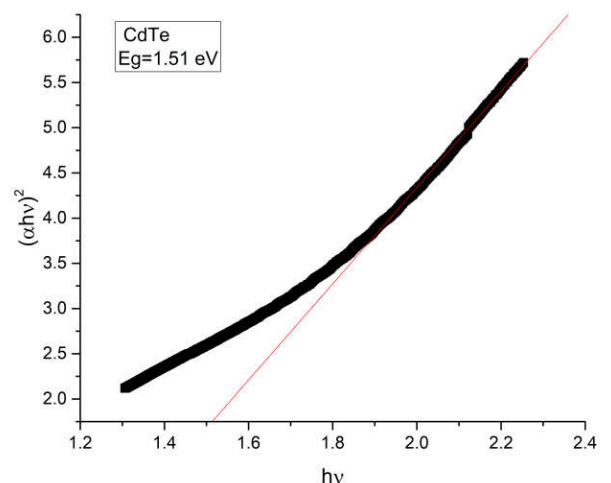


Figure 3. Tauc plots and band gap

Conclusion:

With this study, a thin film of CdTe was produced by using Chrona amperometry method of electrodeposition. In this study, two experiments were carried out. In one experiment, 2 drops of HCl were used and 4 drops of HCl were used in the other. In the sample added 4 drops HCl, only Te precipitated. On the other

hand, when 2 drops of HCl was used, good crystalized CdTe could be obtained.

Kaynakça

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