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Effect of Concentration of Cd^{2+} on the Material Properties of CdTe Thin Films Electrodeposited via a Two Electrode Electrolytic Cell

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Cadmium telluride (CdTe) is a vital semiconductor material which can absorb most of the electromagnetic radiation of solar energy spectrum to yield more efficient solar cells. Among the thin film fabrication methods, electrodeposition is an emerging technique to produce good quality CdTe materials using either two or three electrode system. This study was performed using the two electrode electrolytic system to investigate the effect of Cd^{2+} concentration on the material properties of CdTe thin films to enhance its photovoltaic activities.

Electrodepositions of CdTe were carried out in an aqueous electrolyte which was prepared utilizing analytical grade $CdSO_4$ as the cadmium and TeO_2 as the tellurium precursors. Fluorine doped tin oxide coated conducting glass (1×3 cm^2) and high purity carbon electrode were used as the working (cathode) and counter electrodes (anode) respectively in the electrolytic cell used for the depositions. The concentration of TeO_2 was maintained around 1 mmol/L throughout while varying the $CdSO_4$ concentration from 1.00 mol/L to 1.50 mol/L. pH of the electrolyte was initially adjusted to 2.2 and depositions were carried out in the cathodic potential range of (1.33 - 1.37) V at 65 °C while stirring at continuous stirring rate of 60 rpm. The resulting electrodeposited CdTe layers were heat treated for 10 minutes at 400 °C in air and subsequently, their optical, electrical morphological and structural properties were studied using UV-visible spectrophotometry, photo-electrochemical cell, scanning electron microscopy and X-ray diffraction spectroscopy. As elucidated by the results, at the deposition potentials of 1.34 V and 1.35 V, the short circuit current and open circuit voltage values were increased with the increasing of concentration of Cd^{2+} from 1.00 mol/L to 1.25 mol/L while the band gap energy reached to its theoretical value of 1.50 eV.

Keywords: *Cadmium telluride, Electrodeposition, Thin films, Two electrode system, Solar cells*

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