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Electrodeposition of CdTe thin films using a two electrode system

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Cadmium telluride (CdTe) is a promising material for thin film solar cell applications due to its ideal band gap of ~1.5 eV which has the ability to absorb the maximum of the solar spectrum and higher conversion efficiency of sun light. Among the various deposition techniques available to produce CdTe semiconductor material in commercial quantities, electrodeposition has drawn more attention due to its simplicity, scalability and easy control of the material properties through growth parameters; applied potential, temperature, pH and the composition of the bath etc. Since the reference electrode could be a potential impurity source in the conventional three electrode electrolytic system, this study was mainly focused on the use of two electrode electrolytic system to determine suitable deposition potential and pH ranges for growth of CdTe thin film while avoiding the influence of impurities.

The two electrode electrolytic cell consisted of, fluorine doped tin oxide coated glass substrate as the working electrode and 99.99% pure carbon electrode as counter electrode was used for the deposition of CdTe thin films. The electrolyte contained analytical grade reagents of 1.25 mol/L $CdSO_4$ and 1.0 mmol/L TeO_2 as cadmium and tellurium precursors respectively. Prior to electrodepositions, pH of the electrolytic baths were varied from 2.0 to 2.4 at 25 °C. While changing the cathodic deposition potentials in the range of (1.30 - 1.37) V, the CdTe depositions were carried out stirring the bath at 60 rpm and at the temperature of 65 °C. Following the heat treatment of the samples for 10 minutes at 400 °C in air, the characterization of CdTe thin films was carried out based on optical absorption, photo-electrochemical cell, X-ray diffraction and scanning electron microscopic studies. The results of the study indicate that, CdTe thin films can be successfully grown in the cathodic potential range of (1.34 -1.35) V and at a pH of 2.2 using two electrode electrolytic system.

Keywords: Electrodeposition, Two electrode system, Cadmium telluride

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