**Electro-deposition of Cadmium Zinc Sulphide at High Cadmium Ion Concentration, Low Zinc Ion Concentration, High Temperature and Low pH**

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Thin films are nanoscale materials which are widely used for solar cells and other optoelectronic devices. $Cd_{(1-x)}Zn_xS$ (cadmium zinc sulphide) is formed by incorporating zinc ions to CdS (cadmium sulphide). $Cd_{(1-x)}Zn_xS$ is a n-type semiconductor material which has a wider band gap than that of n-type CdS. Therefore, $Cd_{(1-x)}Zn_xS$ can be used as a window material when application required low absorption of light and n-type semiconductor properties. $Cd_{(1-x)}Zn_xS$ has been electro-deposited by varying cadmium ion concentration, zinc ion concentration, pH, deposition temperature and deposition time. Results reported here were based on the depositions conditions; 0.1 mol $dm^{-3}$ cadmium ion concentration, 0.01 mol $dm^{-3}$ zinc concentration, 2.45 - 2.50 pH and 50 °C deposition temperature. Electro-deposition experiments were carried out by Gamry "series G 300" potentiostat while, working electrode was fluorine doped tin oxide/glass substrate, reference electrode was Ag/AgCl electrode and counter electrode was a semi-spherical graphite rod. The deposition voltage was identified from the cyclic voltammograms and shapes of the deposition current vs time plots. Electro-deposition reported in here was carried out at under-deposition voltages. The best values for electro-deposition parameters; voltage, pH, temperature and time were identified by observing their influence on the band gap values of the thin films deposited and the open circuit voltages of photo-electrochemical cell consisting of 0.1 mol $dm^{-3}$ sodium thiosulphate electrolyte and the thin film semiconductor. A band gap range of 2.5 eV – 2.6 eV was obtained for $Cd_{(1-x)}Zn_xS$ layer which is higher than the band gap of CdS. The open circuit voltage varied from -48 mV to -190 mV during optimization of voltage, pH, temperature and time. An X-ray diffraction spectrum has shown that $Cd_{(1-x)}Zn_xS$ layer has a single hexagonal crystal phase. The crystal parameter, a = 4.1264 Å and it was lower than the standard CdS (a = 4.1364 Å). The results indicate that $Cd_{(1-x)}Zn_xS$ thin films can be produced under the given conditions as a window layer for thin film solar cells in order to harvest more light and hence to improve the efficiency.

*Keywords: cadmium zinc sulphide, electro-deposition, thin films, solar cells.*

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