

Fabrication of CdS (n-type) and CdTe (p-type) Thin Film Semiconductor Materials via Electrodeposition

K A I Sandaruwan¹, P S Athukorala¹, K A S Pathiratne¹, D S M De Silva¹, I M Dharmadasa²

¹Department of Chemistry, University of Kelaniya, Kelaniya

²Materials & Engineering Research Institute, Sheffield Hallam University, Sheffield S1 1WB, UK

Technologically, the electrodeposition (ED) method through the influence of potential, temperature, pH and composition of the reactants offers an excellent control over the properties of semiconductors. Using a potentiostatic approach, the thin films of CdS and CdTe were deposited on glass/ITO or glass/FTO substrates. CdS thin films were deposited in baths of cadmium chloride and ammonium thiosulphate at pH 1.40 at room temperature (28 – 30 °C) at the growth voltages ranging from -700 mV to -1500 mV (Best at -1100 mV), with respect to standard Ag/AgCl electrode. CdTe thin films were deposited in a bath of cadmium sulphate, cadmium chloride, and tellurium dioxide at pH 2.00 at 85 °C at -1570 mV growth voltage with respect to standard Ag/AgCl electrode. Resulted films were characterized by XRD for the determination of the bulk structure, Optical absorption for band gap energy measurements, photoelectrochemical cell

(PEC) measurement and I-V characteristics for the determination of conductivity type of the thin films. ED-CdS was found to be n-type belonging to hexagonal crystal system with the highest V_{oc} value of -148.0 mV and J_{sc} value of $314.5 \mu A cm^{-2}$ with respect to photo-electrochemical cell measurements made with $0.1 mol dm^{-3} Na_2S_2O_3$. Band gap of ED-CdS was 2.54 eV. ED-CdTe was found to be p-type with the highest V_{oc} value of +56.8 mV and J_{sc} value of $35.8 \mu A cm^{-2}$ with respect to photo-electrochemical cell measurements made with $0.1 mol dm^{-3}$ redox couple. Band gap of ED-CdTe was 1.73 eV.

Keywords: *Electrodeposition(ED), Potentiostatic approach, XRD, Optical absorption, Photoelectrochemical cell(PEC), I-V characteristics, Open circuit voltage (V_{oc}), Short circuit current density (J_{sc}), Band gap energy*