

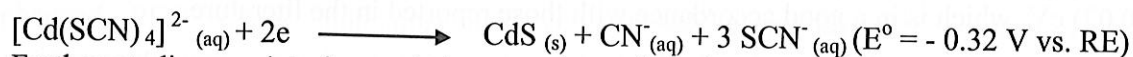
## Electrochemical deposition of CdS thin films using ammonium thiocyanate as the sulfur source

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Use of a complexing agent containing sulfur atoms which can form a charge complex with Cd<sup>2+</sup> ions could provide a condition necessary to bring atoms or ions of both the elements Cd and S together in the form of a charge complex to the electrode surface thereby facilitating the formation of CdS on the electrode surface over other materials. In the present study, electrochemical conditions necessary to electrodeposit thin films of CdS using ammonium thiocyanate as the complexing agent was studied.

A three electrode system consisting of fluorine doped tin oxide (FTO) TEC- 15, 2.3 mm thick conducting glasses (1 cm x 3 cm) were used as the working electrodes. High purity graphite rods and Ag(s)/AgCl(s)/ Cl<sup>-</sup>(aq) electrodes were used as counter and reference electrodes of the cells. Electrochemical depositions were carried out using EG & G Princeton Applied model 366 A bipotentiostat/galvanostat in the potentiostat mode. CdCl<sub>2</sub> and NH<sub>4</sub>CNS with purities of 99.999 % and 99.99 % respectively dissolved in distilled de-ionized water to prepare solutions with required concentrations.

Among many electrochemical baths tested, the bath containing 0.08 mol dm<sup>-3</sup> CdCl<sub>2</sub> and 1.0 mol dm<sup>-3</sup> NH<sub>4</sub>CNS at pH 3.5 and at the deposition voltage of -800 mV with respect to that of the reference electrode and annealed at 400 °C over 10 minutes produced well adhered thin films of CdS with band gap values in the range of 2.15 to 2.43 eV. All films deposited showed n-type electrical conductivity. The maximum Voc value observed with PEC cells containing 0.1 M Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> redox couple was 175 mV. The Jsc values were below 100 μA /cm<sup>2</sup>. The electrochemical reduction reaction that is expected to occur at the conducting substrate is given below.



Further studies need to be carried out to determine electrodeposition conditions necessary to grow CdS thin films with improved photovoltaic activities.

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