

## A Study on CdCl<sub>2</sub> Activation of CBD-CdS Thin Films

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### Abstract

“CdCl<sub>2</sub> treatment” on CdTe absorber is known to be a key step for a drastic improvement of the CdS / CdTe solar cell conversion efficiency. However, CdCl<sub>2</sub> treatment on the CdS window layer has not extensively studied in the literature. In this work, a detailed study is reported on CdCl<sub>2</sub> solution treatment on chemical bath deposited of CdS (CBD-CdS). The CBD-CdS thin films were grown using 0.001 mol dm<sup>-3</sup> CdSO<sub>4</sub> (3CdSO<sub>4</sub>·8H<sub>2</sub>O, 99%, Sigma Aldrich, USA), 0.002 mol dm<sup>-3</sup> CS(NH<sub>2</sub>)<sub>2</sub> (99%, Sigma Aldrich, USA) and 1.1 ml of NH<sub>4</sub>OH (NH<sub>3</sub>, 35% w/w, Sigma Aldrich, USA) at a bath temperature of 80 °C for one hour on FTO glass substrates (~10 Ω /□, TEC 10, Sigma-Aldrich, USA). For the CdCl<sub>2</sub> treatment, deposited CBD-CdS thin films were dip-coated in a saturated methanol (99.8%, ACS reagent, Sigma Aldrich, USA) solution of CdCl<sub>2</sub> (99%, Fluka, USA). Later the CdCl<sub>2</sub> treated samples were cleaned with DI water and annealed at 200 °C for one hour. The dipping duration was varied from 0 to 20 minutes. The CdCl<sub>2</sub> treatment was found to increase the cluster size of CdS thin films and the formation of clusters was identified to be due to coalescence of small clusters. Higher *V<sub>OC</sub>* and *I<sub>SC</sub>* parameters in the photoelectrochemical cell (CdS/0.1 M Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>/Pt) were observed for CdCl<sub>2</sub> treated CBD-CdS thin films, compared to untreated CBD-CdS thin films. The improved, *V<sub>OC</sub>* and *I<sub>SC</sub>* parameters found may be due to high effective area as well as grain boundary passivation. The flat band potential (*V<sub>fb</sub>*) value was found to be tunable with CdCl<sub>2</sub> treatment duration. The photo efficiency was found to be almost doubled for CdS films which underwent CdCl<sub>2</sub> treatment for 10 minutes, compared to the untreated ones.

**Keywords:** CBD, CdS, CdCl<sub>2</sub>, activation