

THE EFFECT OF CONCENTRATION AND PH OF CdCl₂ SOLUTION USED IN CdCl₂ TREATMENT ON THE PROPERTIES OF CdS THIN FILMS

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ABSTRACT

Among the post deposition treatments available for development of CdS/CdTe solar cells, CdCl₂ treatment has been identified as one of the key processing steps that can be effectively used for improving power conversion efficiency of the CdS/CdTe solar cell. This method was identified in late 1970s and currently is used for the CdS layers as well. The present study focuses on the effect of the concentration and pH of the CdCl₂ solution used for the CdCl₂ treatment on the quality of CdS layers based on their electrical, optical and morphological properties. In this study, CdS layers were potentiostatically electrodeposited on glass/FTO substrates at cathodic deposition potential of 660 mV versus a saturated calomel electrode at pH of 1.80 for 30 minutes in electrolytic baths containing 0.10 mol/L CdCl₂ and 0.01 mol/L Na₂S₂O₃. The temperature and the stirring rate of electrolytic baths were maintained constant at 55 °C and 60 rpm respectively. After the depositions, the samples were rinsed in de-ionized water and dried under a high purity N₂ gas flow and conveyed for the CdCl₂ treatment. Nine sets of samples with two replicates in each were treated separately with aqueous CdCl₂ solutions having concentrations of 1.0, 0.5 and 0.1 mol/L and for each concentration three different pH values; as-prepared (5.60, 6.30 and 7.10 respectively), 2.00 and 6.50 were used. To perform the treatment, CdCl₂ solutions were sprayed for 1 minute on the CdS layer until the layers were fully covered by the solution, allowed to dry and the samples were transferred for the process of annealing at 400 °C for 15 minutes in air. Subsequently, samples were rinsed in de-ionized water and dried under a high purity N₂ gas flow. The electrical, optical and morphological properties of the CdS layers were then studied using photo-electrochemical cell measurements, UV-Vis absorption spectroscopy and scanning electron microscopy respectively. As results revealed, the CdCl₂ solution with the concentration of 1.0 mol/L and the pH of 2.00 is suitable for achieving good material properties in the CdS layers.

Keywords: Cadmium sulfide, Cadmium chloride treatment, Electrodeposition, Material characterization.

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