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ORIGINAL RESEARCH ARTICLE

Growth and Characterization of Seed-Assisted, EDTA-Treated, Chemical Bath-Deposited CdS

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Abstract

A simple low-cost method to enhance the electrical properties including open-circuit voltage (V_{OC}), flat-band potential (V_{fb}) and short-circuit current (I_{SC}) in the photoelectrochemical (PEC) cell of cadmium sulfide (CdS) thin films is presented. The PEC cell properties were determined using the configuration Pt/0.1 M $Na_2S_2O_3$/CdS. Three different sets of CdS thin films were grown: (a) chemical bath-deposited CdS (CBD-CdS), (b) electrodeposited seed-assisted CBD-CdS (ED/CBD-CdS) and (c) ED/CBD-CdS deposited under the presence of ethylenediaminetetraacetic acid (EDTA) in a reaction solution of CBD (ED/(CBD+EDTA)-CdS). The FE-SEM images suggested the formation of clusters with spherical shape in the presence of a seed layer. All the samples grown with seed layers demonstrated improved I_{SC} and V_{OC} values in the PEC cell compared to the CBD-CdS films due to better contact between the substrate and CBD-CdS. Furthermore, the carrier concentration (N_D) and V_{fb} were also found to improve due to the introduction of the seed layer. In the case of ED/(CBD+EDTA)-CdS, the cluster size was found to be smaller, giving rise to a larger effective surface area. The improved effective surface area, interparticle connections and adhesion of CdS to the FTO substrate resulted in superior electrical properties of ED/(CBD+EDTA)-CdS compared to ED/CBD-CdS and CBD-CdS films.

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