

A New Technique to Prepare Nano-Sized CdS Films for Light-to-Electricity Conversion

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Abstract:

In this study, we intend to introduce a new technique to prepare nano-sized films of CdS for the purpose of light-to-electricity conversion processes. In order to assess the new systems, their photoelectrochemical (PEC) characteristics have been compared with conventional counterparts.

The nano-sized films were prepared by different techniques, namely: electrochemical (EC), chemical bath (CB), and electrochemical followed by chemical bath (EC/CB) techniques. The latter technique describes the preparation of our new film. All films were deposited onto fluorine-doped tin oxide-coated glass substrates (FTO/glass). The different types of films were compared with each other by monitoring different parameters, such as: open-circuit voltage (V_{oc}), short-circuit current density (J_{sc}), dark current-density-potential (J-V) plots, photo (J-V) plots, conversion efficiency (η) and stability. Enhancement of deposited CdS thin film characteristics in light-to-electricity conversion was investigated.

The characteristics of different films were also studied before and after annealing treatment. The films were annealed to 250°C under N_2 . Cooling of pre-heated films to room temperature was performed by slow cooling and quenching. The effect of each treatment on the film characteristics was measured by monitoring V_{oc} , J_{sc} , dark J-V plots, photo J-V plots and (η). The characteristics of CdS thin films in PEC systems were enhanced by annealing and slow cooling in each preparation. On the other hand, slow cooling showed higher conversion efficiency than quenching, in each preparation.

CdS thin films prepared by EC/CB technique, before annealing, have higher efficiency than films prepared by EC, but lower than CB systems. After annealing, EC/CB prepared systems showed higher efficiency than either EC or CB prepared counterparts.

Keywords: CdS, Nano-Films, PEC, Electrochemical/Chemical Bath Deposition.

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