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

Sahar Khudruj, Ahed Zyoud, Iyad Saadeddin and Hikmat S. Hilal
Graduate Student, Department of Chemistry, An-Najah N. University, PO Box 7, Nablus, Palestine
saharmustafa1985@yahoo.com

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 evaluate the new systems, their photo electrochemical (PEC) characteristics have been compared with conventional counterparts, in addition, their optical and structural characteristics such as SEM and XRD have been studied and 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) deposition techniques. The latter technique describes the new preparation technique for CdS nano particles. 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}), current density (J_{sc}), photo (J-V) plots, efficiency and stability.

Poly crystalline CdS thin films, prepared by different techniques, were modified by annealing and slow cooling to enhance PEC characteristics. The effect of treatment on film characteristics has been studied by: photo (J-V) plots, efficiency, and stability.

Annealing and slow cooling showed higher conversion efficiency for each preparation technique compared with un-treated films.

SEM and XRD results for prepared CdS films were consistent with the efficiency results for each preparation technique before and after modification. Annealing and slow cooling increased the grain size of CdS nano particle and consequently, increased the efficiency.

CdS thin films prepared by EC/CB technique, before annealing, showed higher efficiency than films prepared by EC, but lower than CB systems. After annealing, the EC/CB prepared systems showed higher efficiency than either EC or CB prepared counterparts. The results show that the new preparation technique gives new thin films with higher efficiency and stability than earlier conventional prepared.