

Nanocauliflower like structure of CdS thin film for solar cell photovoltaic applications: In situ tin doping by chemical bath deposition technique

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Abstract

We report on surface morphology changes of in situ tin (Sn) doped cadmium sulphide (CdS) thin film nanostructures prepared on a glass substrate using the chemical bath deposition (CBD) technique. Sn-doping in the presence of triethanolamine (TEOA) as complexing agent resulted in the formation of nanocauliflower like structure of CdS thin film. X-ray diffraction (XRD) results indicated that Sn-doped CdS thin films show a hexagonal structure with a preferential orientation growth along the c-axis (002). The Sn⁴⁺ doping markedly influenced on the evolution of the CdS nanostructures, resulting in the formation of nanocracks due to the substitution of Cd²⁺ ions by larger-than-host Sn⁴⁺ ions as well as a drastic increase in electrical conductivity. An improved optical transmittance property was also achieved by the Sn-doping with no considerable change in the energy band gap. Moreover, a large improvement in both electrical conductivity and photosensitivity observed in the Sn-doped CdS thin films suggests that Sn-doping is highly effective for applications as window/buffer layers in future solar cell applications. Structural evolution of cauliflower like nanostructures are also discussed in this paper.