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Photovoltaic device performance of electron beam evaporated Glass/TCO/CdS/CdTe/Au heterostructure solar cell

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Abstract

In this work, we report on substrate temperature and Cu addition induced changes in photovoltaic device performance of Glass/TCO/CdS/CdTe/Au heterostructure prepared by electron beam evaporation technique. Prior to the photovoltaic study the structural and optical properties of CdTe, CdTe:Cu and CdS/CdTe, CdS/CdTe:Cu layers were studied. X-ray diffraction (XRD) study showed the deposited films belong to zinc blende structure. The existence of Te peak in the XRD pattern revealed the presence of excess Te in the deposited film structures, which confirmed the *p*-type conductive nature of the films. This was further substantiated by the electrical study. The low resistivity of 1×10^3 Ω cm was obtained for 4 wt.% of Cu doped CdTe film, which may be due to the substitutional incorporation of more efficient Cu^{2+} (Cd^{2+}) in the CdTe lattice. The decrease in band gap with increasing Cu content may be attributed to the existence of shallow acceptor level formed by the incorporation of Cu dopant into the CdTe lattice. The efficiency of cell is increased with increasing Cu concentration and the cell prepared at room temperature with 4 wt.% of Cu addition possesses the maximum conversion efficiency of 1.68%. Further, the photo response of the device is good as the V_{oc} and I_{sc} is increased with increase in input power.

Key words: CdTe, grain boundary effect, optical tailoring, recombination losses, ideality factor, parasitic resistances, conversion efficiency.

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