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Characterization of Nanostructured Heterojunction Solar Cells of $CdS/Cd_{2x}(CuIn)_{1-x}S_2$ Grown by Chemical Spray Pyrolysis

Abstract

A nanostructured heterojunction of $CdS/Cd_{2x}(CuIn)_{1-x}S_2$ with x=0.2 was prepared by chemical spray pyrolysis on ITO/glass substrate at 350 °C. The X-ray diffraction pattern obtained from $CdS/Cd_{2x}(CuIn)_{1-x}S_2$ solar cell confirmed the formation of $Cd_{2x}(CuIn)_{1-x}S_2$ (CCIS), $CuInS_2$, In_2S_3, and CdS phases, with crystallite size of 16 nm for CCIS and 26 nm for CdS films. The morphology of the film surface was obtained by AFM technique, which produced a greater grain size of 58.3 nm for CdS and 80 nm for CCIS surfaces. Optical absorbance analysis confirmed the composition-controlled electronic transition in the thin film, and the energy band gap was observed to red shift with the increase in the value of x. The electrical properties produced a P-type conductivity of CCIS with two activation energies. I–V characteristic in dark condition produced unsymmetrical heterojunctions, whereas abrupt-type heterojunctions were produced from the C–V curve. The solar energy conversion efficiencies achieved upon illumination of 100 mW/cm^2 were 0.35%, 0.5%, 0.9%, and 1.28% for CCIS thicknesses of 610, 800, 910, and 1000 nm, respectively.

Keywords; Hetrojunction Solar Cells, Nanostructure, Spray Pyrolysis