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Cadmium Telluride (CdTe) nanoparticles deposition on transparent conductive substrates via thermal evaporation

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Abstract

Cadmium telluride (CdTe) nanoparticles were deposited on glass substrates coated by indium tin oxide (ITO) and fluorine doped tin oxide (FTO) as transparent conducting films at 200 °C under pressure of 2×10^{-5} mbar. The thickness of the prepared films prepared was about 200 nm. The structure, optical, electrical, and morphological properties of the layers were analyzed by x-ray diffraction (XRD), ultraviolet-visible (UV-Vis) spectroscopy, current-voltage (IV) characterization, and scanning electron microscopy (SEM), respectively. XRD patterns show the cubic structure of the deposited CdTe thin film on both ITO and FTO substrates. The preferred orientation of deposited films also changed from (111) for ITO substrate to (220) for FTO substrate. The crystallite size of films on ITO and FTO in these orientations were about 23.41 and 34.84 nm, respectively. The thin-film transmittance spectra were determined using UV-Vis spectroscopy in the wavelength range of 200-1200 nm. The optical energy bandgap of thin films on ITO and FTO substrates was calculated to be 1.60 and 1.63 eV, respectively. The I-V curve shows more electrical conductivity of the CdTe thin film on the FTO compared to the ITO. The surface morphology images show homogeneity and uniformity of the surface.

Keywords: cadmium telluride, thermal evaporation deposition, energy bandgap, crystallite size, extinction coefficient

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