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Structural, Morphological and Optical Properties of Nanocrystalline ZnCdTe Thin Films Developed by Electrodeposition Technique

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ABSTRACT

Zinc Telluride is important binary semiconductor materials of II-VI family (CdS, CdSe, ZnO, ZnSe, CdTe etc.) because of its extensive potential applications in different optoelectronic devices. It has a direct band gap semiconductor having band gap 2.26 eV at 300 K. It is suitable material for several applications like solar cell, photodetector, light emitting diodes. Zinc Telluride (ZnTe) is having p-type conductivity due to its nonstoichiometry (Zn vacancy) characteristic. Among this II-VI semiconductor Cd doped ZnTe (ZnCdTe) thin films possess properties between those of ZnTe and CdTe. Here we investigated the effects of cadmium (Cd) doping on the structural and optical properties of nanocrystalline ZnTe thin films. A nanocrystalline ZnCdTe thin film was successfully electrodeposited on nickel/glass substrate using potentiostat/galvanostat. The structural, compositional and optical properties of developed ZnCdTe thin films were studied by XRD, SEM, EDS, UV-VIS spectroscopy and PL spectroscopy. The diffraction peaks of ZnCdTe films observed at 2θ ≃ 24°, 30°and 40° respectively with preferred orientation indicates the crystalline nature of developed film. Crystalline size has been calculated by using Scherrer formula. A SEM photograph shows that grains are uniform and densely distributed over the surface. Compositional analysis reveals the presence of Zn, Cd and Te. With cadmium doping the optical energy band gap of ZnCdTe films were found to be 1.98 eV and photoluminescence emission of ZnCdTe film shows a broad peak in visible region. The doping of cadmium concentration results into sharp increase in emission intensity. It is observed that developed ZnCdTe thin film provides a smooth flat texture and having optimum energy gap suited for optoelectronic application and device fabrication.

Keywords: Characterization·Optical·Structural·Semiconductor·Thin films·ZnCdTe.