Nanocomposites and nanomaterials

Elaboration and Characterization of TM-doped ZnO Thin Films: Effect of doping on structural and optical properties

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Undoped and Mn-doped ZnO nanostructured thin films have been deposited onto glass substrates by sol–gel spin coating method. Zinc acetate dehydrate [Zn $(CH3COO)_2.2H_2O$], Manganese acetate tetrahydrate [$Mn(CH3COO)_2.4H_2O$], Isopropanol and monoethanolamine (MEA) were used as a precursor, doping source, solvent and stabilizer respectively. The molar ratio of MEA to metal Ions was maintained at 1.0 and a concentration of metal ions is 0.7 $mol.L^{-1}$.The Mn dopant level was defined by the Mn/(Mn+Zn) ratio it varied from 0 to 12.5% mol. The XRD results showed that all films crystallized under hexagonal wurtzite structure and the crystallite size decreases with increase of Mn concentration. The average transmittance of most films is over 80% in the visible region and the band gap energy increases with increase of Mn concentration. In the Raman spectra of Mn-doped ZnO, different vibrational modes were observed. Photoluminescence of the films showed an ultraviolet (UV) and defect related visible emissions. The possible origins responsible for these emission bands have been discussed. ZnO thin films with Mn exhibited the best optical properties; therefore such films can be usefully applied in different optoelectronics device applications.

Keywords: Sol-Gel method; ZnO thin film; Manganese doping; Defects; photoluminescence; optical properties.

1. Xu P S., Sun Y M., Shi C S., Xu F Q., Pan H B.The electronic structure and spectral properties of ZnO and its defects.// Nuclear Instruments Methods in Physics Research B. -2003.-199.-P. 286- 290.
2. Sabri N S., Yahya A K., Talari M K. Emission properties of Mn doped ZnO nanoparticules prepared by mechanochemical processing// J. Luminescence.- 2012.-132.-P. 1735-1739.
3. Mahroug A., Boudjadar S., Hamrit S., Guerbous L. Structural, morphological and Co-doped ZnO thin films prepared and optical properties of undoped by sol–gel process// J Mater Sci: Mater Electron. -2014.-25.-P. 4967–4974