

Enhanced defect emission in Co doped ZnO nanorods synthesized by electrochemical route

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ABSTRACT

We present the effects of Co doping on the morphology, structural and optical properties of ZnO nanocoatings in detail. Highly oriented wurtzite ZnO nanorods were fabricated by electrodeposition method using $\text{Zn}(\text{NO}_3)_2$ as the electrolyte. Again, the Co doped (0.03 mM CoSO_4) ZnO nanocoatings were synthesized on ITO coated glass substrates. The surface morphology and the structural properties of the coatings were studied using field emission scanning electron microscopy (FESEM) and X-ray diffraction (XRD), respectively. The FESEM data (Fig. 1) showed the top view of oriented hexagonal ZnO nanorods. The XRD pattern showed a shift in (002) diffraction peak of ZnO towards higher 2θ values by the substitution of dopant, which indicates that the Zn^{2+} site is successfully replaced by the dopant Co^{2+} . Moreover, the photoluminescence spectroscopy (PL, 325 nm excitation) was used to study the UV emission and the defect emission of the doped and undoped ZnO nanostructures. The PL data (Fig. 2) revealed a blue shift in the UV emission for the doped sample which signifies that for ZnO coating prepared with 0.03 mM CoSO_4 , the energy gap increased from 378 nm (3.27 eV) to 375 nm (3.30 eV). Also, the intensity of deep level emission (~ 600 nm) increased for the doped one as compared to the pure ZnO coating. Our results demonstrate that Co doping may be responsible for the blue shift in band gap of ZnO nanocrystals. The oxygen defects or Zn interstitials may be responsible for the broadening of the PL peak at 600 nm.

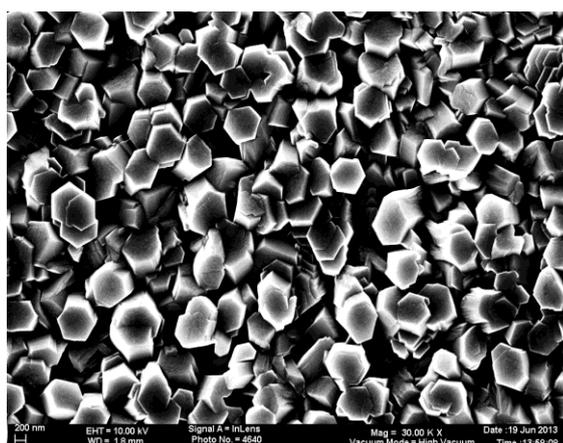


Fig.1 FESEM micrograph of Co doped ZnO nanorods.

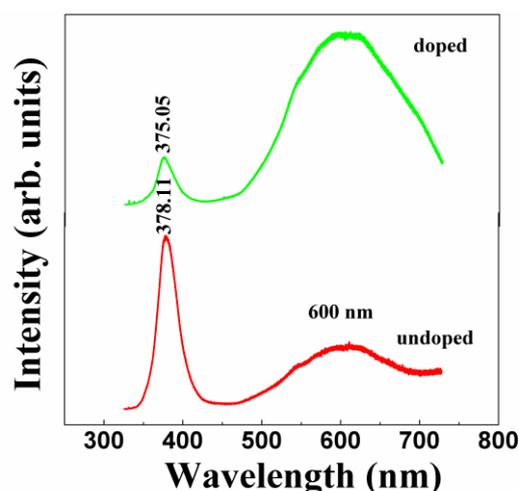


Fig. 2 PL spectra of Co doped and pure ZnO nanorods.