Structural and optical study of co doped zno thin films

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Abstract

ZnO is a n-type II-VI semiconductor with a wurtzite structure, a wide direct band gap of 3.37eV, and a large exciton binding energy of 60meV. It occupies a particular place among wide bandgap semiconductors (GaN, ZnS…), which have been actively studied because of their exceptional electrical and optical properties. There are different (physical and chemical) ways to synthesize ZnO nanostructures which improve these properties. The present study deals with to the fabrication and characterizations of ZnO thin films and Co doped ZnO with different concentrations. The samples preparation was carried out by sol-gel method and films were deposited onto cleaned glass substrates by dip-coating technique. Zinc acetate dehydrate, cobalt acetate, methanol and ethanolamine were used as starting materials with controlled ratios. The obtained films were characterized by different techniques such as X-ray diffraction and Scanning Electron Microscopy (SEM) from which we deduce the good crystallinity of ZnO and the orientation along [002] axis of ZnO crystals. The average size of ZnO crystallites (R = 48 nm) was calculated using the Debye-scherrer formula. The UV-Visible absorption of Co doped ZnO thin films shows a shoulder at 366 nm which indicates a size dispersion of ZnO crystallites. The observed blue shift of the absorption edge and the widening of the bandgap Eg= 1,01 eV confirm the quantum confinement induced by the nanometric size of ZnO crystallites.

Keywords: Nanocrystals; thin films; Sol-gel method; XRD; SEM; UV-Visible absorption; quantum confinement.