Photoluminescence properties of Co-doped ZnO nanorods synthesized by hydrothermal method

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Abstract: Cobalt doped zinc oxide nanorods $Zn_{1-x}Co_xO$ (x = 0.01, 0.10) have been synthesized by a hydrothermal process with $Zn(NO_3)_2$, $Co(NO_3)_2$, NH_4OH, $CO(NH_2)_2$ and C_2H_5OH at 150 °C for 1 h. X-ray diffraction and scanning electron microscopy were used to characterize the crystalline structure, size and morphology of the samples. The photoluminescence (PL) and the PL excitation spectra of the nanorods were measured in the range of temperature from 15 K to room temperature. The PL spectra at low temperatures exhibit a group of ultraviolet narrow lines in the near-band-edge region of 3.0-3.4 eV and a very broad band peaked at 3.20 eV. The origin of the near-band-edge PL is interpreted as an emission from free excitons, neutral donor-bound excitons, radiative transitions from a donor to the valence band and donor-acceptor pairs. In particular, a group of emission lines in the red region of 1.8-1.9 eV have been revealed. These emission lines were assigned to the radiative transitions within the tetrahedral Co^{2+} ions in the ZnO host crystal. © 2009 IOP Publishing Ltd.

Index Keywords: Broad bands; Co-doped ZnO; Crystalline structures; Donor-acceptor pairs; Emission lines; Free excitons; Host crystals; Hydro-thermal process; Hydrothermal methods; Low temperatures; Narrow lines; Near band edges; Neutral donors; Photoluminescence properties; PL excitations; PL spectrum; Radiative transitions; Room temperatures; X- ray diffractions; Zinc oxide nanorods; Zno; Cobalt; Electromagnetic wave emission; Excitons; Nanorods; Photoluminescence; Scanning electron microscopy; Semiconducting zinc compounds; Zinc; Zinc oxide; Emission spectroscopy

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