

NEXAFS, XMCD and Optical studies of Co-ZnO DMS

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The Co doped ZnO, a dilute magnetic semiconductor (DMS), having room temperature ferromagnetism is synthesized by a novel technique of ion implantation and swift heavy ion irradiation (SHI) on the plasma assisted MBE grown ZnO film^{1,2}. The structural, magnetic and magnetic force microscope (MFM) studies revealed the room temperature ferromagnetism of the synthesized films¹. This paper reports the Near Edge X-ray Absorption Fine Structure (NEXAFS), X-ray Magnetic Circular Dichroism (XMCD) and Optical (Low temperature Photoluminescence and UV-visible absorption spectra) studies on the synthesized Co-ZnO DMS films. The XMCD measurements at the Co $L_{2,3}$ edges of Co doped ZnO revealed clear multiplet features, characteristic of ferromagnetic Co^{2+} ions tetrahedrally coordinated by O^{2-} ions. The NEXAFS spectra, matching the reference spectra of CoO (not matching with Co metal and Co_2O_3), clearly show the +2 oxidation state of the Co in ZnO. The low temperature (10 K) photoluminescence spectra shows the crystal field splitted $3t_{2g}$ and $2e_g$ bands of Co d orbitals. The UV-visible absorption spectra show the systematic variation of optical bandgap with the Co implantation dose after SHI irradiation. These results indicate that the synthesized Co-ZnO through ion-implantation and SHI irradiation produces a single phase Co substituted ZnO DMS films and ferromagnetism at room temperature arises from the Co^{2+} ions substituting Zn^{2+} ions.

[References]

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