

Structural, optical, and electronic studies of Ni doped ZnO thin films

© Prateek Gupta, Bhubesh C. Joshi^{1,*}

Department of Physics and Material Science and Engineering, Jaypee Institute of Information Technology, Noida, India 201309

* E-mail: bhubesh.joshi@jiit.ac.in

Received 19 April, 2022

Revised 10 March 2023

Accepted for publication 10 March 2023

The structural, optical, and electronic properties of Ni-doped ZnO (NZO) thin films were studied by X-ray diffraction (XRD), ultraviolet-visible transmittance spectroscopy (UV-Vis), atomic force microscopy (AFM), and Fourier transform infrared spectroscopy (FTIR). 0, 3, 5, and 7% NZO thin films were deposited on quartz substrate by pulsed laser deposition (PLD) technique at a substrate temperature of 300°C and oxygen partial pressure of 1 mTorr. XRD results show that all deposited films were crystalline and oriented along the (002) plane with wurtzite symmetry. All deposited films also show high transmittance in the UV-Visible regime (300–800 nm). Tauc formulation was used to calculate the bandgap. NZO thin films show a lesser bandgap as compared to pure ZnO films and further with Ni concentration the bandgap was reduced from 3.20 eV (3%) to 3.11 eV (7%). AFM results revealed the uniform deposition of NZO and ZnO films over a quartz substrate and FTIR analysis shows the shifting of the Zn-O-Zn band towards higher frequency numbers with Ni concentrations. Results obtained from this study indicate that as PLD grew NZO thin films can be a promising candidate for optoelectronic application.

Keywords: ZnO, PLD, XRD, Ni, UV, NZO.

Full text of the paper will appear in journal SEMICONDUCTORS.