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Reactive magnetron sputtering of Ni doped ZnO thin film: Investigation of optical, structural, mechanical and magnetic properties

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Abstract

Nickel doped ZnO (ZnO:Ni) thin films are considered to be promising materials for optoelectronic applications. The doping of transition metal ion modifies the optical and physical properties of the materials. Therefore, studies on optical and physical properties are important for such applications. In the present work, the ZnO:Ni thin films with different Ni concentrations were deposited on Si (1 0 0) and corning glass substrates at 400 ºC by reactive magnetron sputtering using Ar and O_2 gas mixture. The (0 0 2) growth plane of the ZnO was identified from the X-ray diffraction experiment. It was also confirmed that the films exhibit strong preferred orientation (texture) of crystalline columns in the direction [0 0 1] perpendicular to the substrate surface. The optical transmittance, band gap, and refractive indices of the thin films were studied by UV-Vis spectroscopy, photoluminescence and spectroscopic ellipsometry. The optical band gap and refractive index of the thin films decreased with increase of Ni content. The Raman and FT-IR spectroscopic studies were used to explain the modes of vibrations of the functional groups in the material. The surface