

Spray Pyrolysis Synthesized and ZnO-NiO Nanostructured Thin Films Analysis with Their Nanocomposites for Waveguiding Applications

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In this work, we have prepared ZnO, NiO, and nanocomposites ZnO-NiO thin films elaborated by the chemical method of spray pyrolysis on glass substrates at a temperature of 480°C. The prepared samples have been analyzed by means of the X-ray diffraction (XRD), UV-visible spectrophotometry, micro-Raman and m-lines spectroscopies techniques. The structure of the thin ZnO films is hexagonal of the wurtzite type with a preferential orientation along the axis (002). The size of the crystallites, deduced from the XRD measurements, varies between 25 and 43 nm. The NiO films crystallize in the cubic structure with the size 4 nm of the crystallites. The micro-Raman study confirms the XRD results showing the presence of the vibrational modes characteristics of the wurtzite structure of ZnO and the cubic structure of NiO.

The obtained films have an optical transmission varying from 60 to 95% in the visible region. The forbidden optical band energies, deduced from the transmittance, are 3.28 and 3.89 eV for the ZnO and NiO films, respectively. The optical waveguiding measurements carried out on pure ZnO and ZnO-NiO films show single-guided modes behavior (TE₀ and TM₀). These measurements have allowed deducing the thickness and the refractive index values which are respectively 250 nm and 1.89 for ZnO, 165 nm and 1.80 for ZnO-NiO thin films.

Keywords: ZnO-NiO, nanocomposites, thin films, spray pyrolysis, XRD, waveguiding.

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