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Effects of sol concentration on structural, morphological and optical waveguiding properties of sol-gel ZnO nanostructured thin films

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Abstract: Nanostructured ZnO thin films with different precursor concentrations (0.5-0.8 M) have been deposited on glass substrates by sol-gel dip coating technique. X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM), UV-visible spectrophotometer, and m-lines spectroscopy have been employed to investigate the effect of solution concentration on structural, morphological, optical and waveguiding properties of ZnO thin films. XRD spectra have shown that all the films are polycristalline and exhibit the wartzite hexagonal structire. SEM micrographs and AFM images have revealed that morphology and surface routhness of the thin films deprnd on sol concentration. The UV-visible transmittanceresults show a high transparency in the visible range and a shift of the maximum transmittance to the higher wavelength with increasing sol concentration. Waveguiding properties such as refractive index, number of propagating modes and attenuation coefficient measered at 632.8 nm wavelength by m-lines spectroscopy indicate that our ZnO slab waveguides are single mode and demonstrate optical losses estimated around 1.5 decibel per cm (dB/cm) for the thin film prepared with a sol concentration of 0.7 M.

Keywords : ZnO, sol-gel, thin film