

Properties of Co-doped ZnO thin films grown by pulsed laser deposition on glass substrates

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Abstract : Undoped and Co-doped ZnO (CZO) polycrystalline thin films (Co: 3, 5 at.%) have been deposited at 450°C onto glass substrates using pulsed laser deposition method. The used source was a KrF excimer laser (248 nm, 25 ns, 2 J/cm²). X-ray diffraction patterns showed that the Co-doped ZnO films crystallize in a hexagonal wurtzite type structure with a strong (002) orientation, and the grain sizes calculated from these patterns decrease from 37 to 31 nm by increasing Co doping. The optical waveguiding properties of the films were characterized by using prism-coupling method. The distinct M-lines of the guided transverse magnetic (TM) and transverse electric (TE) modes of the ZnO films waveguide have been observed. In the aim to study the optical properties of the ZnO films, an accurate refractive index and thickness measurement apparatus was set up, which is called M-lines device. An evaluation of experimental uncertainty and calculation of the precision of the refractive index and thickness were developed on ZnO films. The optical transmittance spectra showed a good transparency in the visible region. Calculated optical band gap varying from 3.23 to 3.37 eV when the content of Co doping increases from 0 to 5 at.%.

Keywords : Thin films, ZnO, pulsed laser deposition, Waveguiding properties, Optical transmittance