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

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Abstract: Undoped and cobalt-doped zinc oxide (CZO) polycrystalline piezoelectric thin films (Co: 3,5 at.%) using a series of high quality ceramic targets have been deposited at 4501C ontoglass substrates using a pulsed laser deposition method. The used source was a KrFexcimer laser (248 nm, 25 ns, 2 J?cm2). X-ray diffraction patterns showed that the Codoped 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 nmby increasing Co doping. The optical waveguiding properties of the films were characterized by using a prism-coupling method. The distinct M-lines of the guided transversemagnetic (TM) and transverse electric (TE) modes of the ZnO films waveguide have beenobserved. With the aim of study the optical properties of the ZnO films, an accurate refractive index and thickness measurement apparatus was set up, which is called M-linesdevice. An evaluation of experimental uncertainty and calculation of the precision of therefractive index and thickness were developed on ZnO films. The optical transmittancespectra showed a good transparency in the visible region. Calculated optical band gapvarying 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, Piezoelectric, Waveguiding properties, Optical transmittance