Characterization of optical properties of nanocrystalline doped PZT thin films

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High optical transmittance and refractive index together with strong electro-optic Kerr effect of the ferroelectric lead-zirconate-titanate (PZT) films can be utilized in various active optical applications like optical shutters, modulators and waveguides. Pulsed laser deposition (PLD) with XeCl-excimer laser with a wavelength of 308 nm and Nd-modified PZT target were used for the optical thin film fabrication. The films were deposited on single-crystal MgO(100) substrates. The crystal structure and grain size distribution were studied using XRD technique. The optical transmission spectra of the films were measured at UV-VIS-NIR wavelengths, which was utilized to obtain the refraction index n dispersion, extinction coefficient k, and the value of the band gap E_g. Electro-optic coefficients were determined by ellipsometric technique. In the case of polycrystalline films, mean grain size was between 9 nm and 20 nm. At the wavelength of 633 nm the refractive index varied from 2.28 to 2.46 as a function of mean grain size. Also, the electro-optic coefficient showed dependence on grain size distribution increasing from 0.37×10^{-18} m^2/V^2 to 2.49×10^{-18} m^2/V^2 with increasing mean grain size.