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STUDY OF TRANSPARENT FERROELECTRIC THIN FILMS BY OPTICAL REFLECTOMETRY AND ELLIPSOMETRY

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Ferrolectric thin films have attracted much attention due to their potential applications such as high dielectric constant capacitors, non-volatile memories, infrared sensors and electro-optic devices. Their ferroelectric and dielectric properties have been extensively investigated, while their optical properties have been relatively rarely studied. However, the optical constants, e.g., refractive index and extinction coefficient has great importance for waveguiding and other optical applications. In this report optical reflectometry and ellipsometry techniques are combined as an efficient non-destructive tools for measuring thickness and refractive index of transparent ferroelectric thin films. A miniature Ocean Optics CCD spectrometer, model PC 1000, designed as a plug-in PC ISA slot with fibre optics input is used for the reflectivity measurements under normal light incidence geometry. The film thickness of the 0.05-10 m range can be evaluated immediately within 5-10% precision even without an exact knowledge of refractive index. Additional refinement of results for helium-neon laser wavelength can be obtained by variable-angle ellipsometry taking measurements at several different incidence angles, thereby increasing the amount of information available for analysis. Optical constants were determined by fitting the multilayer model function to the measured data. Barium titanate (BT), lead zirconate titanate (PZT) and lead magnesium niobate (PMN) thin films and alternated strontium titanate barium titanate heterostructures deposited on various substrates by rf-sputtering, laser ablation and sol-gel technique have been investigated. The optical properties related to sample fabrication, structure, dielectric properties and composition will be discussed.

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