

Effects of aging time on microstructure, hydrophobic and optical properties of BiFeO₃ thin films synthesized via sol-gel method

ABSTRACT

BiFeO₃ (BFO) films were synthesized with the sol-gel method followed by the spin coating technique using 2-methoxyethanol as solvent and acetylacetone as chelating agent. The effects of aging time ($t = 0, 1, 3, 6$ days) of the BFO sol on the microstructure, wettability and optical properties of BFO films were investigated by means of X-ray diffraction (XRD), atomic force microscopy (AFM), contact angle (CA) measurement, UV-vis and photoluminescence. The crystallinity of films was affected by t . Crystallite size of the films changed slightly in the range of 14.2 – 15.2 nm while the lattice parameters clearly varied with t . The average particle size of BFO films ranged between 45.9 and 52.7 nm while the mean square roughness (R_q) varied between 1.0 and 4.2 nm. The films showed maximum optical transmittance (81 – 90 %) in the range 600 – 800 nm. The band gap of the films was also affected with t , and it has a value of 2.85 to 2.76 eV. The films showed a hydrophobic property with CA ranging between 95.3 to 104.7 °. The best crystallinity, lowest R_q and highest $E_g = 2.85$ eV were obtained for the film with $t = 1$ day. The results demonstrate possible development of a superhydrophobic coating using BiFeO₃ coating.

Keyword: BiFeO₃ films; Wettability; Aging time; Roughness; Band gap