Growth of multiferroics BiFeO$_3$ thin films by sol–gel method

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Abstract

The growth of BiFeO$_3$ thin films were spin-coated onto Pt(1 1 1)/Ti/SiO$_2$/Si(1 0 0) substrates. The crystal structure of the BiFeO$_3$ annealed at 500 °C was determined to be rhombohedral of R3c space group with its lattice constants $a_0 = b_0 = 5.5728$ Å, $c_0 = 13.8412$ Å, respectively. The Bragg factors R_B and R_F were 8.79% and 4.85%, respectively. Scanning electron microscope (SEM) pictures revealed that the matrix is uniform and no segregation of impurity phase was detected. Auger electron spectroscopy (AES) analysis indicated that the sample is chemically homogeneous with Bi/Fe atomic percent ratio being close to 1. Images of atomic force microscopy (AFM) show that their root-mean squared and average values of the surface roughness of the film were 34.3 and 27.3 Å, respectively. The differential scanning calorimetry (DSC) curve indicates a phase transition at a temperature of 354 °C. The film shows well-saturated weak ferromagnetic hysteresis loop with maximum magnetic field of 10 kOe at room temperature.
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