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| Title | Structural, electronic, and magnetic analysis and device characterization of ferroelectric–ferromagnetic heterostructure (BZT–BCT/LSMO/LAO) devices for multiferroic applications | | |
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| Abstract |  |
| Ferroelectricity and ferromagnetism have been investigated in a lead-free 0.5Ba(Zr 0.2 Ti 0.8 )O 3 -0.5(Ba 0.7 Ca 0.3 )TiO 3 (BZT-BCT)/La 0.7 Sr 0.3 MnO 3 (LSMO) heterostructure for multiferroic (MF) applications. The BZT-BCT thin film has been grown on LSMO/lanthanum aluminate, LaAlO 3 (LAO) by pulsed laser deposition (PLD). Prior to that, the LSMO layer was deposited on a single-crystal LAO substrate by PLD. The epitaxial growth of the (001) oriented films was confirmed by X-ray diffraction analysis. The small value of the full-width at half-maximum of the rocking curve peak (0.1°) performed about (002) plane of the BZT-BCT film indicates an out-of-plane orientation of the film. The polarization switching behavior in the heterostructure device was observed with a remnant polarization of ~47 μC/cm 2 and a coercive field of ~180kV/cm at an applied voltage of 5 V. The frequency-dependent relative dielectric constant varies in-between 5100 and 4900 in the frequency range from 1 to 50 kHz during the dielectric measurements of the fabricated device. The observed low value of the dielectric loss (0.02) confirms the outstanding quality of the ferroelectric device. A well-saturated room temperature magnetization-applied field curve, with a coercive field of ~1200A/m and a remnant magnetization of ~110kA/m, was observed in the LSMO/LAO system indicating the ferromagnetic behavior of the film. The temperature-dependent magnetization of the LSMO film exhibits a ferromagnetic-to-paramagnetic transition at ~360K. These results on all solid-state ferroelectric-ferromagnetic heterostructure using BZT-BCT and LSMO open viable possibilities for MF applications. | |