ABSTRACT

Multiferroic composites could provide more than one spontaneous electric, magnetic, and elastic order simultaneously. Recently, the research interest in multiferroics has focused more and more in thin films area with the development of thin film growth techniques, which enable deposition under epitaxial engineering and non-equilibrium conditions. Among the most widely studied two-phase multiferroic composite thin films, self-assembled epitaxial BiFeO$_3$–CoFe$_2$O$_4$ (BFO–CFO) nanocomposite thin films have attracted tremendous research interest. This kind of thin films is known to self-assembly grow and form (1-3) nanostructure with rectangular-shaped CFO nanopillars embedded in BFO matrix by deposited on (001) SrTiO$_3$ (STO) substrates.

Here, by utilizing such specific nanostructure, we pre-deposited one BFO layer on the bottom, and post-deposited another BFO layer on the top of that above mentioned BFO-CFO (1-3) thin film on (001) STO substrate. Hence, we successfully obtain a new quasi (0-3) heterostructures, which have second phase CFO nanoparticles (nanopillars) embedded in a primary BFO matrix phase. This new heterostructures could significantly reduce possible leakage current paths through the ferromagnetic phase substantially. And the good connectivity among the constituents might result in better coupling between the piezoelectric and magnetostrictive phases to enhance the potential magnetoelectric effects, which would provide much wider application for this new heterostructures.

BIO

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