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Structure, magnetic and transport properties of ferromagnetic/ferroelectric manganite based multilayers.

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We have investigated the structural, magnetic and transport properties of $La_{0.75}Sr_{0.25}MnO_3/Ba_{0.7}Sr_{0.3}TiO_3$ (LSMO/BSTO) superlattices. The samples were grown by magnetron sputtering on $SrTiO_3$ (100) monocrystalline substrates. The ferromagnetic (fm) LSMO and the ferroelectric (fe) BSTO layer thickness have both been varied between 2 and 10 nm in order to study the influence of biaxial strains, ferromagnetism and ferroelectricity on the physical properties of these composed systems.

The structure of the multilayers has been studied by refinement of the XRD patterns using a modified version of the SUPREX software. X-ray diffractions patterns show that the samples present a very good crystalline growth, textured in the direction perpendicular to the sample surface. The interfaces are very well defined with little roughness and interdiffusion. The magnetic properties of the samples were analyzed as function of temperature and magnetic field. Little change is observed in the magnetic properties of the superlattices as the thickness of the fe layer is modified. On the other hand, a reduction of the magnetic transition temperature (Tc) is observed as the thickness of the fm layer is decreased. This effect could be related to the increasing influence of biaxial strains as the fm thickness is reduced due to the different lattice parameters of the LSMO and BSTO compounds. No significant reduction of the saturation magnetization is observed even for the superlattices with fm layers as thin as 2 nm. This result could sugest that there is no magnetically dead layers in the structures, probably due to the chemical and structure properties of the LSMO-BSTO interface. This characteristic is very promising for the future development of ferromagnetic/ferroelectric devices. The transport properties of these systems are correlated with their magnetic properties. A systematic study of this property as function of temperature and magnetic field is also presented.

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