Coupled magnetic and structural transitions in the $La_{0.7}Sr_{0.3}MnO_3/SrTiO_3$ system

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$La_{0.7}Sr_{0.3}MnO_3$ (LSMO) films and LSMO/$PbZr_{0.2}Ti_{0.8}O_3$ (PZT) multilayers were grown on vicinal (miscut angle $0.1^\circ - 0.2^\circ$) $SrTiO_3$ (100) substrates by pulsed laser deposition at an oxygen partial pressure of 300 mbar and a substrate temperature of 600°C. XRD and TEM cross-sectional investigations showed heteroepitaxial growth with excellent structural quality of the LSMO and PZT layers. The focus of this contribution will be on the magnetic properties of bare LSMO films at the structural transition of the $SrTiO_3$ substrates at about 105 K. For this three LSMO films with thickness of 40, 15 and 5 nm, respectively, were selected for further magnetic characterization by SQUID magnetometry and ac-susceptometry. In agreement with the high structural quality the films were found to be magnetically soft with coercive fields below 1 mT near 100 K. Below 105 K the development of a multiple-step transition in the magnetization reversal characteristics is clearly observed. The coercive field versus temperature curve splits into three branches below the structural transition. This is attributed to the formation of three different types of structural domains in the LSMO films as a response to twinning in the $SrTiO_3$ substrate. The influence of strain at the LSMO/$SrTiO_3$ interface as well as the modification of this transition in the LSMO/PZT multilayers is analyzed and discussed.

9.7 cm

13.4 cm

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