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Nanostructure engineering of epitaxial colossal magnetoresistive oxide thin films ANIL RAJAPITAMAHUNI, VIJAY RAJ SINGH, LE ZHANG, XIA HONG, Department of Physics and Astronomy, University of Nebraska-Lincoln, NE-68588 — We have fabricated nanostructured colossal magnetoresistive (CMR) oxide thin films to study the effect of phase separation. Using off-axis radio frequency magnetron sputtering, we have grown epitaxial single crystalline 4-6 nm La0.5Sr0.5MnO3 (LSMO) and La0.7Ca0.3MnO3 (LCMO) films on (110) NdGaO3 and (001) SrTiO3 substrates, respectively. X-ray diffraction and atomic force microscopy characterizations show the films have high crystalinity and RMS roughness of 2-3 Å. Films close to the electrical dead layer thickness (3-5 nm) are patterned into periodic depth modulation by e-beam lithography and fluorine based reactive ion etching. We fabricated nanostructures with periodic thickness variations of 1-2 nm and 100-200 nm periodicities. The etched patterns retain the atomic smoothness of the as grown films. We have the control of the etching depth with sub-nanometer precision on both LSMO and LCMO films. We discuss the effect of the periodicity and depth modulation of the nanostructures on the I-V characteristics and magnetotransport properties of these CMR thin films within the phase separation model.

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