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Enhancement of Magnetic Anisotropy in Ultrathin Epitaxial $La_{0.67}Sr_{0.33}MnO_3$ Thin Films via Nanostructure Engineering ANIL RAJAPITAMAHUNI, LE ZHANG, JOHN BURTON, VIJAY SINGH, EVGENY TSYMBAL, XIA HONG, University of Nebraska-Lincoln — We report a more than ten-fold enhancement of magnetic anisotropy in nanostructured $La_{0.67}Sr_{0.33}MnO_3$ (LSMO) thin films grown epitaxially on (001) $SrTiO_3$ substrates. We have etched periodic linear trenches in 6 nm LSMO films, and investigated magnetic anisotropy in these nanostructured thin films via the planar Hall effect (PHE). These trenches have depth of 2 nm and periodicities of 200 - 400 nm. The PHE resistance of the un-patterned LSMO films exhibits sinusoidal angular dependence in an in-plane magnetic field, and shows four-fold sharp resistance switching below a critical magnetic field of 400 Oe, corresponding to a biaxial magnetic anisotropy of $\sim$ 1x10^5 erg/cm^3 along <110>directions. In the nanostructured samples, we observe an additional two-fold resistance switching feature, which persists in magnetic fields higher than 4000 Oe, corresponding to a uniaxial magnetic anisotropy >1x10^6 erg/cm^3 along one of the biaxial magnetic easy axes. This significant enhancement of magnetic anisotropy cannot be accounted for by shape anisotropy or a uniform strain modulation. We also discuss the effects of the orientation and periodicity of the nano-trenches on the anisotropy enhancement.

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