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Controlled lateral anisotropy in correlated manganite heterostructures by interface-engineered oxygen octahedral coupling

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Ultimate miniaturization of magnetic random access memory (MRAM) devices is expected by the utilization of spin-transfer torques, because they present an efficient means to switch elements with a very high magnetic anisotropy. To overcome the low switching speed in current collinearly magnetized devices, new routes are being explored to realize magnetic tunnel junction stacks with non-collinear magnetization between two magnetic electrodes. Controlled in-plane rotation of the magnetic easy axis in manganite heterostructures by tailoring the interface oxygen network would provide a promising direction for non-collinear magnetization in correlated oxide magnetic tunneling junctions. Here, we demonstrate how to manipulate magnetic and electronic anisotropic properties in manganite heterostructures by engineering the oxygen network on the unit-cell level. The strong oxygen octahedral coupling is found to transfer the octahedral rotation, present in the NdGaO3 (NGO) substrate, to the La2/3Sr1/3MnO3 (LSMO) film in the interface region. This causes an unexpected realignment of the magnetic easy axis along the short axis of the LSMO unit cell as well as the presence of a giant anisotropic transport in these ultrathin LSMO films. As a result we possess control of the lateral magnetic and electronic anisotropies by atomic scale design of the oxygen octahedral rotation.

[1]Membership Pending