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Reversible Control of Magnetism in La0.67Sr0.33MnO3 through Chemically-Induced Oxygen Migration ALEXANDER GRUTTER, DUSTIN GILBERT, BRIAN MARANVILLE, JULIE BORCHERS, BRIAN KIRBY, National Institute of Standards and Technology, ELKE ARENHOLZ, Lawrence Berkeley National Lab, URUSA ALAAN, YURI SUZUKI, Stanford University, KAI LIU, University of California, Davis — There has been a surge of interest in controlling magnetism through oxygen migration for applications in hybrid ionic/magnetoelectric device architectures. With a rich magnetic and electronic phase diagram, the colossal magnetoresistive perovskite (La,Sr)MnO3 (LSMO) is an ideal candidate for achieving large modulations in magnetic properties with small changes in oxygen content. We demonstrate reversible control of magnetism in LSMO films through interfacial oxygen migration. Gd metal capping layers deposited onto LSMO leach oxygen from the film to form porous Gd_2O_3. X-ray absorption and polarized neutron reflectometry measurements show Mn valence alterations consistent with high oxygen vacancy concentrations, resulting in suppressed magnetization and increased coercive fields. Oxygen migration is observed both at the interface and also throughout the majority of a 40 nm thick film, suggesting extensive oxygen vacancy diffusion. After Gd-capped LSMO is exposed to atmospheric oxygen for a prolonged period of time, oxygen diffuses through the Gd_2O_3 layer and the magnetization of the LSMO returns to the uncapped value. These findings showcase perovskite heterostructures as ideal candidates for developing functional interfaces through chemically-induced oxygen migration.

Kai Liu
University of California, Davis

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