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Strain dependence of interfacial antiferromagnetic coupling in $La_{0.7}Sr_{0.3}MnO_3/SrRuO_3$ superlattices[1] SUJIT DAS, Institute for Physics, MLU Halle-Wittenberg, Germany, ANDREAS HERKLOTZ, Oak Ridge National Lab., Oak Ridge, 37830 TN, USA, ECKHARD PIPPEL, Max Planck Institute of Microstructure Physics, Weinberg 2, 06120 Halle, Germany, ER-JIA GUO, Institute for Physics, Johannes-Gutenberg University Mainz, 55128 Mainz, Germany, DIANA RATA, KATHRIN DÖRR, Institute for Physics, MLU Halle-Wittenberg, Germany
— We have investigated the magnetic response of $La_{0.7}Sr_{0.3}MnO_3/SrRuO_3$ superlattices to biaxial in-plane strain applied *in-situ*. Superlattices grown on piezoelectric substrates of $0.72PbMg_{1/3}Nb_{2/3}O_3$-$0.28PbTiO_3$(001) (PMN-PT) show strong antiferromagnetic coupling of the two ferromagnetic components. The coupling field of $\mu_0 H_{AF}$ = 1.8 T is found to change by $\mu_0 \Delta H_{AF}/\Delta\varepsilon \sim$ -520 mT $\%^{-1}$ under reversible biaxial strain ($\Delta\varepsilon$) at 80 K in a $[La_{0.7}Sr_{0.3}MnO_3$(22 Å)/$SrRuO_3$(55 Å)$]_{15}$ superlattice. This reveals a significant strain effect on interfacial coupling. The applied in-plane compression enhances the ferromagnetic order in the manganite layers which are under as-grown tensile strain. It is thus difficult to disentangle the contributions from strain-dependent antiferromagnetic Mn-O-Ru interface coupling and Mn-O-Mn ferromagnetic double exchange near the interface, since the enhanced magnetic order of Mn spins leads to a larger net coupling of $SrRuO_3$ layers at the interface. We discuss our experimental findings taken into account both the strain-dependent orbital occupation in a single–ion picture and the enhanced Mn order at the interface.

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