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Enhanced Antiferromagnetic Ordering Temperature in Metallic $LaMnO_3/SrMnO_3$ Superlattices TIFFANY SANTOS, STEVEN MAY, ANAND BHATTACHARYA, Argonne National Lab, J. LEE ROBERTSON, Oak Ridge National Lab — The perovskite manganite $La_{1-x}Sr_xMnO_3$ has a rich magnetic phase diagram, exhibiting ferromagnetism (F) for La-rich compositions and antiferromagnetism (AF) for those that are Sr-rich. Our study focuses on the x=0.5 doping region containing the F-AF phase transition, particularly the role of strain and cation-site disorder in nucleating the F or AF state. Using ozone-assisted molecular beam epitaxy, we have prepared fully-epitaxial superlattices of $LaMnO_3$ and $SrMnO_3$ on $SrTiO_3$ substrates, along with random alloy films of $La_{1-x}Sr_xMnO_3$ with equivalent composition. In our digital synthesis method, whereby we interleave single unit-cell layers of undoped $LaMnO_3$ and $SrMnO_3$, we have eliminated disorder at the La/Sr cation site. Our structural characterization shows atomic layer precision in the synthesis of these superlattices. The structural, magnetic and transport properties of the superlattices are compared with those of the random alloys. A-type AF order (F alignment in-plane, AF alignment of adjacent planes) is verified by neutron diffraction, also revealing an enhanced Néel temperature with no F phase at higher temperature, in contrast to bulk. These AF thin films display metal-like behavior, opening the possibility of using the discrete layers of opposite spins for coherent spin transport. Supported by DOE, Office of Basic Energy Sciences.

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