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Ferroelectricity and compositional inversion symmetry breaking in $PbTiO_3/SrRuO_3$ superlattices S.J. CALLORI, J. GABEL, Department of Physics and Astronomy, Stony Brook University, D. SU, Center for Functional Nanomaterials, Brookhaven National Laboratory, J. SINSHEIMER, M.V. FERNANDEZ-SERRA, M. DAWBER, Department of Physics and Astronomy, Stony Brook University — Most work to date on artificially layered ferroelectric superlattices has utilized the insulating titanium perovskite oxides (e.g. $PbTiO_3$, $BaTiO_3$, $CaTiO_3$ and $SrTiO_3$) as "building blocks," from which a layered structure is assembled by sequential deposition. However, the need for new functionalities, particularly related to magnetism, demands that we expand this set. The much-studied compound $SrRuO_3$ provides the proof of concept that metallic magnetic oxides can transform into thin-film dielectric components in certain heterostructures, in this case $PbTiO_3/SrRuO_3$ superlattices. Our high quality epitaxial $PbTiO_3/SrRuO_3$ superlattices, grown by RF magnetron sputtering on $SrTiO_3$ substrates (with $SrRuO_3$ bottom electrodes) show both ferroelectricity, and, as they have both A and B site variation, compositional breaking of inversion symmetry. We will present experimental measurements made on this system using x-ray diffraction, transmission electron microscopy, and electrical characterization, which together with first principles density functional theory simulations, demonstrate how, as the constituent layer thicknesses are varied, the metallicity of the superlattice changes and polarization evolves.

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