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Polarization enhancement and heterointerfacial coupling in artificial perovskite superlattices HO NYUNG LEE, HANS CHRISTEN, MATTHEW CHISHOLM, CHRISTOPHER ROULEAU, DOUGLAS LOWNDES, Oak Ridge National Laboratory — Bi- and tri-color superlattices comprised of $BaTiO_3$, $SrTiO_3$, and $CaTiO_3$ with compositionally-abrupt interfaces have been grown on atomically-flat $SrRuO_3$ bottom electrodes on (001) $SrTiO_3$ single crystals by pulsed laser deposition. These superlattices provide additional freedom in tuning the average lattice parameter and the structures physical properties. We found that locally asymmetric heterointerfaces (TiO_6- octahedra bound by different A-site cations) play a crucial role in the polarization enhancement due to elastic and electrostatic couplings at the interfaces. Such subtle effects, especially in tri-color superlattices, can be attributed to the broken inversion symmetry, although the effects are sometimes weak. A strong polarization enhancement is achieved by the proper balancing between two competing requirements: the ferroelectric layers must thick enough to contain a sufficient amount of non-interfacial TiO6 octahedra, but thin enough to remain fully strained. For a superlattice, this produces a maximum polarization as much as 50% higher than that of a $BaTiO_3$ single film. Research sponsored by the U.S. Department of Energy under contract with the Oak Ridge National Laboratory, managed by UT-Battelle, LLC, as part of a BES NSET initiative.

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