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Built-in electric field and polarization in $LaCrO_3$-$SrTiO_3$ superlattices PETER SUSHKO, RYAN COMES, STEVEN SPURGEON, PHUONG-VU ONG, Pacific Northwest National Laboratory, STEVE HEALD, Argonne National Laboratory, SHIH-CHIEH LIN, CHENG-TAI KUO, CHUCK FADLEY, UC Davis, SCOTT CHAMBERS, Pacific Northwest National Laboratory — Superlattices combining ferroelectric and non-polar materials exhibit an intriguing induced polarization in the non-ferroelectric phase, such as $SrTiO_3$ (STO). However, there has been no report of a superlattice where two non-ferroelectric materials combine to produce bulk polarization. We present studies of STO-$LaCrO_3$ (LCO) superlattices and show that by controlling interfacial termination between layers we can induce a ferroelectric-type polarization in STO. Density functional theory (DFT) predictions show that by alternating terminations between positively charged TiO_2-LaO and negative CrO_2-SrO interfaces a polarization is induced in each material. Using molecular beam epitaxy, we have synthesized superlattices with such interfaces and a built-in electric field is observed using x-ray photoelectron spectroscopy. X-ray absorption spectroscopy and electron microscopy confirmed these results and were used to estimate the polarization within the STO layers. Our results agree well with the DFT predictions for the cation displacements and induced polarization. We also present models of the band dispersion to quantify the electronic structure in each of the STO and LCO layers.

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