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Single-domain, lattice-tunable, rare-earth scandate templates for strain engineering oxide films CHAD FOLKMAN, CHANG-BEOM EOM, University of Wisconsin - Madison, YANBIN CHEN, XIAOQING PAN, University of Michigan - Ann Arbor, MSE TEAM — Epitaxial functional oxides have generated excitement due to the improvement in properties over their amorphous and polydomain counterparts. Generally, high quality epitaxy becomes undesirable with large strain. Widely available substrates with site-terminated and atomically flat surfaces unfortunately have large mismatches (>1.0%) with oxides like $BiFeO_3$ a_p = 3.96Å, $BaTiO_3$ a_p = 4.00Å, and PZT(MPB) a_p = 4.07Å. For this reason, orthorhombic Rare-Earth Scandates ($REScO_3$) have been developed in bulk and film where tuning the lattice constant is executed by changing the RE ion. Lattice parameters decrease with increasing Z in the range Z = 51, $LaScO_3$ a_c = 4.05Å to Z=71, $LuScO_3$ a_c = 3.89Å. In this work, we demonstrate that single domain $REScO_3$ template films of $LaScO_3$, $PrScO_3$, $NdScO_3$, $SmScO_3$, $GdScO_3$, and $DyScO_3$ can be deposited with pulsed laser deposition on highly miscut (001) $SrTiO_3$ or orthorhombic (110) $NdGaO_3$ substrates with crystalline quality approaching that of the bulk crystal. The rocking curve full width at half maximums were typically below 0.1° and transmission electron microscopy cross sections exhibit large areas of defect free regions near the surface. The result is a lattice tunable template for growth of strain engineered oxide films.

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