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Atomic layer-by-layer growth of oxide thin films by laser MBE
QINGYU LEI, GUOZHEN LIU, MARYAM GOLALIKHANI, KE CHEN, Department of Physics, Temple University, SUILIN SHI, FUQIANG HUANG, CAS Key Laboratory of Materials for Energy Conversion, Shanghai Institute of Ceramics, Chinese Academy of Science, ANDREW FARRAR, DMITRI TENNE, Department of Physics, Boise State University, RAKESH SINGH, School of Materials, Arizona State University, XIAOXING XI, Department of Physics, Temple University — We have studied an atomic layer-by-layer thin film growth technique for complex oxide thin films and heterostructures. By using a laser-MBE system and monitoring the reflection high-energy electron diffraction (RHEED) intensity to control the flux for each atomic layer in-situ, we actively control the structure and stoichiometry down to the atomic layer level. In the growth of $SrTiO_3$ from the separate SrO and TiO_2 targets, or from metal Sr and oxide TiO_2 target, we studied the phases of the specular and diffraction spot intensities as well as that of the Kikuchi lines. UV Raman spectroscopy was used to probe the symmetry breaking due to the cation off-stoichiometry. Similar stoichiometry control as shown by reactive MBE has been demonstrated. We also studied the target preparation of various oxides, including the highly reactive La_2O_3 and BaO. We have successfully applied this atomic layer-by-layer growth method to the deposition of $LaAlO_3$ and $LaNiO_3$ thin films and superlattices.

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