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Superconducting Nd1-xEuxNiO2 (NENO) Thin Films Using In-Situ MBE Synthesis

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The rare-earth nickelates display a broad range of phenomena, including functional behavior such as antiferromagnetism and superconductivity. The ability to synthesize heterogeneous epitaxial thin film structures out of nickelates enables one to control and modify these functional properties via the creation of atomically abrupt interfaces. Advanced synchrotron characterization can then be used to measure the resulting electronic and magnetic properties of these atomically engineered systems. Here, we discuss synchrotron characterization of the square-planar nickelates, which are a novel class of superconductors. We use in situ aluminum reduction of the perovskite nickelates to achieve superconducting $Nd_{1-x}Eu_xNiO_2$ (NENO) thin films grown by molecular beam epitaxy (MBE). Atomic structure is characterized using crystal truncation rod (CTR) analysis, and electronic structure is characterized using diffraction-based X-ray absorption near edge structure (dXANES). We also report on unusual superconducting transport properties of NENO films, including magnetic field enhanced superconductivity.