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Controlling the order parameter coupling in nickelate based superlattices

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Rare-earth nickelates belong to the wider family of perovskite oxides. These materials display a characteristic temperature-dependent metal-to-insulator transition (MIT) together with a lowering of the crystal symmetry, concomitant with a breathing distortion of the NiO6 octahedra units [1,2]. Using nickelate superlattices we recently studied the characteristic length scale over which a metallic or an insulating phase can be established and the physics that sets this length scale [3]. By growing SmNiO3/NdNiO3 superlattices and using experimental and theoretical methods we showed that this length scale depends on the interplay between the energy cost of the boundary between metallic and insulating phases and the energy gain of the bulk phases [3]. To further understand this unusual coupling and the evolution of the structural and electronic order parameters across these phase boundaries, SmNiO3/NdNiO3 superlattices were grown with additional insulating LaAlO3 spacer layers, that should lead to a progressive decoupling of the nickelate layers. The samples are grown using RF off axis magnetron sputtering, and are morphologically and structurally characterized using atomic force microscopy (AFM), X-ray diffraction (XRD) and STEM-EELS. Temperature dependent transport measurements will be presented, and should give a first indication of how the metal-to-insulator transitions couple in this novel superlattice system.

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