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Transport and Spectroscopy Studies of Ultrathin Doped Nickelate Films YARON SEGAL, JOSEPH NGAI, DIVINE KUMAH, ANKIT DISA, JAMES REINER, JARRET MOYER, Yale University Applied Physics, DARIO ARENA, Brookhaven National Lab, FRED WALKER, CHARLES AHN, Yale University Applied Physics — The notion of a rational, first-principles based design of a novel superconducting material has intrigued physicists for decades. Recently it was suggested that by enforcing a two- dimensional confinement and tensile strain on $LaNiO_3$ films, their electronic structure can be made sufficiently similar to that of the Mott-Hubbard system in the cuprates, possibly inducing an antiferromagnetic insulator-superconductor transition [PRL 100, 016404]. We adopt this approach through the synthesis of ultrathin $La_xNd_{1-x}NiO_3$ and hole-doped $La_xBa_{1-x}NiO_3$, $Nd_xBa_{1-x}NiO_3$ films using molecular beam epitaxy. High structural quality is demonstrated by RHEED oscillations and synchrotron x-ray diffraction. Transport measurement show a transition from metallic behavior to localization for films less than 8 uc thick. Tuning of the La/Nd ratio allows the film to be driven into the antiferromagnetic insulating regime. Surprisingly, Ba incorporation increases the localization in the films, which is in contrast to the metallicity-promoting effect of hole doping in bulk nickelates. X-ray absorption measurements allow us to follow the evolution of the Ni and O orbitals and relate it to the observed transport properties.

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