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Modulating the properties of thin film nickelates using a ferroelectric MATTHEW S. J. MARSHALL, ANDREI MALASHEVICH, ANKIT S. DISA, HANGHUI CHEN, SOHRAB ISMAIL-BEIGI, FRED J. WALKER, CHARLES H. AHN, Center for Research on Interface Structures and Phenomenon (CRISP), Yale University and Dept. of Applied Physics, Yale University — Controlling materials properties using electric fields is an important approach to creating novel electronic materials. The perovskite oxides, which exhibit some of the most interesting phenomena found in the solid state, represent an ideal system for exploring how electric fields couple to material properties. As an example, the rare-earth nickelates ($LaNiO_3$, $NdNiO_3$, etc.) undergo a metal-insulator transition when the unit cell structure is changed by chemical doping or through the application of strain. Here we show that the polarization of the canonical ferroelectric $PbZr_{0.2}Ti_{0.8}O_3$ couples to the structure and conductivity of the rare earth nickelates ($RNiO_3$). As the polarization of the PZT is switched, we introduce atomic-scale structural distortions at the PZT-nickelate interface that modulate the carrier concentration in the nickelate. We find that interfacial effects dominate, resulting in a large change in the conductivity of the nickelate.

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