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Tailoring polarity in a layered nickelate with single atomic layer control ANAND BHATTACHARYA, MSD and NST, Argonne National Laboratory, BRITTANY NELSON-CHEESEMAN, MSD, Argonne National Laboratory and School of Engineering, University of St. Thomas, HUA ZHOU, APS, Argonne National Laboratory, PRASANNA BALACHANDRAN, Department of Materials Science and Engineering, Drexel University, GILBERTO FABBRIS, Washington University, St. Louis and APS, Argonne National Laboratory, JASON HOFFMAN, MSD, Argonne National Laboratory, DANIEL HASKEL, APS, Argonne National Laboratory, JAMES RONDINELLI, Department of Materials Science and Engineering, Drexel University — Many of the 3d transition metal oxides share a common structural MO_6 building unit—a central transition metal (TM) cation octahedrally coordinated with oxygen nearest neighbors. The electronic states in these materials can be modified by tailoring the M-O bonds, which typically include the application of epitaxial strain in thin films, or pressure and isovalent cation substitution in bulk samples. Here, we present a new route to tailor the M-O bonds without changes to the strain state or stoichiometry in two-dimensional perovskite nickelate ($n=1$ in the Ruddlesden Popper series). We do this by tailoring the dipolar electrostatic interactions at the unit cell level in nominally non-polar LaSrNiO_4 via single atomic layer-by-layer synthesis using oxide-MBE. We reconstruct the response of the crystal lattice to the induced polarity using a x-ray phase retrieval technique (COBRA). We find that the response of the O anions to the resulting local electric fields distorts the M-O bonds, being largest for the apical oxygens (O_{ap}). It also alters the Ni valence.

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