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Coexistence of Two Electronic Nano-Phases on a $CH_3NH_3PbI_{3-x}Cl_x$ Surface Observed in STM Measurements ANDREW J YOST, ARTEM PIMACHEV, Department of Physics and Astronomy, University of Wyoming, CHUN-CHIH HO, Department of Materials Science and Engineering, National Taiwan University, SETH B. DARLING, Center for Nanoscale Materials, Argonne National Laboratory, LEEYIH WANG, Center for Condensed Matter Sciences, National Taiwan University, WEI-FANG SU, Department of Materials Science and Engineering, National Taiwan University, YURI DAHNOVSKY, TEYU CHIEN, Department of Physics and Astronomy, University of Wyoming — Scanning tunneling microscopy is utilized to investigate the local density of states of a $CH_3NH_3PbI_{3-x}$Clx perovskite in cross-sectional geometry. Two electronic phases, 10−20 nm in size, with different electronic properties inside the $CH_3NH_3PbI_{3-x}Cl_x$ perovskite layer are observed by the $\mathrm{d}I/\mathrm{d}V$ mapping and point spectra. In addition, the distinct electronic phases are found to have preferential orientations close to the normal direction of the film surface. Density functional theory calculations indicate that the observed electronic phases are associated with local deviation of I/Cl ratio, rather than different orientations of the electric dipole moments in the ferroelectric phases. By comparing the calculated results with experimental data we conclude that phase A (lower contrast in $\mathrm{d}I/\mathrm{d}V$ mapping at −2.0 V bias) contains a lower I/Cl ratio than that in phase B (higher contrast in $\mathrm{d}I/\mathrm{d}V$).[1] [1] *ACS Appl. Mater. Interfaces*, **2016**, 8 (42), pp 29110–29116

Andrew J Yost
Department of Physics and Astronomy, University of Wyoming

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