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Electrical conduction at domain walls in multiferroic BiFeO3[1]
JAN SEIDEL, LANE MARTIN, QING HE, UC Berkeley, QIAN ZHAN, Lawrence Berkeley National Lab, YING-HAO CHU, National Chiao Tung University, Taiwan, AXEL ROTHER, TU Dresden, Germany, MICHAEL HAWKRIDGE, Lawrence Berkeley National Lab, PETER MAKSYMOVYCH, Oakridge National Lab, PU YU, MARTIN GAJEK, NINA BALKE, UC Berkeley, SERGEI KALININ, Oakridge National Lab, SYBILLE GEMMING, FZ Dresden-Rossendorf, Germany, FENG WANG, UC Berkeley, GUSTAU CATALÁN, JAMES SCOTT, University of Cambridge, NICOLA SPALDIN, UC Santa Barbara, JOSEPH ORENSTEIN, RAMAMOORTHY RAMESH, UC Berkeley — We report the observation of room temperature electronic conductivity at ferroelectric domain walls in BiFeO3. The origin and nature of the observed conductivity is probed using a combination of conductive atomic force microscopy, high resolution transmission electron microscopy and first-principles density functional computations. We show that a structurally driven change in both the electrostatic potential and local electronic structure (i.e., a decrease in band gap) at the domain wall leads to the observed electrical conductivity. We estimate the conductivity in the wall to be several orders of magnitude higher than for the bulk material. Additionally we demonstrate the potential for device applications of such conducting nanoscale features.

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