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Functional Properties at Domain Walls in $BiFeO_3$: Electrical, Magnetic, and Structural investigations QING HE, C.-H. YANG, P. YU, M. GAJEK, J. SEIDEL, R. RAMESH, F. WANG, Department of Physics, UC Berkeley, Y.-H. CHU, Department of Materials Science and Engineering, National Chiao Tung University, L. W. MARTIN, Materials Science Division, LBNL, N. SPALDIN, Materials Department, UC Santa Barbara, A. ROTHER, Institute of Structure Physics, Dresden University — $BiFeO_3$ (BFO) is a widely studied robust ferroelectric, antiferromagnetic multiferroic. Conducting-atomic force microscopy studies reveal the presence of enhanced conductivity at certain types of domain walls in BFO. We have completed detailed TEM studies of the physical structure at these domain walls as well as in-depth DFT calculations of the evolution of electronic structure at these domain walls. These studies reveal two major contributions to the observed conduction: the formation of an electrostatic potential at the domain walls as well as a structurally-driven change in the electronic structure (i.e., a lower band gap locally) at the domain walls. We will discuss the use of optical characterization techniques as a way of probing this change in electronic structure at domain walls as well as detailed IV characterization both in atmospheric and UHV environments. Finally, the evolution of magnetism at these domain walls has been studied through the use of photoemission measurements. Initial findings point to a significant change in the magnetic order at these domain walls in BFO.

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