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Tunable Metallic Conductivity in Ferroelectric Nanodomains P. MAKSYMOVYCH, Oak Ridge National Laboratory, Oak Ridge, TN, A.N. MOROZOVSKA, Institute for Semiconductor Physics, National Academy of Science of Ukraine, P. YU, Department of Materials Science and Engineering , University of California, Berkeley, CA, E.A. ELISEEV, Institute for Problems of Materials Science, National Academy of Science of Ukraine, Y.-H. CHU, Department of Materials Science and Engineering, National Chiao Tung University, R. RAMESH, Department of Materials Science and Engineering, University of California, Berkeley, CA, A.P. BADDORF, S.V. KALININ, Oak Ridge National Laboratory, Oak Ridge, TN — Domain wall conductivity in ferroelectric and multiferroic oxides is an essential example of new electronic properties created by topological defects. So far electron transport through domain walls in canonical $BiFeO_3$ and $PbZr_{0.2}Ti_{0.8}O_3$ (PZT) ferroelectrics has been dominated by thermally activated hopping, concealing the enabling physics and limiting potential applications. We will present a pioneering observation of metallic conductivity in nanoscale ferroelectric domains in PZT, that unambiguously identifies a new conduction channel created through the bulk of the oxide film [1]. From a corollary theoretical analysis, we conclude that metallic conductance is enabled by the interplay of charging and flexoelectric effects at tilted and curved walls of the nanodomain. Furthermore, both type and density of carriers can be tuned by manipulation of the order parameter. Thus, a new family of electronic properties may be found in multiferroic and topologically nanostructured complex oxides. [1] Maksymovych et al. *Nano Lett.* in review (2011). Research conducted at the Center for Nanophase Materials Sciences, sponsored by BES, U. S. DOE.

[X] Prefer Oral Session
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