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Nanoscale spatial control of domain wall conductivity in $BiFeO_3$ thin films BRIAN SMITH, University of Twente, RAMA VASUDEVAN, University of New South Wales, BOUWE KUIPER, ANDRE TEN ELSHOF, University of Twente, ART BADDORF, PETER MAKSYMOVICH, SERGEI KALININ, Oak Ridge National Laboratory, MARK HUJBEN, GUUS RIJNDERS, GERTJAN KOSTER, University of Twente — Use of ferroelectric domain walls for applications is an attractive prospect. Domain walls can have properties not found in bulk allowing added functionality. The 1D nature of a ferroelectric domain wall could be exploited to create devices with dimensions on the order of a single unit cell. Intensive research on domain wall conductivity in $BiFeO_3$ is ongoing since the first report in 2009 [1]. Here we report on the spatial control of domain wall conductivity in an epitaxial grown $BiFeO_3$ film 25nm thick on self-assembled $SrRuO_3$ nanowires using an ordered mixed terminated $DyScO_3$ substrate as a growth template [2]. The $SrRuO_3$ nanowires (5nm high, 100nm wide separated by 200nm) run across the substrate and are contacted at the sample edge creating alternating insulating/conducting surfaces. Using PFM/cAFM the domains, switching and domain wall conductivity is explored. Domain wall conductivity is only present in over the nanowires. In addition to providing spatial control of the conductivity this result provides evidence that the conduction is confined to a single domain wall throughout the thickness of the film and is not the results of network of interconnected domains.

[1] Seidel J, et. al. Nat. Mat. 2009, 8, 229
[2] Kuiper et al., MRS Communications, Doi:10.1557/mrc.2011.8

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