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Ferroelectric domain alignment in $PbTiO_3/SrTiO_3$ superlattice nanostructures JOONKYU PARK, University of Wisconsin Madison, JOHN MANGERI, University of Connecticut, QINGTENG ZHANG, University of Wisconsin Madison, MOHAMMED HUMED YUSUF, Stony Brook University, ANASTASIOS PATERAS, University of Wisconsin Madison, MATTHEW DAWBER, Stony Brook University, MARTIN HOLT, OLLE HEINONEN, Argonne National Laboratory, SERGE NAKHMANSON, University of Connecticut, PAUL EVANS, University of Wisconsin Madison — Alignment of spontaneously formed 180^oferroelectric stripe domains is observed in PbTiO3/SrTiO3 superlattice (SL) ridge nanostructures created using focused-ion beam patterning. Synchrotron x-ray nanodiffraction studies exhibit angular shifts of diffraction patterns and enhanced domain scattering intensity, which are associated with lattice tilts and degree of domain alignment, respectively. The domain diffuse scattering intensity is enhanced in the region of reciprocal space corresponding to domains arranged parallel to the boundaries of the ridge. The domain diffuse scattering is approximately an order of magnitude brighter in nanostructures than unpatterned regions, with a Maier-Saupe distribution function fitting with an order parameter of 0.92. A Landau-Ginzburg-Devonshire theory simulation demonstrates that different magnitudes of elastic relaxation, caused by domain configurations with domain walls either antiparallel or parallel to the patterned edges, result in the parallel domain wall configuration in nanostructures more energetically favorable than the antiparallel configuration, which agrees with the experimental observation.

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