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Temperature-composition phase diagram of $PbTiO_3/CaTiO_3$ superlattices[1] MATTHEW DAWBER, BENJAMIN BEIN, JOHN SINSHEIMER, SARA J. CALLORI, HSIANG-CHUN HSING, MOHAMMED HUMED YUSUF, HUMA YUSUF, Department of Physics and Astronomy, Stony Brook University — An experimental enhancement of the piezoelectric response and dielectric constant can be achieved in artificially layered epitaxial $PbTiO_3/CaTiO_3$ superlattices through an engineered rotation of the polarization direction. As the relative layer thicknesses within the superlattice are changed from sample to sample, evidence for polarization rotation is found in multiple x-ray diffraction measurements and associated measurements of functional properties. Here we report on synchrotron x-ray diffraction measurements performed at X22C at the National Synchrotron Light Source at Brookhaven National Laboratory and the MS SD beam line at the Swiss Light Source at the Paul Scherrer Institute. Through these measurements we studied the rotation of the ferroelectric polarization direction as a function of both composition and temperature. This work provides significant insight into the polarization rotation mechanism in general, and illuminates routes for exploiting it in artificially layered structures to produce enhanced piezoelectric materials.

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