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Strained enabled Ferroelectricity in $CaTiO_3$ Thin Films Probed by Nonlinear Optics and Scanning Probe Microscopy EFTIHIA VLAHOS, AMIT KUMAR, SAVA DENEV, CHARLES BROOKS, Materials Science and Engineering, Pennsylvania State University, DARRELL SCHLOM, Materials Science and Engineering, Cornell University, CARL-JOHAN EKLUND, KARIN M. RABE, Department of Physics and Astronomy, Rutgers University, CRAIG J. FENNIE, Applied and Engineering Physics, Cornell University, VENKATRAMAN GOPALAN, Materials Science and Engineering, Pennsylvania State University — Calcium titanate, $CaTiO_3$ is not a ferroelectric in its bulk form. However, first principles calculations predict that biaxially tensile strained $CaTiO_3$ thin films should become ferroelectric. Here, we indeed confirm that strained $CaTiO_3$ films become ferroelectric with a Curie temperature of ∼125K. Optical second harmonic generation (SHG) measurements, polarization studies, and in-situ electric-field measurements for a number of films with different strain values will be presented: $CaTiO_3/DyScO_3(110)$, $CaTiO_3/SrTiO_3(100)$,$CaTiO_3/GdScO_3/NdGaO_3(110)$, $CaTiO_3/LaSrAlO_3(001)$ as well as for a single crystal $CaTiO_3$. From these studies, we conclude that strained $CaTiO_3$ films are ferroelectric with a point group symmetry of *mm2*, and show reversible domain switching characteristics under an electric field. We also present results of variable temperature piezoelectric force microscopy for imaging the polar domains in the ferroelectric phase. These results suggest that strain is a valuable tool for inducing polar, long range ferroelectric order in even non-polar ceramic materials such as $CaTiO_3$.

Eftihia Vlahos
Pennsylvania State University

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