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Ferroelectricity in Strain-Free SrTiO₃ Thin Films AMIT KUMAR, SAVA DENEV, Pennsylvania State University, HO WON JANG, CHAD FOLKMAN, S.H. BAEK, University of Wisconsin, Madison, NINA BALKE, PETER MAKSYMOWYCH, MIKE BIEGALSKI, SERGEI KALININ, Oak Ridge National Laboratory, DARRELL SCHLOM, Cornell University, Ithaca, C.T. NELSON, X.Q. PAN, University of Michigan, Ann Arbor, L.Q. CHEN, Pennsylvania State University, CHANG BEOM EOM, University of Wisconsin, Madison, VENKAT GOPALAN, Pennsylvania State University — Biaxial strain is known to induce ferroelectricity in thin films of nominally non-ferroelectric materials such as SrTiO₃. However, we show that even strain-free SrTiO₃ films and the paraelectric phase of strained films exhibit bulk frequency-dependent polarization hysteresis loops on the nanoscale at room temperature, and stable switchable domains at 50 K. By a direct comparison of the strained and strain-free SrTiO₃ films using dielectric, ferroelectric, nonlinear optical and nanoscale piezoelectric property measurements, we conclude that both strain states of SrTiO₃ films are bulk relaxor ferroelectrics, and the role of strain is to stabilize longer-range correlation of preexisting nanopolar regions. This mechanism could have broader applicability to strain-induced ferroelectricity in other incipient ferroelectric materials.

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