Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Room-temperature Ferroelectricity in Uniaxially Strained Single-crystalline $SrTiO_3$ Freestanding Films DI LU, GLAM, Dept. of Phys., Stanford Univ., SAM CROSSLEY, HYEOK YOON, GLAM, Dept. of Appl. Phys., Stanford Univ., YASUYUKI HIKITA, SIMES, SLAC, HAROLD HWANG, GLAM, Dept. of Appl. Phys., Stanford Univ.; SIMES, SLAC — Single crystal pure bulk $SrTiO_3$ (STO) is an incipient ferroelectric whose dielectric permittivity rises to high values as temperature is reduced, but remains paraelectric to the lowest observable temperatures. Ferroelectric phases of STO may be stabilized via doping and strain, whose common effect is to split the spatial free energy well of ionic displacements. With epitaxial strain of the order of a few percent, Curie temperatures T_C ˜293 K have been observed. By exploiting a highly novel process to exfoliate epitaxial oxide films deposited by pulsed laser deposition, we have isolated sub-100 nm-thick freestanding films of STO which are readily manipulated and mechanically strained to high levels. Measurements of the in-plane dielectric properties for various applied strains reveal a continuously tunable ferroelectric T_C. A two-order-of-magnitude enhanced dielectric response is displayed by a 1.2%-strained sample at T_C ˜290 K, as compared with the same sample unstrained at the same temperature. This is consistent with a phenomenological Ginzburg-Landau model, and previous studies on anchored films. The functional properties of strained STO have generated intense interest and debate, and have been suggested for device applications due to e.g. high voltage-tunable dielectric properties. Our work exhibits strain as a continuously variable experimental degree of freedom, which can induce numerous functional effects.

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Date submitted: 05 Nov 2015 Electronic form version 1.4