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Strain Phase Diagram of SrTiO₃ Thin Films FEIZHOU HE, B.O. WELLS, S.P. ALPAY, University of Connecticut, S.M. SHAPIRO, Brookhaven National Lab — SrTiO₃ thin films were used as a model system to study the effects of strain and epitaxial constraint on structural phase transitions of oxide films. The basic phenomena revealed will apply to a variety of important structural transitions including the ferroelectric transition. Highly strained, epitaxial films of SrTiO₃ were grown on different substrates. The structural phase transition temperature T_c increases from 105 K in bulk STO to 167 K for films under tensile strain and 330 K for films with compressive strain. The measured temperature-strain phase diagram is qualitatively consistent with theory [1], however the increase in T_c is much larger than predicted in all cases. The symmetry of the phases involved in the transition is different from the corresponding bulk structures largely because of epitaxial constraint, the clamping effect. Thus the shape of the STO unit cell is tetragonal at all temperatures. The possibility exists of a very unique low temperature phase with orthorhombic symmetry ($Cmcm$) but tetragonal unit cell shape. More generally, we have characterized at least three different manifestations of the clamping effect, showing it is much more subtle than usually recognized. This work is supported through NSF DMR-0239667, DMR-0132918, by the Research Corp, and at BNL by the US DOE DE-AC02-98CH10886. [1] N. A. Pertsev, A. K. Tagantsev and N. Setter, Phys. Rev. B61, R825 (2000).

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