

Abstract Submitted  
for the MAR12 Meeting of  
The American Physical Society

**Use of dimensionality to enhance tunable microwave dielectrics**

D.G. SCHLOM, Cornell U., CHE-HUI LEE, R. HAISLMAIER, E. VLAHOS, V. GOPALAN, Pennsylvania State U., T. BIROL, Y. ZHU, L.F. KOURKOUTIS, N. BENEDEK, Y. KIM, J.D. BROCK, D.A. MULLER, C.J. FENNIE, Cornell U., N.D. ORLOFF, J.C. BOOTH, NIST, V. GOIAN, S. KAMBA, ASCR, M.D. BIEGALSKI, ORNL, M. BERNHAGEN, R. UECKER, Leibniz Institute for Crystal Growth, X.X. XI, Temple University, I. TAKEUCHI, U. Maryland — The miniaturization and integration of frequency-agile microwave circuits—*tunable* filters, resonators, phase shifters and more—with microelectronics offers tantalizing device possibilities, yet requires thin films whose dielectric constant at GHz frequencies can be tuned by applying a quasi-static electric field. Appropriate systems, e.g.,  $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ , have a paraelectric-to-ferroelectric transition just below ambient temperature, providing high tunability. Unfortunately such films suffer significant losses arising from defects. Recognizing that progress is stymied by dielectric loss, we start with a system with exceptionally low loss— $\text{Sr}_{n+1}\text{Ti}_n\text{O}_{3n+1}$  phases—where in-plane crystallographic shear  $(\text{SrO})_2$  faults provide an alternative to point defects for accommodating non-stoichiometry. In this talk we will establish both experimentally and theoretically the emergence of a ferroelectric and highly tunable ground state in biaxially strained  $\text{Sr}_{n+1}\text{Ti}_n\text{O}_{3n+1}$  phases with  $n \geq 3$  at frequencies up to 40 GHz. With increasing  $n$  the  $(\text{SrO})_2$  faults are separated further than the ferroelectric coherence length perpendicular to the in-plane polarization, enabling tunability with a figure of merit at room temperature that rivals all known tunable microwave dielectrics.

Che-Hui Lee  
Pennsylvania State U.

Date submitted: 21 Nov 2011

Electronic form version 1.4