

Carnegie Mellon

Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

Hui Du

Graduate Research Assistant
Department of Materials Science and Engineering
Carnegie Mellon University

“Growth, Microstructure, and Tunable Microwave Dielectric Properties of (Ba, Sr)TiO₃ Thin Films”

**Friday, April 10, 2009
11:30 A.M. Seminar in Baker Hall 136A**

The tunable microwave dielectric properties of Ba_xSr_{1-x}TiO₃ (BST) films were investigated and correlated to structural characteristics. High quality films were deposited using pulsed laser deposition in conditions optimized to yield a 2D growth mode. Films were characterized using TEM and high-resolution XRD to quantify extended defect populations and strains. The temperature dependences of microwave dielectric properties were measured using interdigitated capacitors at GHz frequencies. The important effects that both homogeneous strains, from lattice and thermal-expansion-coefficient mismatches, and inhomogeneous strains, associated with threading dislocations, have on properties will be emphasized with regard to the physical observations. For example, strained BST films on GdScO₃(110) and DyScO₃(110) substrates had similar dislocation concentrations, which were two orders of magnitude lower than typical films on conventional substrates. Though bulk-like dielectric properties were observed for the slightly tensile strained (0.1%) BST film on GdScO₃(110), the slightly compressive strained (0.3%) BST films on DyScO₃(110) had much different (and worse) dielectric properties. Using simulations based on Landau-Devonshire theory, the experimental properties of BST on DyScO₃ could be understood to arise from homogeneous strains.

Hui Du received his Bachelor degree in Materials Science and Engineering from Zhengzhou University in 1999 and Master's degree in Ceramic Engineering from Chinese Academy of Sciences in 2002, respectively. He is currently a Ph.D. candidate under the guidance of Prof. Skowronski and Prof. Salvador.