Thermal Conductivity and Phonon Scattering Mecha SAND2013-10755C Ferroelectric Thin Films

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In this presentation we explore the effects of composition, phase, and morphology on the thermal conductivity of ferroelectric thin films. Thermal conduction properties in epitaxial and polycrystalline ferroelectric films comprising compositions based on $BiFeO_3$, $Sr_2Nb_2O_7$, and the PZT family will be presented. It will be shown that interfaces ranging from highly disordered grain boundaries to completely coherent domain and weakly bound lattice boundaries can affect the thermal conduction through these materials. Domain boundaries, in particular, will be shown to significantly decrease thermal transport through the film thickness. Additionally, compositional dependencies on thermal conduction in PZT films are observed. The composition-dependent trends can be well described by considering the scale of the finest phonon scattering features superimposed on the trends expected from alloy scattering. This presentation represents one of the first studies of the compositional and morphology dependence of thermal conductivity in ferroelectric thin films. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.