Abstract for an Invited Paper
for the NWS10 Meeting of
The American Physical Society

Ultraviolet Raman spectroscopy of ferroelectric thin films and superlattices[1]

DMITRI TENNE, Boise State University, Department of Physics

Nanoscale ferroelectrics possess essentially different properties compared to bulk materials and provide an opportunity to manipulate and enhance the ferroelectric properties. Vibrational (Raman and infrared) spectroscopies can provide valuable information for understanding the behavior of nanoscale ferroelectrics. However, conventional vibrational spectroscopies operating in visible and infrared range fail to measure the phonon spectra of nanoscale ferroelectric structures because of extremely weak signals and the overwhelming substrate contribution. In this talk, application of ultraviolet (UV) Raman spectroscopy for studies of lattice dynamics and ferroelectric phase transitions in nanoscale ferroelectrics will be presented. UV Raman spectroscopy has been demonstrated to be an effective technique allowing the observation of phonons and determination of the phase transition temperatures in nanoscale ferroelectrics, specifically, $BaTiO_3/SrTiO_3$ superlattices and ultrathin (as thin as 1.6 nm) $BaTiO_3$ single layer films. UV Raman studies of the effects of strain and film thickness on phase diagrams in $BaTiO_3/SrTiO_3$ ferroelectric heterostructures will be discussed will be discussed and compared with thermodynamic phase-field model and first principles lattice dynamics calculations. Also, recent results on the effect of strontium non-stoichiometry on ferroelectricity in homoepitaxial $SrTiO_3$ films will be presented.

[1]This work has been partially supported by NSF (DMR-0705127) and Research Corporation for Science Advancement (CCSA 7134).