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UV Raman study of ferroelectric BaTiO3/SrTiO3 superlattices
D.A. TENNE , X.X. XI, Dept. of Phys. and Mater. Research Inst., Penn State Univ., University Park, A. SOUKIASSIAN, J.H. HAENI, W. TIAN, D.G. SCHLOM, Y.L. LI, L.Q. CHEN, Dept. of Mater. Sci. and Eng. and Mater. Research Inst., Penn State Univ. , K.M. RABE, Dept. of Phys. and Astron., Rutgers Univ., NJ, X.Q. PAN, Dept. of Mater. Sci. and Eng., Univ. of Michigan, Ann Arbor, R.S. KATIYAR, Dept. of Phys., Univ. of Puerto Rico, San Juan — The results of the first experimental study of ferroelectric short-period superlattices (SLs) by ultraviolet (UV) Raman spectroscopy will be presented. The high quality $(BaTiO_3)_m/(SrTiO_3)_n$ SLs (m, n are between 4 and 10 unit cells) with atomically smooth interfaces were grown by molecular beam epitaxy on $SrTiO_3$ substrates. Raman spectroscopy with UV excitation (351.1 nm) made possible the observation of superlattice phonons without overwhelming substrate signal in the spectra. Raman data on the $BaTiO_3$ phonons show that $BaTiO_3$ layers in SLs remain in the tetragonal phase in the entire temperature range studied (80-400K), and the low-temperature phases characteristic for bulk $BaTiO_3$, are suppressed. Biaxial compression of $BaTiO_3$ layers in SLs is likely cause for such a behavior, according to the calculated phase diagram for $BaTiO_3$ as a function of temperature and strain. Features attributed to the first-order Raman scattering in $SrTiO_3$ layers indicate that the inversion symmetry is broken, and the $SrTiO_3$ layers in the SLs are polar. Supported in part by DOE (Grant # DE-FG02-01ER45907).

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