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Ferroelectric phase transitions in $BaTiO_3/SrTiO_3$ superlattices studied by ultraviolet Raman spectroscopy DMITRI A. TENNE, X.X. XI, Dept. of Phys., Pennsylvania State Univ., A. SOUKIASSIAN, W. TIAN, Y.L. LI, L.Q. CHEN, D.G. SCHLOM, Dept. of Mater. Sci. & Engin., Pennsylvania State Univ., A. BRUCHHAUSEN, A. FAINSTEIN, Centro Atomico Bariloche, Argentina, X.Q. PAN, Dept. of Mater. Sci. & Engin., Univ. of Michigan, A. CANTARERO, Univ. of Valencia, Spain, R.S. KATIYAR, Dept. of Phys., Univ. of Puerto Rico, San Juan, PR — Ferroelectric $(BaTiO_3)_m/(SrTiO_3)_n$ superlattices (SLs) grown by molecular beam epitaxy on $SrTiO_3$ substrates have been investigated by ultraviolet (UV) Raman spectroscopy. Using the UV excitation allowed us to overcome the problem of overwhelming substrate contributions in Raman spectra and made possible the observation of phonons in SLs having the ferroelectric $BaTiO_3$ layers as thin as 2 unit cells. The ferroelectric-paraelectric phase transitions have been observed. Depending on the thickness of the $BaTiO_3$ layers and strain, the phase transition temperature varies by hundreds of degrees from $\sim$140 K to 630 K, which is over 200 degrees higher than in bulk $BaTiO_3$. Below T_c, the SLs likely remain in the single (tetragonal) ferroelectric phase down to 7 K, i.e. the low-temperature phases characteristic for bulk $BaTiO_3$, are suppressed by strain. The experimental data are in good agreement with the results of the thermodynamic calculations of polarization in SLs as a function of temperature. This work was supported by DOE, NSF, and ONR.

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