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Piezoelectric force microscopy of crystalline oxide-semiconductor heterostructures[1] MATTHEW S.J. MARSHALL, JAMES W. REINER, DIVINE KUMAH, CRISP, Dept. of Applied Physics, Yale University, PETER MAKSYMOVYCH, ART P. BADDORF, CNMS, Oak Ridge National Lab, CHARLES AHN, FRED J. WALKER, CRISP, Dept. of Applied Physics, Yale University — Coupling the properties of a ferroelectric material to a semiconductor has been pursued for decades. Epitaxial, coherently strained thin films of ferroelectric BaTiO3 can be grown on germanium with out-of-plane polarization using molecular beam epitaxy (MBE). Similarly, epitaxial thin films of SrTiO3 can be grown on Si with some indication that these films can be ferroelectric. In this work, we use oxide MBE to grow epitaxial films of SrTiO3 and BaTiO3 on Si and Ge, respectively, and we use both ambient and ultrahigh vacuum (UHV) piezoelectric force microscopy (PFM) to study the question of ferroelectricity in these systems. We find that the modulation of the PFM amplitude for thin films of SrTiO3 (6 uc. and 25 uc) on Si is the result of an electrostatic mechanism that can be traced back to tip-induced or as-grown defects in the film. These results are compared to results on thin films of BaTiO3 on Ge.

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