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Continuous strain modulation of strontium titanate ($SrTiO_3$) on semiconductor interface by thermal strains LEI ZHANG, YAKUN YUAN, SHIMING LEI, BERND KABIUS, VENKATRAMAN GOPALAN, ROMAN ENGEL-HERBERT, Pennsylvania State Univ. — Strain engineering is a general strategy for tuning the desired material properties, such as enhancing carrier mobility and increasing the spontaneous polarization and Curie temperature in ferroelectric films. Control over the strain state in thin film is provided by the substrate with lattice mismatch. Although growth of strained perovskite oxides was demonstrated, the limited number of suitable substrates of high quality imposed difficulty towards utilizing the strain. We'll discuss a novel route towards wafer-scale strain engineering of ferroelectric oxide based on large thermal mismatch between film and substrate, enabling to continuously modulate the strain state. $SrTiO_3$ films were grown on Si (001) between 400 °C and 900 °C above the critical film thickness. The films relaxed at growth temperature and accumulated a tensile strain ranging from 0.2% to 0.7% during cool-down, which was proportional to the temperature difference. X-ray reciprocal space maps and geometric phase analysis obtained from cross section transmission electron microscopy have been used to relate the film's strain state to the ferroelectric properties, probed by second harmonic generation and piezo force microscopy.

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