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Correlation of strain and quantum corrections to resistance in very thin films of $SrTiO_{3-\delta}$ on Si through X-ray diffraction measurements JOHN MIRACLE, DEAN KOEHNE, RYAN COTTIER, DANIEL CURRIE, NIKOLETA THEODOROPOULOU, Texas State University — Our group has shown that a 2-d electron gas forms in strained thin films of oxygen deficient $SrTiO_{3-\delta}$(STO) grown epitaxially on Si(001). Low temperature magnetotransport measurements show quantum corrections to the Drude conductivity due to both quantum interference and electron-electron interaction (EEI) effects, and insulating behavior with Mott-Variable Range Hopping. The EEI are observed only for low carrier concentrations of $4 - 9 * 10^{-12} cm^{-2}$, and for thicknesses less than 15 nm. The coherent growth of STO on Si produces a compressive in-plane strain of 1.7% and a tetragonal distortion. A Mott insulating phase is predicted for STO for large distortions of the crystal structure with Ti-O-Ti angles of 165° compared to 180° in the cubic phase and for a high doping level.[1] We use x-ray diffraction to investigate the effect of film strain on EEI and the Mott insulating behavior. Wide angle $\theta - 2\theta$ scans along with phi scans of the Si{202}and STO{202}family of planes show coherent crystal growth with STO(002)||Si(004) and a 45° in-plane rotation of STO on Si. Rocking curve measurements of STO(002) and the STO{202}verify the tetragonal distortion ($a = b \neq c; \alpha = \beta = \gamma = 90°$). We use X-ray reflectivity to measure the thickness of the films, the interface roughness, and composition.

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