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Transport properties of $SrTiO_{3-\delta}$ thin films grown by Molecular Beam Epitaxy on p-Si(001) substrates[1] NIKOLETA THEODOROPOULOU, DANIEL CURRIE, RYAN COTTIER, Physics Dpt., Texas State University, ARTURO PONCE-PEDRAZA, JESUS CANTU, OSCAR VILLARREAL, Physics, Dpt., University of Texas-San Antonio — $SrTiO_3$ (STO) films were grown on p-Si(001) and STO(001) bulk substrates using molecular beam epitaxy (MBE). Oxygen vacancies were introduced by controlling the Oxygen pressure during growth ($P(O_2)$: 4×10^{-8} - 8×10^{-7}) resulting in $SrTiO_{3-\delta}$ with $\delta \sim 0.02\%$ for the lowest $P(O_2)$. The single-phase STO/Si films were of high crystalline quality as verified by x-ray diffraction, transmission electron microscopy, and atomically flat. Transport measurements were performed on the STO/Si structures in a Van der Pauw configuration. The $P(O_2)$ during growth determines the conduction behavior which changes from strongly localized transport that fits a Variable Range Hopping (VRH) model (low $P(O_2)$-high disorder) to thermally activated transport (high $P(O_2)$-low disorder). The resistivity of the strongly disordered STO/Si films decreased from 1 Ohm·cm to $3x10^{-2}$ Ohm·cm as the film thickness increased (3nm-60nm). The perpendicular magnetoresistance (MR) is positive at 300K and becomes negative at T=3-20K. We consider competing effects on the STO/Si heterostructure such as 1.7% compressive strain induced by lattice mismatch to Si, defects due to oxygen vacancies, the bulk STO antiferrodistortive phase transition at 105K, and structural dislocations.

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