Abstract Submitted
for the TSF14 Meeting of
The American Physical Society

Transport mechanisms in epitaxial $SrTiO_{3-\delta}$/Si (001) with varying oxygen deficiency RYAN COTTIER, DANIEL CURRIE, NIKOLETA THEODOROPOULOU, Texas State University — Epitaxial $SrTiO_3$ (STO) films were grown on p-Si (001) substrates using molecular beam epitaxy (MBE). Oxygen vacancies were introduced by controlling the oxygen pressure during growth resulting in oxygen deficient $SrTiO_{3-\delta}$ with δ up to 0.004. The single phase STO/Si films were of high crystalline quality as verified by x-ray diffraction (XRD), transmission electron microscopy (TEM), and had a surface roughness less than 0.5 nm (RMS) as measured by atomic force microscopy (AFM). Transport measurements in a Van der Pauw configuration showed semiconducting behavior. The competing effects of disorder and increased carrier concentration (n-type measured by Hall) due to oxygen vacancies influence the conduction behavior. Low oxygen pressure during growth induces more oxygen vacancies and a larger number of carriers (n-type, measured by Hall) but also leads to more disordered films. Transport in these more disordered films is strongly localized and can be fit to a Variable Range Hopping (VRH) model. Transport in films with a smaller number of oxygen vacancies is thermally activated. We consider competing effects in STO/Si: lattice mismatch with Si, strain and defects due to oxygen vacancies, structural dislocations and the bulk STO antiferrodistortive phase transition at 105K.

Ryan Cottier
Texas State University

Date submitted: 28 Sep 2014 Electronic form version 1.4