

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Electrostatic carrier doping of GdTiO₃/SrTiO₃ heterostructures

POUYA MOETAKEF, TYLER CAIN, Materials Department, University of California Santa Barbara, DANEIL OUELLETTE, Physics Department, University of California Santa Barbara, JACK ZHANG, CLAYTON JACKSON, Materials Department, University of California Santa Barbara, SIDDHARTH RAJAN, Department of Electrical and Computer Engineering, Ohio State University, JAMES ALLEN, Physics Department, University of California Santa Barbara, SUSANNE STEMMER, Materials Department, University of California Santa Barbara — Two-dimensional electron gases (2DEGs) at interfaces between Mott insulators and band insulators have attracted significant attention because they can exhibit unique properties, such as strong electron correlations, superconductivity and magnetism. At interfaces between SrTiO₃ and the rare earth titanates (Mott insulators) an interfacial fixed polar charge arises due to a polarization discontinuity, which can be compensated by a 2DEG, residing in the bands of the Mott/band insulator. In this presentation, we report on intrinsic electronic reconstructions at a Mott/band insulator interface between stoichiometric GdTiO₃ and SrTiO₃ that were grown using molecular beam epitaxy. The sheet carrier densities of all GdTiO₃/SrTiO₃ heterostructures containing more than one unit cell of SrTiO₃ are approximately 1/2 electron per unit cell, independent of layer thickness and growth sequence. These carrier densities closely meet the electrostatic requirements for compensating the fixed charge at these polar interfaces. Based on the experimental measurements, insights into the location and confinement of the charge and the influence of different electrostatic boundary conditions are obtained.

Pouya Moetakef
Materials Department, University of California Santa Barbara

Date submitted: 11 Nov 2011

Electronic form version 1.4