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Characterization of extreme-concentration 2DEGs at the $SrTiO_3/GdTiO_3$interface CLAYTON JACKSON, POUYA MOETAKEF, TYLER CAIN, UC Santa Barbara, SIDDHARTH RAJAN, Ohio State University, JAMES ALLEN, SUSANNE STEMMER, UC Santa Barbara — Heterostructures of Mott and band insulators exhibit unique interface properties, including two-dimensional electron gases (2DEGs) with extremely high sheet carrier densities due to the polarization discontinuity at the interface. Of paramount importance for the properties is the location, spatial extent and confinement of the 2DEG. Here, we study the 2DEG with carrier densities of $3x10^{14}$ cm^{-2} formed at $GdTiO_3/SrTiO_3$ interfaces grown by MBE. Using a self-consistent Schrödinger-Poisson solver, we estimate the majority of the carriers are confined in a narrow region (< 3 nm) at the $SrTiO_3$-side of the interface. Given the large and rapid spatial variation in charge density, experiments are needed to verify the assumptions underlying such models. We measure the admittance as a function of frequency at different fixed DC bias. To extract the carrier distribution in the depletion approximation, a distributed model is used to account for loss and series resistance effects. The resulting CV profile corresponds to a p-type layer. This is explained with a highly conductive space charge layer, resulting in significant depletion only in the p-type $GdTiO_3$. We report on the carrier distribution near the interface.

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