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Understanding the Origin of Surface Depletion in δ-doped $SrTiO_3$ Structures HYEOK YOON, HISASHI INOUE, ADRIAN G. SWARTZ, Stanford Univ, YASUYUKI HIKITA, SLAC National Accelerator Laboratory, HAROLD Y. HWANG, Stanford Univ, SLAC National Accelerator Laboratory — Unlike most of the conventional semiconductors, the large dielectric constant of $SrTiO_3$ results in a pronounced surface depletion width [1]. In thin films, the effect of surface depletion is even more dramatic: reduction of mobility and two-dimensional carrier density. To avoid this effect, capping and buffering a narrow channel of n-type doped $SrTiO_3$, so called δ-doping, is designed to make the channel free from surface scattering, resulting in highly mobile carriers [2-4] We have investigated systematic changes in electronic transport by tuning the thicknesses of the undoped surface buffering cap and the δ-doped layer. This has allowed us to map the phase diagram consisting of a three-dimensional metal, two-dimensional metallic behavior, and an insulating phase. We also show the surface depletion width as a function of doping density in order to study the origin of surface depletion of $SrTiO_3$ [1] A. Ohtomo and H. Y. Hwang, *Appl. Phys. Lett.* **84**, 1716 (2004). [2] Y. Kozuka *et al.*, *Appl. Phys. Lett.* **97**, 222115 (2010). [3] Y. Kozuka, M. Kim *et al., Nature* **462**, 487 (2009). [4] M. Kim *et al., Phys. Rev. Lett.* **107**, 106801 (2011).

Hyeok Yoon
Stanford University

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