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A high-mobility electronic system at an electrolyte-gated oxide surface PATRICK GALLAGHER, MENYOUNG LEE, TREVOR PETACH, Department of Physics, Stanford University, Stanford, California 94305, USA, SAM STANWYCK, Department of Applied Physics, Stanford University, Stanford, California 94305, USA, JAMES WILLIAMS, Department of Physics, Stanford University, Stanford, California 94305, USA, KENJI WATANABE, TAKASHI TANIGUCHI, Advanced Materials Laboratory, National Institute for Materials Science, 1-1 Namiki, Tsukuba, 305-0044, Japan, DAVID GOLDHABER-GORDON, Department of Physics, Stanford University, Stanford, California 94305, USA — Electrolyte gating is a powerful technique for accumulating large carrier densities in surface two-dimensional electron systems (2DES). Yet this approach suffers from significant sources of disorder: electrochemical reactions can damage or alter the surface of interest, and the ions of the electrolyte and various dissolved contaminants sit Angstroms from the 2DES. In this talk, we demonstrate that this disorder can be minimized by protecting the sample with a chemically inert, atomically smooth sheet of hexagonal boron nitride (BN). We illustrate our technique with electrolyte-gated strontium titanate, whose mobility improves more than tenfold when protected with BN. We find this improvement even for our thinnest BN, of measured thickness 6 Angstrom, with which we can accumulate electron densities nearing 10^{14} cm^{-2}. Our technique is portable to other materials, and should enable future studies where high carrier density modulation is required but electrochemical reactions and surface disorder must be minimized.

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