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Two-dimensional electron gas at $LaAlO_3$/ $SrTiO_3$ heterointerfaces grown on silicon[1] JAE-WAN PARK, Department of Materials Science and Engineering, University of Wisconsin-Madison, DANIELA F. BOGORIN, CHENG CEN, University of Pittsburgh, CHRISTOFER NELSON, YI ZHANG, University of Michigan, WUNG BARK, CHAD FOLKMAN, DAVID FELKER, MARK RZCHOWSKI, University of Wisconsin-Madison, XIAOQING PAN, University of Michigan, JEREMY LEVY, University of Pittsburgh, CHANG-BEOM EOM, University of Wisconsin-Madison — Reversible nanoscale control over the metal-insulator transition in a two-dimensional electron gas (2DEG), formed at the heterointerface between $LaAlO_3$ and $SrTiO_3$, raises the possibility to develop ultrahigh-density oxide nanoelectronics. Prerequisites to the development of new technologies are integration with existing electronics platforms and scaling to a commercially available large wafer process. Here, we demonstrate the viability of 2DEGs formed at $LaAlO_3/SrTiO_3$ heterointerfaces grown directly on Si. We observe 2DEG behavior only when growth of $LaAlO_3$ layer occurs on post-annealed TiO_2-terminated $SrTiO_3$ template on (001) Si substrate. The ability to form reversible conducting nanostructures below 10 nm-scales highlights the viability of this materials synthesis route for commercial device applications. Atomic-scale control of the surfaces of quasi-single-crystal $SrTiO_3$ templates on Si substrates also inspires the development of new oxide electronics using novel interfacial phenomena.

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