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High-mobility $SrTiO_3$ delta-doped field-effect transistors HISASHI INOUE, ADRIAN SWARTZ, GLAM, Stanford University, YASUYUKI HIKITA, SIMES, SLAC National Accelerator Laboratory, HAROLD HWANG, GLAM, Stanford University, SIMES, SLAC National Accelerator Laboratory — Two-dimensional electron systems in $SrTiO_3$ show intriguing properties such as high mobility transport, magnetism, and possible unconventional superconductivity. A delta-doped structure, sandwiching a narrow two-dimensional conducting $SrTiO_3$ channel between two insulating $SrTiO_3$ layers, provides a clean platform to realize such electronic states, with symmetric confining potential in the absence of interface or surface scattering. Electric field gating of the conducting channel in a field-effect transistor (FET) geometry is a powerful method for tuning low-dimensional systems via carrier density modulation. We have synthesized high quality $SrTiO_3$ delta-doped structures using pulsed laser deposition, and optimized the device processing steps to achieve ideal FET characteristics at room temperature. This progress enabled examination of high-mobility transport in the carrier density regime as low as 3 $\times$ 10^{12} cm^{-2} at low-temperatures, opening promising avenues to investigate quantum transport and realization of exotic quantum phases in $SrTiO_3$ two-dimensional electron systems.

Hisashi Inoue
GLAM, Stanford University

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