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Intersubband scattering in modulation-doped Si two-dimensional electron gases YI-HSIN SU, JIUN-YUN LI, Graduate Institute of Electronic Engineering, National Taiwan University, Taipei, Taiwan, LEONID ROKHINSON, Department of Physics, Purdue University, West Lafayette, IN, USA, JAMES STURM, Department of Electrical Engineering, Princeton University, Princeton, NJ, USA — A bilayer of modulation doped two-dimensional electron gas (2DEG) is of great interest to probe Coulomb drag. For bottom-doped Si 2DEGs, impurity scattering due to poor phosphorus (P) turn-off results in low carrier mobility. Here we demonstrate a record-high electron mobility of 470,000 cm^2/V-s at 0.3 K in a bottom-doped 2DEG, comparable to that in top-doped structures. The power-law exponent of mobility vs. density was also evaluated for different P turn-off slopes. With fast turn-off, the power is 1.5, indicative of dominant remote doping scattering. The power decreases with slower P turn-off due to the enhanced scattering from the segregated P atoms. Further, for the first time, we report the second subband occupancy and intersubband scattering in a single Si quantum well, supported by the Shubnikov-de Haas oscillation data.

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