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Two-Dimensional Electron Gases in Nanomembrane-based Epitaxial Si/SiGe Heterostructures[1] YIZE LI, PORNSATIT SOOKCHOO, XIAORUI CUI, ROBERT MOHR, DONALD SAVAGE, RYAN FOOTE, R.B. JACOBSON, JOSE SANCHEZ-PEREZ, XIAN WU, DAN WARD, SUSAN COPPERSMITH, MARK ERIKSSON, MAX LAGALLY, University of Wisconsin-Madison
— To assess possible improvements in the electronic performance of two-dimensional electron gases (2DEGs) in silicon, SiGe/Si/SiGe heterostructures are grown on fully elastically relaxed single-crystal SiGe nanomembranes fabricated through a strain engineering approach. This procedure eliminates the formation of dislocations in the heterostructure. Top-gated Hall bar devices are fabricated to enable magnetoresistance and Hall effect measurements. Both Shubnikov de Haas oscillations and the quantum Hall effect are observed at low temperatures, demonstrating the formation of high-quality 2DEGs. Values of charge carrier mobility as a function of carrier density extracted from these measurements are at least as high or higher than those obtained from companion measurements made on heterostructures grown on conventional strain graded substrates. In all samples impurity scattering appears to limit the mobility.

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