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Heterostructure surface effects on Si/SiGe 2DEGs XIAN WU, C.B. SIMMONS, J.R. PRANCE, D.E. SAVAGE, M.G. LAGALLY, M.A. ERIKSSON, University of Wisconsin-Madison — We present the results of Hall and Shubnikov-de Haas measurements of the two-dimensional electron gas (2DEG) in Si/SiGe heterostructures at 2 K. We demonstrate that the condition of the surface has significant effects on the carrier density and mobility of electrons in the quantum well. Results from multiple samples show that the carrier density and mobility decrease with the amount of time that the samples are exposed to air. Surface treatment via a forming gas anneal or by dipping the samples in HF restores the carrier density and mobility of the degraded samples, and storing the samples in vacuum slows the rate of degradation. We believe that the reduction in carrier density of the 2DEG is a result of interface traps that form in the surface native oxide. Forming gas anneal passivates the interface traps, and HF strips the oxide. Illuminating the degraded samples at 2 K also improves the carrier density and mobility, possibly by activating electrons out of trap states. Deposition of AL2O3 on the surface using ALD caused a severe reduction in carrier density, which we believe is the result of a high trap density.

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