Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Electronic properties of epitaxial Ge/AlAs heterostructures on Si and GaAs[1] J. J. HEREMANS, YUANTAO XIE, Virginia Tech, Department of Physics, M. K. HUDAIT, M. CLAVEL, P. S. GOLEY, Virginia Tech, Department of Electrical and Computer Engineering — Ge, with high electron and hole mobilities, has advantages over Si for low-power high-speed nanoscale logic. We report on the MBE growth of Ge/AlAs/GaAs and Ge/AlAs/GaAs/Si structures, where the Ge/AlAs band offsets provide carrier confinement inside the Ge layer. We studied the confinement of carriers in the Ge layer, the effect of the AlAs buffer layer, and the effects of a growth pause and growth temperature, correlated to structural and morphological properties. Magnetotransport and quantum transport measurements were obtained down to 390 mK and in magnetic fields up to 9 T. A weak-localization signal, in contrast to antilocalization, indicates absence of spin-orbit interaction and hence electron confinement in the Ge rather than in the III-V layers. For the Ge/AlAs/GaAs/Si structure a low-temperature sheet carrier density 1.4 x 10^{14} cm^{-2} and mobility 390 cm^2/Vs were obtained, with similar values at 290 K, while at 200 K a maximum in mobility is reached of 470 cm^2/Vs. For the Ge/AlAs/GaAs structures a mobility up to 260 cm^2/Vs was obtained at 2 x 10^{13} cm^{-2} at 290 K. The Ge/AlAs/GaAs structures have also shown phonon-limited scattering vs temperature, attesting to the quality of interfaces.

[1]Supported by DOE DE-FG02-08ER46532, NSF ECCS-1348653, Intel Corp.

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Date submitted: 02 Nov 2015 Electronic form version 1.4