Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

High Mobility InSb Quantum Well with Dislocation Filtering Buffer Layer Grown on GaAs (001) Substrates MADHAVIE EDIRISOORIYA, TETSUYA MISHIMA, MICHAEL SANTOS, University of Oklahoma — A small electron mass makes InSb quantum wells (QWs) with $Al_xIn_{1-x}Sb$ barriers attractive for field-effect transistors, mesoscopic magnetoresistors, and ballistic transport devices. The large spin-orbit effects in InSb make InSb QW structures attractive for spin transport devices. The electron mobility of an InSb QW with an $Al_xIn_{1-x}Sb$ buffer layer is partly limited by scattering caused by crystalline defects that arise from the large lattice mismatch (14.6%) between the epilayers and the GaAs (001) substrate. Our transmission electron microscopy measurements show that $Al_xIn_{1-x}Sb/Al_yIn_{1-y}Sb$ interfaces reduce the concentration of threading dislocations. We observed electron mobilities of 38,000 cm^2/Vs and 121,000 cm^2/Vs at 300K and 77K, respectively, in an InSb QW grown on a 1.5μm thick $Al_xIn_{1-x}Sb$ buffer layer with two $Al_yIn_{1-y}Sb$ interlayers. These values are 16% and 75% higher at 300K and 77K, respectively, than observed in a structure without interlayers. The improved mobility is apparent in studies of geometrical magnetoresistance in devices with channels that are short and wide.

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Date submitted: 01 Dec 2006 Electronic form version 1.4