Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Carrier mobility as a function of InGaAs quantum well to quantum wire transition on GaAs (311)A WILLIAM BLACK, VASYL KUNETS, BAOLAI LIANG, YURIY MAZUR, ZHIMING WANG, JOHN SHULTZ, GREG SALAMO, University of Arkansas — Molecular beam epitaxy is used to study self-assembly of $In_{0.4}Ga_{0.6}As$ quantum wires on GaAs (311)A. Using an InGaAs layer embedded in an AlGaAs/GaAs heterostructure, the correlation between surface morphology, photoluminescence, and electrical transport is investigated. In particular, we will present data and discuss carrier mobility as a function of InGaAs deposition and the resulting surface morphology. As the thickness of the InGaAs layer is increased, a compressive strain field develops, which is relieved at a critical thickness in the form of faceted quantum wires. Paralleling this dramatic change in morphology, the conductivity of the sample is observed to change as measured using Hall bar structures oriented both parallel and perpendicular to the quantum wires. A large anisotropy in conductivity is found to be directly correlated to changes in surface morphology and photoluminescence measurements. The surface morphology was revealed using atomic force measurements on an InGaAs capping layer that reproduced the quantum well or quantum wires embedded in the AlGaAs/GaAs heterostructure.

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Date submitted: 09 Jan 2006 Electronic form version 1.4