Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Structural and Electronic Properties of GaN and InN Nanowires grown using Hot-Wall CVD ELENA CIMPOIASU, ERIC STERN, GUOSHENG CHENG, RYAN MUNDEN, ARIC SANDERS, MARK A. REED, Departments of Electrical Engineering, Applied Physics, and Physics, Yale University, New Haven, CT — We study the electron-mobility dependence on the free carrier concentration n exhibited by hot-wall chemical-vapor deposition-grown gallium nitride (GaN) and indium nitride (InN) nanowires. The growth involves flow of ammonia over solid sources of gallium or indium and the substrate, which is covered with metal catalyst (in case of GaN) or is catalyst-free (in case of InN). The nanowires are subsequently deposited on oxidized silicon wafers and fabricated in field-effect transistors using optical lithography. In this way, more than 1000 devices were characterized at room temperature. Both types of nanowires show high carrier concentration ($10^{19}-10^{20}$ cm^{-3} for GaN and $10^{20}-10^{21}$ cm^{-3} for InN), with mobility decreasing with increasing free carrier concentration, consistent with ionized impurity scattering. Mobility levels range between below 1 to 100 cm^2/Vs. Estimations of the ionized impurity mobility indicate that GaN wires grow heavily compensated, and subsequent anneals in ammonia result in even higher compensation levels. We were also successful in doping GaN nanowires with magnesium, for p-type doping. Similar chemical, structural, and electronic analysis will be presented. This work was partially supported by DARPA through AFOSR, ARO, AFOSR, NASA, by the Department of Homeland Security, and by NSF.

Elena Cimpoiasu
Yale University

Date submitted: 29 Nov 2005 Electronic form version 1.4