Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Influence of Nitrogen Incorporation Mechanisms on Optical and Electronic Properties of GaAsN Alloys M. REASON, H.A. MCKAY, W. YE, D. MAO, R.S. GOLDMAN, Dept. of Materials Science and Engineering, Univ. of Michigan, X. BAI, C. KURDAK, Dept. of Physics, Univ. of Michigan, V. ROTBERG, Dept. of Nuclear Engineering and Radiological Sciences, Univ. of Michigan — We have examined the effects of N incorporation mechanisms on the properties of $\mathrm{GaAs}_{1-x}\mathrm{N}_x$ alloys. Nuclear reaction analysis and Rutherford backscattering spectrometry in channeling and non-channeling conditions reveal significant non-substitutional incorporation of N, presumably as either N-N or N-As split interstitials. Our optical absorption measurements reveal a substitutional nitrogen composition-dependent bandgap reduction, which is less significant than typical literature reports. However, when the data are corrected to account for the typical 20% incorporation of non-substitutional nitrogen, all measurements reveal a bandgap reduction of ~150 meV per 1% N. Thus, GaAsN bandgap bowing is significantly influenced by substitutional nitrogen ad is smaller than previously reported. In addition, GaAsN films with minimal interstitials exhibit perhaps the highest room temperature electron mobilities reported to date. We have also developed an *in-situ* approach to control N incorporation in heterostructures, using a separately-pumped plasma chamber. This approach enables significant improvements in superlattice interface abruptness and electron mobilities in GaAsN-based superlattices and modulation-doped heterostructures.

M. Reason
University of Michigan

Date submitted: 21 Jan 2005

Electronic form version 1.4