Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Demonstration of carrier mediated ferromagnetism in GaMnN by co-doping and heterostructures MEREDITH REED, NCSU/ARO/NRC, ERDEM ARKUN, NCSU, MASON REED, ACAR BERKMAN, NCSU, OLIVER LUEN, NCSU, SALAH BEDAIR, NCSU, NADIA EL-MASRY, NCSU, JOHN ZAVADA, ARO — We demonstrate carrier mediated ferromagnetism via GaMnN films co-doped with Si and Mg, heterostructures, and p-i-n junction devices that were grown by metal-organic chemical vapor deposition. The magnetic properties of GaMnN are affected by intentional introduction of donor or acceptor states into the film. Si or Mg co-doping of GaMnN films led to either ferromagnetic or paramagnetic behavior depending on the concentration. The magnetic properties of the GaMnN material system correlates with the Fermi level. Ferromagnetism was observed only when the Fermi level was near the Mn energy band resulting in a partially occupied Mn energy level; a prerequisite for conduction within this band. This allows carriers to be present in this band to mediate ferromagnetic behavior. In addition to co-doping, the dependence of ferromagnetic properties of GaMnN films on carrier transfer across heterojunctions was also studied. The magnetic properties of GaMnN, as a part of GaMnN/GaN:Mg heterojunctions depend on the thickness of both the GaMnN film and the adjacent GaN:Mg layer. These results are explained based on the occupancy of Mn energy band and how this occupancy is altered by carrier transfer at the GaMnN/GaN:Mg interface. Thus, the ferromagnetic properties result from a solid solution of Mn in GaN.

Meredith Reed
NCSU/ARO/NRC

Date submitted: 14 Dec 2004 Electronic form version 1.4