Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Electrical and Optical characterization of GaN_xAs_{1-x} fabricated using Ion Implantation and Pulsed Laser Melting TAESEOK KIM, MICHAEL J. AZIZ, VENKATESH NARAYANAMURTI, School of Engineering and Applied Sciences, Harvard University, KIRSTIN ALBERI, National Renewable Energy Laboratory, OSCAR D. DUBON, Dept. of Materials Science and Engineering, University of California, Berkeley — We present a systematic investigation of the band structure of GaN_xAs_{1-x} alloys synthesized using nitrogen ion implantation followed by pulsed laser melting and rapid thermal annealing. The evolution of the nitrogen concentration-depth profile is consistent with liquid-phase diffusion, solute trapping at the rapidly moving solidification front, and surface evaporation. The reduction of the Schottky barrier height at nitrogen composition up to $x = 0.016$ is studied by ballistic electron emission microscopy (BEEM) and determined quantitatively using second voltage derivative (SD) BEEM spectra. This composition effect on the barrier height is consistent with the bandgap narrowing measured on the same samples by photomodulated reflectance and is also consistent with the band anti-crossing model for the splitting of the conduction band in GaN_xAs_{1-x} alloys. Lithographically patterned GaN_xAs_{1-x} dots are imaged by BEEM. Analysis of BEEM spectra from the locally confined dots indicates an alloying-induced decrease in the Schottky barrier height of four times the thermal energy at room temperature.

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Date submitted: 25 Nov 2008 Electronic form version 1.4