Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Bandedge transitions in GaN and AlN at elevated temperatures

N. NEPAL, M. L. NAKARMI, J. LI, J. Y. LIN, AND H. X. JIANG, Department of Physics, Kansas State University, Manhattan, KS 66506 — GaN and AlN are recognized as promising materials for high power high temperature optoelectronic and electronic devices. For device realization, understanding fundamental properties of these materials at elevated temperature is very important. Probing the optical properties such as the temperature dependence of the bandedge transitions reveals important information pertaining to the fundamental band structures, exciton and carrier recombination and activation processes. Deep-ultraviolet photoluminescence (PL) spectroscopy has been employed to study the bandedge transitions in metalorganic chemical vapor deposition grown GaN and AlN epilayers up to 800 K. The temperature dependence of the PL emission intensity revealed two different activation processes in both GaN and AlN epilayers. The first process occurring below $T_t = 325$ K ($T_t = 500$ K) for GaN (AlN) is due to the activation of free excitons to free carriers. Whereas the second activation process occurring above T_t with an activation energy of 0.29 eV (0.3 eV) for GaN (AlN) is believed to be associated with the existence of a satellite valley (Γ_3) at about 0.3 eV above the conduction band minimum, Γ_1. Consequence of this satellite valley in the conduction band on the high temperature and high power device applications of GaN and AlN will be discussed.

Neeraj Nepal
Kansas State University

Date submitted: 28 Nov 2005

Electronic form version 1.4