Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Carrier recombination in m-plane GaN thin films ZHI-XUAN TZENG, Department of Physics, National Kaohsiung Normal University, YAN-ZHI TZENG, Department of Physics, National Sun Yat-sen University, MENG-EN LEE, Department of Physics, National Kaohsiung Normal University, IKAI LO, DER-JUN JANG, Department of Physics, National Sun Yat-sen University — We report the ultrafast time-resolved photoluminescence (TRPL) study of m-plane GaN thin films grown on γ-$LiAlO_2$ substrates by molecular beam epitaxy. The TRPL was measured by a time-correlated single-photon counting instrument with temporal resolution of 150 ps using laser pulses of energy 4.5 eV from a Ti:sapphire laser. Two major PL peaks were found in all the three GaN samples with different N/Ga ratios. The PL contributed by the bandgap recombination was found first blue-shift below 100 K and then red-shift as temperature increases. We found that the internal quantum efficiency as well as the nonradiative recombination rate decreased with N/Ga ratio may be due to the large defect concentration in high N/Ga ratio. The radiative recombination rate was constant below 100 K in all samples and was dependent on temperature with $T.^{-3/2}$ The temperature dependence of radiative recombination time is consistent with theoretical prediction. The carrier localization, for both holes and electrons, is responsible for the blue-shift in PL spectra and constant of radiative rates below 100 K.

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Date submitted: 09 Nov 2012 Electronic form version 1.4