Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Carrier Dynamics in Site-Controlled InGaN/GaN Quantum Dots[1] TYLER HILL, LEI ZHANG, HUI DENG, University of Michigan Physics, CHU-HSIANG TENG, BRANDON DEMORY, PEI-CHENG KU, University of Michigan EECS — We investigate the individual micro-photoluminescence and time resolved photoluminescence properties of several hundred site-controlled InGaN/GaN quantum dots fabricated "top down" by plasma etching. The optical properties of semiconductor quantum dots can be very inhomogeneous due to small fluctuations in dot size, compositions, growth conditions, or doping levels. Controlled variation of growth conditions combined with the knowledge of experimental uncertainties in the semiconductor properties allows for a statistical analysis to obtain quantitative correlations between the optical properties of the quantum dots and the growth conditions or structural properties. We find that, with an indium fraction of 10-15%, quantum dots with diameters smaller than 33 nm show markedly different carrier dynamics than those with a diameter larger than 60nm: 1) fluctuations in indium mole fraction or monolayer fluctuations in the InGaN layer have a more significant effect on photoluminescence than changing dot diameter; 2) nonradiative decay related to surface recombination is the dominant decay channel in the system; 3) Increasing surface to volume ratio helps suppress the internal quantum efficiency of multi-exciton states, leading to more strongly antibunched photon sources.

[1]TH, LZ, and HD acknowledge support by the National Science Foundation (NSF) under Awards ECCS 0901477, ECCS 1102127, and DMR 1120823 (MRSEC).

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Date submitted: 11 Dec 2012 Electronic form version 1.4