Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Study of the carrier concentration dependent photoluminescence of Ga-doped ZnO thin films grown by molecular-beam epitaxy ZHENG YANG, LEELAPRASANNA MANDALAPU, JIANLIN LIU, Quantum Structures Laboratory, Department of Electrical Engineering, University of California, Riverside — The undoped and Ga-doped ZnO thin films were grown on *r*-sapphire using molecular-beam epitaxy (MBE) system. The samples of electron concentrations ranging from 1.4x10^{18} to 3.4x10^{19} cm^{-3} were grown and studied. The RT PL peaks show a monotonic red shift from 3.280 to 3.229 eV with the increase of electron concentration, which is attributed to the band-gap narrowing effect. The red-shifted peak values have been fitted. The evolution of the LT PL spectra were studied and discussed. The free exciton emission at 3.371 eV, the first Ga-level-related peak at 3.313-3.321 eV, and the second Ga-level-related peak at 3.359 eV (assigned as the Ga D^0X peak) are competing with each other in the LT PL spectra. These three kinds of peaks are dominating in the lightly (or undoped), mediate, and heavily doped ZnO:Ga samples, respectively. From the experiments, we conclude that there are two Ga levels in ZnO. In the lightly doped sample, the Ga atoms contribute to the first Ga level around 3.32eV. When the Ga incorporation reaches some critical amount, Ga atoms form the second Ga level in ZnO at 3.359 eV.

Zheng Yang
University of California, Riverside

Date submitted: 12 Dec 2007 Electronic form version 1.4