Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Electronic Properties of Energetic Particle-Irradiated In-rich InGaN Alloys S.X. LI, R.E. JONES, E.E. HALLER, UC Berkeley and LBNL, Berkeley, CA 94720, K.M. YU, J. WU, W. WALUKIEWICZ, J.W. AGER III, W. SHAN, LBNL, Berkeley, CA 94720, HAI LU, WILLIAM J. SCHAFF, Cornell University, Ithaca, NY 14853, W. KEMP, Kirtland AFB, NM 87117 — InGaN alloys, whose fundamental bandgaps span almost perfectly the solar spectrum, are potential materials for high-efficiency tandem solar cells. We have carried out a systematic study on the effect of irradiation on the electronic and optical properties of InGaN alloys over the entire composition range. Three different types of energetic particles (electrons, protons, and alpha particles) were used to produce displacement damage doses (D_d) spanning five orders of magnitude. The electron concentrations in InN and In-rich InGaN increase with D_d and finally saturate after a sufficiently high dose of irradiation. The saturation of carrier density is attributed to the Fermi level pinning at the Fermi Stabilization Energy (E_{FS}), as predicted by the amphoteric native defect model. Electrochemical capacitance-voltage (ECV) measurements reveal a surface electron accumulation whose concentration is determined by pinning at E_{FS}. Modeling with a combination of various scattering mechanisms provides an excellent fit with the mobility measurements.

Wladyslaw Walukiewicz
LBNL, Berkeley, CA 94720

Date submitted: 01 Dec 2004 Electronic form version 1.4