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Spectroscopy and Modeling of Carrier Dynamics in $Al_xGa_{1-x}N$ Alloys with Compositional Inhomogeneity H. SHEN, C.J. COLLINS, A.V. SAMPATH, G.A. GARRETT, W.L. SARNEY, M. WRABACK, US Army Research Laboratory, SENSORS AND ELECTRON DEVICES DIRECTORATE TEAM — AlGaN samples grown by plasma-assisted molecular beam-epitaxy on sapphire (0001) substrates, with 20-50% Al content, show intense room-temperature photoluminescence (PL) that is significantly red-shifted from band edge. Low temperature PL shows two distinct peaks: a very bright red-shifted (RS) peak that decreases by a factor of $\sim$7 as the temperature is increased from 10 to 300 K, and a feature associated with band edge (BE) emission that rapidly decreases by greater than 3 orders of magnitude from 10 K to 300 K. Room-temperature monochromatic cathodoluminescence images at the RS peak reveal spatially nonuniform emission. Time resolved (TR) PL data for the BE emission peak show a prompt response at $t = 0$ and an intensity dependent decay that saturates at higher pump intensity. TRPL data for the RS peak, however, show intensity dependent initial rise times with slow and nearly intensity independent decay times. From fitting to a phenomenological model, the density of the localized states associated with the RS feature, the carrier life times in the BE and the RS states, and the transfer time between the two states are determined.

Michael Wraback
US Army Research Lab

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