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Nonequilibrium carrier dynamics in AlGaN/GaN surface quantum wells monitored by time-resolved photoluminescence spectroscopy
Y. D. GLINKA[1], J. V. FOREMAN[2], W. DAVENPORT, H. O. EVERITT[3], U.S. Army Aviation and Missile RDEC, Redstone Arsenal, AL, X. ZHANG, I. P. WELLNIUS, J. F. MUTH, Electrical and Computer Engineering, North Carolina State Univ., Raleigh, NC, J. ROBERTS, P. RAJAGOPAL, J. COOK, E. PINER, K. LINTHICUM, Nitronex Corporation, Raleigh, NC — The photoluminescence (PL) from a GaN surface quantum well of an AlGaN/GaN heterostructure has been studied by using a wide range of ultrafast (∼200 fs) laser excitations and temperatures (4.2 – 300 K) for quantum wells of varying widths. We observe a broad (∼100 meV) PL band whose peak shifts linearly from 3.5 to 3.8 eV with decreasing GaN quantum well thickness from 2.9 to 1.5 nm. The spectral shift of the band is accompanied by the corresponding temporal shift in the range <30 ps. The dynamics of nonequilibrium electrons in the GaN layer confined by the AlGaN barrier and the vacuum level is discussed, with particular emphasis on carrier interactions with both acoustic and optical phonons.

[1]Nano and Micro Devices Center, University of Alabama in Huntsville, Huntsville, AL
[2]Dept. of Physics, Duke University, Durham, NC
[3]Dept. of Physics, Duke University, Durham, NC

Y. D. Glinka
U.S. Army Aviation and Missile RDEC, Redstone Arsenal, AL

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