Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Self-heating study of an AlGaN/GaN-based high electron mobility transistor using visible and ultraviolet micro-Raman scattering I. AHMAD, V. KASISOMAYAJULA, J.M. BERG, M. HOLTZ, Texas Tech University, Lubbock, Texas 79409, S.R. KURTZ, C.P. TIGGES, A.A. ALLERMAN, A.G. BACA, Sandia National Laboratory, Albuquerque, New Mexico 87185 — We report micro-Raman studies of self-heating in an AlGaN/GaN heterostructure field effect transistor using both visible (488.0 nm) and ultraviolet (363.8 nm) excitations. The < 100 nm optical penetration depth of the UV light allows us to measure temperature rise (ΔT) in the two-dimensional electron gas (2DEG) region of the device between source and drain, while visible light gives us the average ΔT in the GaN layer and that of the SiC substrate at the same lateral position. Combined, we depth profile the self-heating in the device. Measured ΔT in the 2DEG is consistently over twice the average GaN-layer value. Simulations are performed to describe the electrical behavior of the device. The results of electrical simulations are used for thermal simulations to describe the thermal behavior of the device. The presence of a hotspot, located at the edge of the gate in the 2DEG on drain side was observed. The measured temperature rise is related to the growth of the hotspot. Excellent agreement between experimental results and simulations is produced over the wide range of operating conditions.

Iftikhar Ahmad
Texas Tech University

Date submitted: 22 Dec 2004 Electronic form version 1.4