Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Measuring Nanoscale Heat Transfer for Gold–(Gallium Oxide)–Gallium Nitride Interfaces as a Function CHESTER SZWEJKOWSKI, James Madison University, KAI SUN, the University of Michigan, COSTEL CONSTANTIN, James Madison University, ASHUTOSH GIRI, CHRISTOPHER SALTONSTALL, PATRICK HOPKINS, University of Virginia, NANOSYNCH TEAM, EXSITE TEAM — Gallium nitride (GaN) is considered the most important semiconductor after the discovery of Silicon. Understanding the properties of GaN is imperative in determining the utility and applicability of this class of materials to devices. We present results of time domain thermoreflectance (TDTR) measurements as a function of surface root mean square (RMS) roughness. We used commercially available 5mm x 5mm, single-side polished GaN (3-7 μm)/Sapphire (430 μm) substrates that have a Wurtzite crystal structure and are slightly n-type doped. The GaN substrates were annealed in the open atmosphere for 10 minutes (900-1000 °C). This high-temperature treatment produced RMS values from 1-60 nm and growth of gallium oxide (GaO) as measured with an atomic force microscopy and transmission electron microscopy respectively. A gold film (80nm) was deposited on the GaN surface using electron beam physical vapor deposition which was verified using ellipsometry and profilometry. The TDTR measurements suggest that the thermal conductivity decays exponentially with RMS roughness and that there is a minimum value for thermal boundary conductance at a roughness of 15nm.

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Date submitted: 15 Nov 2013 Electronic form version 1.4