Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

In-situ TEM study of heat transfer between a carbon nanotube and contacting material MERIJNTJE BRONSGEEST, NORVIK VOSKANIAN, HANNA NILSSON, JOHN CUMINGS, University of Maryland — Due to their interesting intrinsic properties and 1D nature, carbon nanotubes may be (part of) the solution to the heat management challenge in nanoelectronics in multiple ways: e.g. as thermal interface material and/or interconnects in existing Si-based electronics, or as a building block in carbon-based electronics. Of crucial importance for any of these applications is the (in)ability to get heat in and out of the tube: the thermal contact resistance. Thermal contact resistance for carbon nanotubes is not fully understood yet, and theory is under construction. Measuring it is a challenge of its own as it is intimately connected to the thermal conductivity of the connected materials which are not necessarily known that well either. We study the thermal properties of carbon nanotubes with Electron Thermal Microscopy [T. Brintlinger et al., Nano Lett. 8, 582 (2008)], which allows for thermal imaging with a resolution of 150 nm, and combine that with finite-element modeling. With this approach we have already demonstrated that also on a substrate the CNT thermal conductivity is high, and that different heat transfer mechanisms (e.g. phonon-phonon, electron-surface polariton interaction) can be important. Our goal is to study and quantify thermal contact resistance between a carbon nanotube and its surroundings and we will present our latest results.

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Date submitted: 11 Nov 2011 Electronic form version 1.4