Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Anomalous Current-Voltage Characteristics in Suspended Carbon Nanotubes in Various Gas Environments MOH AMER, University of Southern California, ADAM BUSHMAKER, The Aerospace Corporation, STEVE CRONIN, University of Southern California — Electrically-heated suspended, carbon nanotubes (CNTs) exhibiting negative differential conductance in the high bias regime experience a sudden drop in current (or "kink") in various gaseous environments. We study the effect of different gas molecules on these $I-V$ characteristics while simultaneously monitoring the changes in the nanotube vibrational structure under high bias voltages using Raman spectroscopy. When the nanotube is electrically biased at the kink, the G band Raman mode is observed to downshift, as is typical of electrically heated devices. However, the G band frequency at the kink (ω_G^{kink}) lies in the narrow range between 1575 and 1579cm^{-1} for all samples measured, regardless of gas environment. The voltage at which the kink occurs depends on the type of the gas environment with the following dependence: $V_{kink}^{Ar} < V_{kink}^{He} < V_{kink}^{CO_2}$. The magnitude of the kink, however, has the following ordering: $\Delta I_{kink}^{Ar} < \Delta I_{kink}^{CO_2} < \Delta I_{kink}^{He}$. This ordering was observed consistently in all samples measured. Several possible mechanisms underlying this phenomenon are discussed within the context of these findings.

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Date submitted: 23 Nov 2010 Electronic form version 1.4