

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Geometry-dependent resistivity scaling in single-walled carbon nanotube films ASHKAN BEHNAM, ANT URAL, Electrical and Computer Engineering, University of Florida — We study the resistivity scaling in transparent and conductive carbon nanotube films as a function of nanotube and device parameters. First, we observe experimentally that the nanotube film resistivity exhibits an inverse power law dependence on device width below a critical width of 2 microns. We then use Monte Carlo simulations to model this behavior and to study the effect of four parameters, namely tube-tube contact to nanotube resistance ratio, nanotube density, length, and alignment on resistivity and its scaling with device width. We observe stronger resistivity scaling with device width when the transport characteristics in the film are dominated by tube-tube contact resistance, or when the nanotube density, length, or alignment is increased. We also observe that, near the percolation threshold, the resistivity of the nanotube film exhibits an inverse power law dependence on all of these parameters, which is a distinct signature of percolating conduction. However, the strength of resistivity scaling for each parameter is different. We explain these observations, which are in agreement with experimental work, by simple physical and geometrical arguments. Nanoscale study of percolating transport mechanisms in nanotube films is essential for understanding and characterizing their performance in submicron devices.

Ashkan Behnam
Electrical and Computer Engineering, University of Florida

Date submitted: 19 Nov 2006

Electronic form version 1.4