Tailoring of Transport Properties of Carbon Nano Tubes

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Summary

The growing miniaturization of electronics devices, developing of nano devices, developing of wireless technology for body worn applications, the high integration levels and the continuous increase of working frequencies push towards overcoming the copper technology for the realization of interconnects inside ICs. In fact, reducing the metal based interconnect, cross-sectional dimensions give birth to problems such as *reliability* related to electrical, thermal and mechanical stresses in integrated structures, decay of the conductive property of the materials increases cross talks, and noise in the integrated structures.

Therefore new developments of interconnects are needed to meet the following requirements:

1) High conductivity of nano inter-connects characterized by width smaller than 25nm as needed by the ITRS-2008;
2) Feasibility and easily reproducibility of the interconnection systems;
3) Performance modeling and simulation of nano structures/nano devices, and;
4) Matching /acceptation properties of high mechanical and thermal stability, high thermal conductivities and large current carrying capabilities and non bio hazardous material acceptable for printable/organic electronics.

The solutions we suggest for such a technology is a material based on **chelconaide** technology or CNTs. As from literature we found that the high dc resistance associated with an isolated CNT suggests the use of bundles made by numerous parallel CNTs to realize low-impedance interconnects. So, we propose CNT technology as a solution for new interconnect materials for ULSI/Nano electronics/Hybrid electronics.

One key aspect in the development of the CNT interconnect technology and design consists in the availability of simulation tools for the analysis and prediction of the current carrying capability at radio-frequency (RF) and the signal integrity of CNT circuits. However, the electrical property of nanotubes as passive high-frequency components such as interconnects, mixers, detectors and antennas are currently not well understood. In latter part we study theoretically the interaction of one-dimensional electronic systems with microwave radiation, leading to a quantitative theory of nanowire and nanotube antenna performance. In previous modeling work, nanotubes were considered as antennas but did not quantitatively assess their performance potential. Recently, we have been able to synthesize and electrically contact single-walled carbon nanotubes (SWNTs) up to 1 cm in length. These tubes are comparable in length to the wavelength of microwaves in free space. This motivates our study of the interaction of microwaves with nanotubes and the exploration of their properties as antennas. In spite of heavy losses, these may allow a wireless nonlithographic connection between nanoelectronic devices and the macroscopic world. If lower resistance nanotubes can be grown, we predict the antenna properties to be dramatically different from conventional thin-wire antennas.

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