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Carbon nanotube devices: Sorting, Assembling, Characterizing

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Carbon nanotubes have been studied extensively over the last decade. Various exceptional properties have been revealed which still drive the vision about using carbon nanotube in future electronics, for instance as molecular nanoscale transistors or electromigration resistant interconnects. For many years a major obstacle was the inability to grow nanotubes with defined dimensions (length, diameter) and electronic properties (metallic,semiconducting). Recently those problems have been solved to a large extent by advanced sorting techniques. Today the challenge is to assemble nanotubes devices with defined properties to form a complex circuitry. As progress is made in making highly-integrated nanotube device arrays new characterization techniques have to be developed which allow testing large number of devices within an acceptable time. Along this line I will report on the state-of-the-art of sorting of carbon nanotube, as a base for nanotube device fabrication [1]. I will then explain our strategy to assemble high-density arrays of nanotube devices [2] and discuss a new characterization technique for nanotube devices [3]. Finally I will introduce a novel device engineering tool [4].

[1] R. Krupke et al., "Separation techniques for carbon nanotubes" in Chemistry of Carbon Nanotubes, p.129-139, American Scientific Publishers 2008

[2] A. Vijayaraghavan et al., "Ultra-Large-Scale Directed Assembly of Single-Walled Carbon Nanotube Devices", Nano Lett. 7 (2007) 1556-1560

[3] A. Vijayaraghavan et al., "Imaging Electronic Structure of Carbon Nanotubes by Voltage-Contrast Scanning Electron Microscopy", Nano Resarch 1 (2008) 321-332

[4] C. W. Marquardt et al., "Reversible metal-insulator transitions in metallic single-walled carbon nanotubes", Nano Lett. 9 (2008) 2767-2772