Highly-selective semiconducting single walled carbon nanotubes separation for optoelectronic at telecom wavelength

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Resume : Single-wall carbon nanotubes are known for their exceptional properties, which are expected to give rise to innovative applications. However, SWNTs are produced as a poly-disperse mixture of nanotubes with different lengths, diameters and chiralities. The nanotube population depends on the synthesis parameters and always contains both metallic and semiconducting chiralities. It is highly desirable to be able to selectively extract the nanotubes with the targeted properties. We report an effective polymer-assisted technique for the high-selectivity separation of semiconducting SWNTs with their fundamental optical transition centred at 1550 nm. For applications, the concentration and alignment of the nanotubes are also of great importance. We used a modified evaporative self-assembly approach that can deposit concentrated SWNT with configurations varying from random to highly-oriented networks. We characterize the samples with optical and electrical measurements. The absence of residual metallic single walled carbon nanotubes is proved by absorption measurement and resonant Raman spectroscopy and is confirmed by electrical measurements on nanotube transistors. Asymmetric (Pd and Sc) contacts and local gates are also implemented. We elaborate configurations enabling photo-detection and electroluminescence, which pave the way to exploit s-SWNTs for optoelectronic at telecom wavelengths ranges. This work was funded by the European Union through the FP7 Project CARTOON (Contract FP7 -618025).