Resonance Raman Spectra of Optical Purified (6,5) Nanotubes Sorted by Density Gradient Ultracentrifugation

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We present a protocol to selectively isolate single-walled carbon nanotubes (SWNTs) with a chirality of (6,5) using density gradient ultracentrifugation (DGU)[1]. Starting with SWNTs synthesized by the alcohol catalytic chemical vapor deposition (ACCVD) method, we used sodium deoxycholate (DOC), sodium dodecyl sulfate (SDS) and sodium cholate (SC) as co-surfactant encapsulating agents[2] to isolate (6,5) SWNTs. Successful isolation was determined by photoluminescence excitation (PLE) maps, which show only one feature corresponding to (6,5). However, additional spectroscopic data (Fig. 1) such as resonance Raman spectra (488 nm laser excitation) and optical absorbance, as well as transmission electron microscopy (TEM) observation before and after the DGU process show that the sample contained a high relative purity of (6,5) SWNTs, but other chiralities were still present at low concentrations. Some evidence of their existence can be seen in optical absorbance spectra, but resonance Raman spectra using different excitation energies clearly reveal the existence of these minority species. This shows that resonance Raman spectroscopy is a more sensitive too for determining the purity of optically isolated SWNT samples, and we hope that iterated refinement of our DGU process can lead to successful extraction of single-chirality SWNTs.

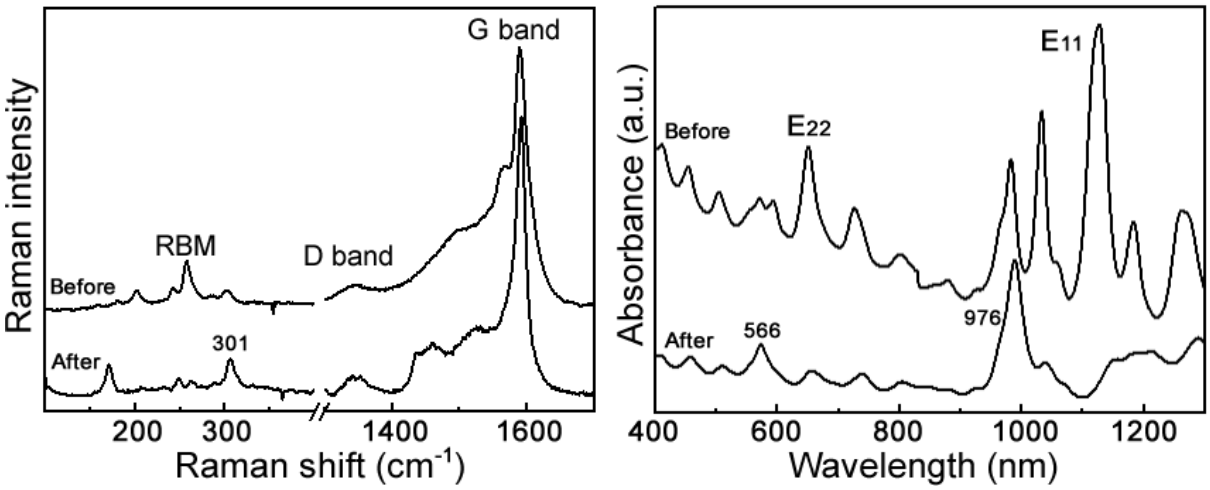

Figure 1: Resonance Raman spectra (left, 488 nm laser excitation) and optical absorbance spectra (right) before and after DGU process showing selective isolation of optically purified (6,5) SWNTs from pristine ACCVD samples.

[1] M. Arnold, A. Green, J. Hulvat, S. Stupp and M. Hersam. *Nat. Nanotechnol.* **1**, 60 (2006)

[2] K.Yanagi, Y. Miyata and H.Kataura, *Appl. Phys. Express* **1**, 034003 (2008)

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