Selective Isolation of Single-Walled Carbon Nanotube Chiralities Using Density Gradient Ultracentrifugation

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We present a protocol to selectively isolate single-walled carbon nanotubes (SWNTs) using density gradient ultracentrifugation (DGU)[1]. Starting with SWNTs synthesized by the alcohol catalytic chemical vapor deposition (ACCVD) method and using *sodium deoxycholate* (DOC) and *sodium dodecyl sulfate* (SDS) as co-surfactant encapsulating agents[2] we achieved isolation of SWNTs with different properties. By changing the order in which surfactants were added, SWNTs could be separated into colorful layers containing different chiralities or diameters, such as (6,5) in a violet layer. However, if the co-surfactants are both added to disperse SWNTs, subsequent DGU results in the simultaneous selection of (6,5) nanotubes and separation of semiconducting/metallic nanotubes. Various optical spectroscopies, such as optical absorbance, photoluminescence excitation (PLE), and resonance Raman spectra (RRS) were used to characterize the SWNTs before and after DGU. A time-dependent sequence of the simultaneous selection and separation (Fig. 1) shows that three main portions—corresponding to semiconducting, metallic, and (6,5) nanotubes—clearly have different moving behavior during the DGU process.

This method illustrates the potential for nanotube isolation and separation, and we believe that further refinement of this process can lead to higher purity extractions of SWNTs.

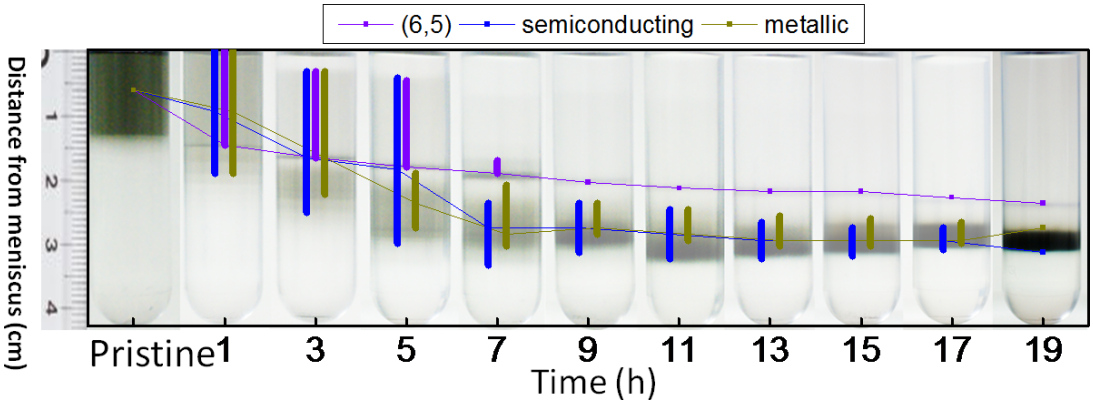

Figure 1. Time-dependent sequence of simultaneous selection and separation of SWCNTs.

References:

[1] Arnold et al., Nat. Nanotechnol. 1 (2006) 60.
[2] K. Yanagi et al., Appl. Phys. Express 1 (2008) 034003.

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