Absolute Absorption Cross-Sections of (n,m)-selected SWCNTs

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The optical absorption cross-section is a basic photophysical property of fundamental and practical importance. However, cross-sections remain unknown for most single-walled carbon nanotube (SWCNT) structures. Difficulties in determining these values arise from challenges in measuring absolute concentrations of individual *(n,m)* species in heterogeneous samples. We apply here a new approach to find concentrations by directly counting SWCNTs within a specific volume in sorted samples. Nanotube suspensions enriched in a single semiconducting species by nonlinear DGU are loaded into a microfluidic channel and then observed with near-infrared fluorescence videomicroscopy. Resonant excitation and spectral emission filtering are used to restrict imaging to the specific semiconducting *(n,m)* species of interest. Nanotube concentrations are found by carefully counting SWCNTs within well-defined imaged volumes of the micro-channel. Nanotube length distributions are determined by the LAND method (length analysis from nanotube diffusion) and confirmed by AFM imaging. Initial measurements have been made on (6,5) and (7,5) enriched samples. A value of 3.10×10^{-17} cm^2 per C atom was found for the orientationally averaged E_{11} absorption cross-section of (6,5) SWCNTs.

A related approach involves drop casting a dilute PFO-extracted sample onto a microscope slide. Near-infrared fluorescence microscopy images are then used to measure the relative abundances of (7,5), (7,6), (8,6), (8,7) and (9,7) SWCNTs. These data are used with the bulk absorption spectrum to calculate their relative absorption cross-sections, which are then converted into absolute cross-sections using the (7,5) value found as described above.