Structured Fluorescence from Micelle-suspended Individual Fullerene Nanotubes

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Individual single-walled carbon nanotubes have been prepared as aqueous suspensions in micelles using a simple new separation process based on ultrasonication and centrifugation. These samples show structured optical absorption spectra and previously unreported photoluminescence in the near-infrared range from 870 to 1400 nm. The spectra consist of superimposed exciton transitions, each of which is associated with the van Hove singularities of a particular semiconducting nanotube structure. Features in the emission spectrum closely match the first-branch van Hove absorptions. The emission is identified as fluorescence on the basis of its short (< 2 ns) duration and small (ca. 45 cm^{-1}) red shift from the corresponding absorption peaks. Spectrofluorimetric results dissect the overall spectra into components from distinct nanotube species. Further findings will be presented that assign individual spectral features to specific nanotube structures and illustrate the sensitivity of fluorescence to the nanotubes' aggregation state and chemical environment. Fluorescence spectroscopy will prove a powerful tool for characterizing samples of single-walled carbon nanotubes and for exploring their electronic structure and excited state dynamics.