Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Endohedral Volume Control for Improved Single-Wall Carbon Nanotubes JOCHEN CAMPO, JEFFREY FAGAN, Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, Maryland — Liquid-phase processing of single-wall carbon nanotubes (SWCNTs) generally results in the exposure of their core volumes to the environment (opening) due to energy input necessary for purification and solubilization. For aqueous processing this results in SWCNTs routinely getting filled with water, which is detrimental to several properties. Importantly, water filling leads to significant redshifts to, and inhomogeneous broadening of, the electronic transitions of the SWCNTs, as well as a substantial decrease to their fluorescence quantum efficiency. Selection of (remaining) empty (end-capped) SWCNTs to avoid these adverse effects is possible by means of ultracentrifugation, but is a natively low yield process. In this work, SWCNTs are prefilled with linear alkanes or similar organic compounds, serving as a passive, highly homogeneous spacer, blocking the ingestion of water and hence preventing the detrimental consequences. Moreover, the low dielectric nature of the alkane core only weakly affects the local electronic wavefunction of the SWCNTs, effectively simulating empty core conditions and hence yielding much more resolved optical spectra with blue shifted peak positions compared to water filled SWCNTs. It is demonstrated that a wide variety of linear as well as cyclic alkanes can be applied for this purpose, in combination with various SWCNT materials.

Jochen C
Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, Ma

Date submitted: 06 Nov 2015 Electronic form version 1.4