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**Intrinsic and Extrinsic Magnetic Anisotropies of Single-Wall Carbon Nanotubes**

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Interpretation of bulk magnetization measurements of single-wall carbon nanotubes (SWNTs) is often complicated by the presence of ferromagnetic (FM) catalyst impurities. I will discuss how magnetic alignment of SWNTs in suspension can be used to detect FM impurities attached to nanotubes. A combination of Raman scattering and polarized absorbance is first used to determine the bare optical polarized absorbance cross-sections for light parallel and perpendicular to the nanotube axis. Next, these spectra serve as a benchmark for performing quantitative and high-resolution studies of SWNT alignment in suspensions. These studies reveal that even after chemical purification FM moments significantly enhance SWNT alignment and have an easy axis along the SWNT axis. Lowering the FM impurity content using magnetic gradient fractionation produces a concomitant reduction in the number of SWNTs whose alignment is dominated by FM anisotropy. These studies permit an estimate of the tethered FM moment size for both laser-oven and HiPCO SWNTs, and give an accurate measure of SWNT diamagnetic anisotropy. Studies of DNA-wrapped SWNTs available from DuPont show essentially no FM impurity moment. Since the latter samples can be selectively enriched with single SWNT species, we are able to compare diamagnetic responses for different wrapping vectors (m,n). Work done in collaboration with M.F. Islam, D. E. Milkie, O.N. Torrens, C. L. Kane and A. G. Yodh at PENN and M. Zheng, G.B. Onoa, T. Gierke at DuPont CR&D. Support NSF through DMR-0203378, DMR-079909 and DGE-0221664, NASA through NAG8-2172, DARPA/ONR through N00014-01-1-0831, and SENS.