Environmental Effects on Photoluminescence Properties of Carbon Nanotube sp^3 Defects

Stephen K. Doorn[1]

[1]*Center for Integrated Nanotechnologies, Materials Physics and Applications Division, Los Alamos National Laboratory, Los Alamos, NM 87545, U.S.A.*

Photoluminescent defect states introduced by low-level covalent functionalization of single wall carbon nanotubes (SWCNTs) are of growing interest as routes to enhanced photoluminescence (PL) quantum yields and new functionality [1,2]. In particular, exciton localization in deep traps at the defect sites gives rise to single photon emission at room temperature that is tunable to telecom wavelengths [3,4]. We present results exploring the effects of varying dielectric environments on PL spectroscopic and dynamic behaviors of sp^3 defects introduced via aryl diazonium functionalization chemistry. Changes in PL relaxation times with dielectric constant of various solvents will be discussed as evidence for an electronic to vibrational energy transfer from the defect-trapped exciton to the solvent degrees of freedom. Solvent interactions are thus seen to be an important component of relaxation that also includes multi-phonon decay processes [5]. Strategies for tailoring the SWCNT environment to extend defect-state PL lifetimes (to nanoseconds) and optimize linewidths will also be presented. Environmental impacts on dephasing times will also be discussed.

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[5] Hartman, N.F., *et al., ACS Nano*, **10**, 8355 (2016).