Dependence of exciton transition energy of single-walled carbon nanotube on dielectric constant of surrounding material

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We have experimentally investigated the dependence of exciton transition energy of single-walled carbon nanotubes (SWNTs) on surrounding dielectric material, in the range of dielectric constant (ϵ) from 1.0 to 37, by means of photoluminescence spectroscopy [1]. The sample with SWNTs bridging over trenches was immersed in various organic solvent with different ϵ. With increasing ϵ, both E_{11} and E_{22} exhibited a redshift by several tens meV and a tendency to saturate at $\epsilon \sim 5$ without an indication of significant (*n*,*m*) dependence. The redshifts can be explained by dielectric screening of the repulsive electron-electron interaction [2]. We have also measured the time-resolved photoluminescence in air and solvent, respectively, by utilizing the excitation intensity correlation technique [3]. When the sample was immersed in a solvent, the correlation signal collapsed and decay time decreased drastically. [1] Y. Ohno, S. Iwasaki, Y. Murakami, S. Kishimoto, S. Maruyama, T. Mizutani, arXiv:0704.1018v1 [cond-mat.mtrl-sci] (2007). [2] Y. Ohno, S. Iwasaki, Y. Murakami, S. Kishimoto, S. Maruyama, and T. Mizutani, Phys. Rev. B **73**, 235427 (2006). [3] Y. Ohno, T. Shimada, S. Kishimoto, S. Maruyama, and T. Mizutani, J. Physics: Conf. Series **38**, 5 (2006).