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Environmental effect for exciton transition energy of single carbon nanotubes[1] RIICHIRO SAITO, KENTARO SATO, PARK JINSUNG, Tohoku University, YUHEI MIYAUCHI, SHIGEO MARUYAMA, The University of Tokyo, MILDRED DRESSELHAUS, GENE DRESSELHAUS, MIT — The exiton transition energies of single wall carbon nanotubes which are observed in resonance Raman, photo-absorption, and photoluminescense spectroscopies, depend on the surrouding materials (environmental effect). The environmental effect can be explained by screeining of the excitonic states by the dielectric materials. We calculate the transition energies for many different (n,m) carbon nanotubes up to 4eV and to 3nm in diameter. The calculated results are compare with many experimental data with different conditions for samples. The energy shift for the exciton transition energies can be explained by a fitting parameter of static dielectric constants of surrouding materials. However we will show that the effective dielectric constant has a unique, type, metallicity, diameter, and energy dependence of the dielectric constants in order to reproduce the exciton energies for the wide range of diameter and excitation energies. By analyzing the data, we will give a simple formula for the dielectric constants for carbon nanotubes themselves and the surrounding materials as a function of chirality and diameter of single wall carbon nanotubes.

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