# Environmental effect on the exciton transition energy of single wall carbon nanotubes

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The optical transition energy of single wall carbon nanotubes (SWNTs) are frequently used for assigning *(n,m)* values of SWNTs in the resonance Raman spectroscopy, resonance Rayleigh spectroscopy and photoluminescence spectroscopy. Depending on the surrounding materials of SWNTs, the transition energy is shifted up to 100meV, which is known as the environmental effect. The origin of the environmental effect is the modification of the Coulomb interaction between an electron and a hole of an exciton which is stable even at the room temperature. In the previous work, we discussed the environmental effect of a SWNT by the two dielectric constants of surrounding materials and the SWNT itself [1], which explains well the dependence of the transition energy as a function of the dielectric constant of the surrounding materials. However, the effective dielectric constants which are used for the exciton calculation depend on the diameter of SWNTs, which was difficult for making a reasonable transition energy as a function of diameter (the Kataura plot) which can be applicable for many different surfactant materials [2]. Here, we present three major results of the progress of the environmental effect; (1) a fitting function of the dielectric function for reproducing the experimental Kataura plot, (2) a numerical simulation of the Coulomb interaction of the exciton in the presence of the surrounding the materials and (3) an analytic expression of the exciton Coulomb energy for two different dielectric constants. Now we can give a bright exciton Kataura plot for given dielectric constants of the surrounding materials. We will show the comparison with the experimental results of resonance Raman spectroscopy, too, which will give an accurate results for a wide range of diameter up to 3nm and for an energy up to 3eV.

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