# Functionalization of Carbon Nanotubes by Molecular Encapsulations

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Controlling the physical properties of solids by doping molecules or atoms is a common practice in materials science. For single-wall carbon nanotubes (SWCNTs), such doping techniques are extremely important from the viewpoints of both basic science and practical applications. One of the most characteristic features of SWCNTs is that they have an inner space with dimensions suitable for accommodating molecules and molecular materials. Doping molecules to the inner spaces instead of outside the SWCNTs is expected to be a useful technique for achieving realistic applications of SWCNTs to increase their stability and durability.

We have studied on the electronic and the phonon properties of fullerenes encapsulating SWCNTs (nanopeapods) by using spectroscopic techniques such as photoluminescence (PL) [1-4] and resonance Raman scattering [5-7]. The PL peak positions and the radial breathing mode (RBM) frequencies show characteristic changes upon fullerene encapsulations. For instance, the observed shifts in the optical transition energies and the RBM frequencies of SWCNTs show strong tube diameter dependence, which can be explained by the van der Waals type intermolecular interaction between SWCNTs and the encapsulated fullerenes.

In this talk, we report the modification of the electronic structures of SWCNTs by encapsulating the other molecules such as ferrocenes. The difference in the encapsulation effects between ferrocene and fullerene will be discussed.

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