Photoluminescence spectroscopy in an individual single-walled carbon nanotube

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Recently, photoluminescence (PL) from micell-encapsulated single-walled carbon nanotubes (SWNTs) [1] and SWNTs suspended between pillars above silicon substrates [2] has been observed, when nanotubes prevent becoming bundled or contact substrates. However, the macroscopic PL spectra reflect ensemble average of signals from a lot of SWNTs. This causes an inhomogeneous broadening in the PL spectra, which covers intrinsic properties of a SWNT. The spectroscopic observation of an individual SWNT is a useful probe and contributes to understand physics of SWNTs. In this presentation, we report optical properties of an individual SWNT at room and low temperature using a technique of individual SWNT spectroscopy.

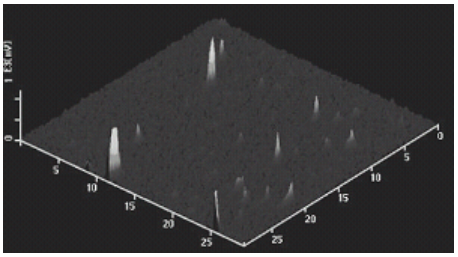

Fig.1 PL image of SWNTs at room temperature.

Figure 1 shows the 3-dimensional plot of a PL image of SWNTs at room temperature. The bright peaks correspond to PL signals from individual SWNTs. Figure 2 shows PL spectra of an individual SWNT at 20 K and 300 K. The PL linewidth corresponds to a homogeneous linewidth decreases from 15 meV at 300 K to less than 1.5 meV at 20 K. In some SWNTs, we have observed the PL intensity fluctuation, which originates from PL blinking or PL intermittency phenomena.

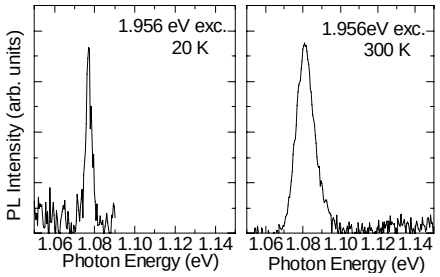

Fig.2 PL spectrum of individual SWNTs at 20 K and 300 K.

[1] M. J. O'Connell et al., *Science* **297,** 593 (2002).

[2] J. Lefebvre et al., *Phys. Rev. Lett*. **90,** 217401 (2003).

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