Photoluminescence spectroscopy in an individual single-walled carbon nanotube

○Kazunari Matsuda1,2,3, Keita Irie4, Toshiharu Saiki2,4, Yuhei Miyauchi5, Yoichi Murakami5 and Shigeo Maruyama5

1Institute for Chemical Research, Kyoto University, Gokasho Uji, Kyoto, Japan
2Kanagawa Academy of Science and Technology, 3-2-1 Sakado, Takatsu, Kawasaki, Japan
3Nanostructure and Material Property, PRESTO, Japan Science and Technology Agency, 4-1-8 Honcho Kawaguchi, Saitama, Japan
4Department of Electronics and Electrical Engineering, Keio University, 3-14-1 Hiyoshi, Kohoku, Yokohama, Kanagawa, Japan
5Department of Mechanical Engineering, The University of Tokyo, 7-3-1, Hongo, Bunkyo, Tokyo, Japan

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.

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.


Corresponding Author: Kazunari Matsuda
TEL: +81-774-38-4515, FAX: +81-774-38-4510, E-mail: matsuda@scl.kyoto-u.ac.jp