Cross-polarized absorption of single-walled carbon nanotubes by photoluminescence excitation spectroscopy

Yuhei Miyauchi, Mototeru Oba, Shigeo Maruyama

The University of Tokyo

Contact e-mail: *miyauchi@photon.t.u-tokyo.ac.jp*

Photoluminescence excitation (PLE) spectroscopy of single-walled carbon nanotubes (SWNTs) have been extensively studied for characterization of their unique electronic properties. In this report, we have studied polarized PLE spectra of various (n, m) nanotubes in surfactant suspension. Using a simple theory for PL anisotropy, we have obtained decomposed PL maps for parallel and perpendicular polarization from two PL maps measured by so-called L-format method [1]. Distinct absorption peaks corresponding to E12 and E21 transitions for perpendicular polarization were observed. Observed E12 and E21 energies compared to E11 and E22 were considerably blue-shifted than the single-particle expectation within tight-binding calculation of SWNT considering geometry optimization and curvature effect [2]. This qualitative discrepancy between measurement and single-particle calculation is attributed to smaller exciton binding energy for cross-polarized excitation.

References:

[1] J.R. Lakowicz, Principles of Fluorescence Spectroscopy, Plenum Pub. Corp., New York, 1999.

[2] M. Oba, S. Okada, T. Miyake, S. Maruyama, the 30th Fullerene Nanotubes General Symposium, Nagoya (2006).