Exciton Radiative Lifetimes and Their Temperature Dependence in Single-Walled Carbon Nanotubes

We have investigated the radiative lifetimes of excitons in single-walled carbon nanotubes (SWNTs) from simultaneous measurements of the photoluminescence (PL) lifetimes [1] and the PL quantum yields. A high-quality sample of PFO dispersed-SWNTs was used for the PL measurements. The evaluated radiative lifetimes were $\sim 5 - 15$ ns for SWNTs with diameters $\sim 0.8 - 1.1$ nm at room temperature. The radiative lifetimes increased with the tube diameter. The exciton spatial coherence volume (length) was of the order $10^2$ nm along the tube axis, as deduced from the radiative lifetimes. Furthermore, we discuss the dynamics of bright and dark excitons [2] from the temperature dependence of the radiative lifetime (10 to 300 K).