Room-temperature single photon emission from micron-long air-suspended carbon nanotubes

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Carbon nanotubes have great potential for single photon sources as they have stable exciton states even at room temperature and their emission wavelengths cover the telecommunication bands. In recent years, single photon emission from carbon nanotubes has been achieved by creating localized states of excitons [1]. In contrast to such an approach, here we utilize mobile excitons and show that single photons can be generated at room temperature in air-suspended carbon nanotubes with lengths of several microns. We perform photoluminescence microscopy on as-grown air-suspended carbon nanotubes in order to determine their chirality and suspended length. Photon correlation measurements are performed on nanotube emission at room temperature using a Hanbury-Brown-Twiss setup with InGaAs/InP single photon detectors. We observe antibunching with a clear excitation power dependence, where we obtain $g^{(2)}(0)$ value less than 0.5 at low excitation powers (Fig. 1), indicating single photon generation. We show such $g^{(2)}(0)$ data with different chiralities and suspended lengths, and the effects of long exciton diffusion lengths and efficient exciton-exciton annihilation [2] on single photon generation processes are discussed.

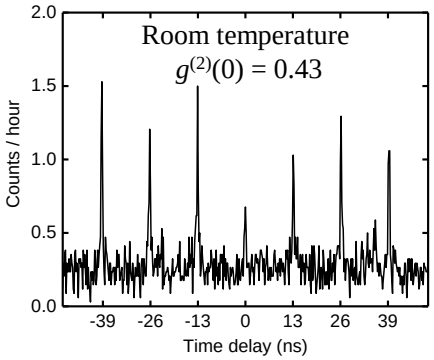

Fig.1 Photon correlation of an individual (9,7) carbon nanotube measured at room temperature.

Work supported by KAKENHI (JP16H05962), MEXT (Photon Frontier Network Program, Nanotechnology Platform). T.U. is supported by ALPS and JSPS Research Fellowship.

References

[1] X. Ma, N. F. Hartmann. J. K. S. Baldwin, S. K. Doorn, H. Htoon, *Nature Nanotech.* **10**, 671 (2015).
[2] A. Ishii, M. Yoshida, Y. K. Kato, *Phys. Rev. B* **91**, 125427 (2015).