Optical and Electrical Generation of Exciton-Polaritons in Single-Walled Carbon Nanotubes

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Exciton-polaritons are quasiparticles that form upon strong coupling between electronic excitations of a material and photonic states of a surrounding microcavity. The special nature of excitons in semiconducting single-walled carbon nanotubes (s-SWCNTs) leads to particularly strong coupling even at room temperature (see Figure 1) [1]. The coupling strength and the relaxation properties of the polaritons depend on the overall concentration and density of the s-SWCNTs. While exciton-polariton emission is usually initiated by optical excitation, the high ambipolar charge carrier mobilities of s-SWCNTs make them suitable for electrically driven polariton light-emitting devices with high current densities. Here, we show that strong coupling is observed and near-infrared exciton-polaritons can be generated and tuned in s-SWNT light-emitting field-effect transistors with integrated microcavities [2].

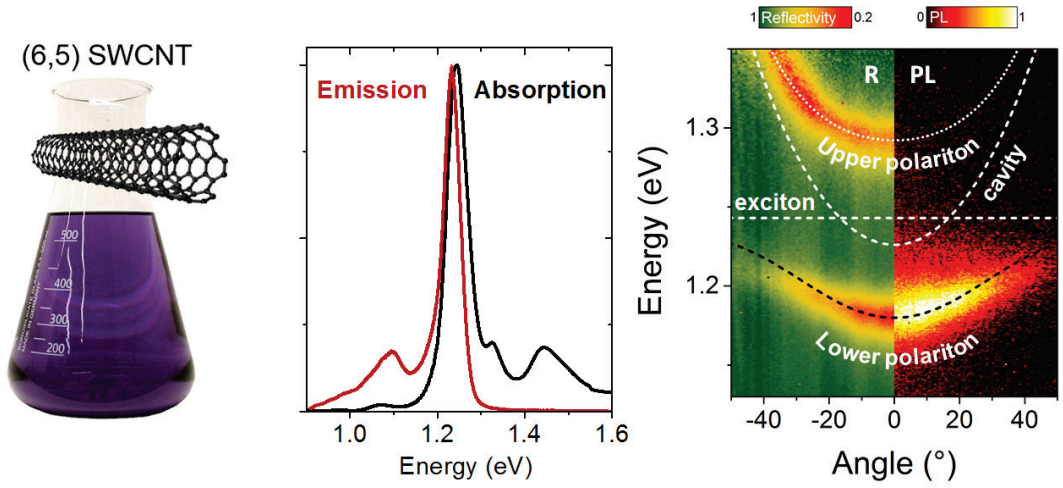

Fig. 1. Purified dispersion of only (6,5) single-walled carbon nanotubes, emission and absorption spectrum of dispersion, angle-resolved reflectivity and photoluminescence from a metal-clad microcavity filled with (6,5) SWCNTs in a polymer matrix showing a Rabi splitting of 114 meV.

References

[1] Graf et al. *Nature Comm.* 2016, 7, 13078.

[2] Graf et al. *Nature Materials* 2017, doi: 10.1038/NMAT4940