Optical properties of core-shell systems based on carbon nanotubes

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Single-walled carbon nanotubes exhibit unique physical properties. In particular, single-photon emission at room temperature has been recently reported ([1], [2]). This has been achieved by surface chemistry that creates point-like defects that localize the nanotube's exciton. The design of these defects allows creating potential well with deepness far above kT leading to the antibunching at room T. The last achievement reports $g^2(0)<0.01$ at room T and in the telecom wavelength bands ([2]). Concomitantly, first Cavity Quantum Electrodynamics experiments have been carried out using nanotubes as the quantum emitter. These experiments exhibit Purcell effect and cavity feeding ([3], [4]). These results pave the way to the use of nanotubes as emitters in quantum devices.

Nevertheless, efforts have to be made on the material side in order to integrate nanotubes in devices. Nanotubes being only made of surface atoms, they show an uncontrolled sensitivity to their local environment. One of the main problems for the use of nanotubes as quantum emitters is the degradation of the purity of the source due to blinking and spectral diffusion processes. Here, we report on a strategy that consists in protecting carbon nanotubes from their close environment to improve the stability of their emission while being suitable materials for incorporation in real devices. To do so, we synthesize core/shell nanostructures: the nanotube is the active core, while a double polymer layer acts as protective shell [5]. In this poster, we discuss our preliminary results about the influence of a double shell structure on the emission properties of single nanotubes investigated by microphotoluminescence experiments at low temperature.

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