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Optical near-field investigations of individual single-walled carbon nanotubes[1]

ACHIM HARTSCHUH, LMU Muenchen

Optical excitation of semiconducting nanotubes creates excitons that determine nearly all light-based applications. Near-field photoluminescence (PL) and Raman imaging with a spatial resolution better than 15 nm was used to probe the spectroscopic properties of excitonic states along single nanotubes on substrates [1,2]. The PL intensity was found to decrease towards the nanotube ends on a length scale of few 10 nm probably caused by exciton transport to localized end states followed by efficient non-radiative recombination. DNA-wrapping of nanotubes results in pronounced emission energy variations on a length scale of few 10 nm indicating the potential of the material for nanoscale sensing applications [3]. Inter-nanotube energy transfer was studied for different pairs of semiconducting nanotubes forming bundles and crossings [4]. Efficient transfer is found to be limited to a few nanometres because of competing fast non-radiative relaxation and can be explained in terms of electromagnetic near-field coupling. We also report on our recent experimental results on time-resolved near-field PL measurements, electrically gated nanotubes and the PL of nanotubes on metal surfaces.

References:
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