Seminář odd. 26
Tenkých vrstev a nanostruktur

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TÉMA

Optoelectronic properties of single-molecule junctions

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Future ultrafast devices may rely on hybrid electronic-plasmonic circuitry. A keystone for the realization of such components is the production of transducers allowing to controllably couple electrical and plasmonic signals. Single-molecule light sources can be coupled to surface plasmons and have the ability to produce single-photon and narrow line emission, two mandatory characteristics for quantum computation applications. Conserving these characteristics for a single-molecule integrated in a hybid electronic-plasmonic circuit is challenging because of the required contact to metallic electrodes which alters the properties of the molecule.

Recently, we showed that intrinsic radiative transitions of molecular junctions may be recovered when elongated molecules are used as bridging element. In this example, however, a broad emission band (FWHM ≥ 150 meV) is reported, indicating the poor coherence of the emitted light (Fig. 1a). In my presentation, I will report on the ultra narrow-line emission (FWHM ≈ 2.5 meV wide) from an electrically addressed molecular emitter suspended in the plasmonic junction of a scanning tunnelling microscope (STM) (Fig. 1b). I will show how progressive lifting of the emitter from the substrate provides control over the temporal coherence of the emission which is finally limited by interactions with low energy phonons. Our data also reveal the detailed mechanism that rules the complex interactions between the single-molecule emitter and localized surface plasmons. We envision that the extended coherence of the emission will open the way to nanoplasmonic devices integrating coherent molecular optoelectronic emitters as excitation sources .

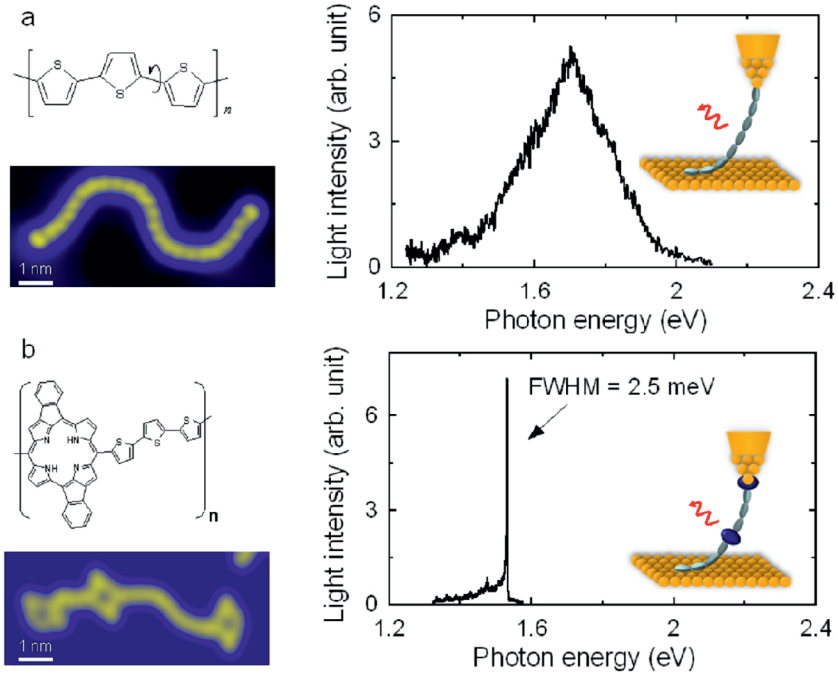

Figure : (a) Chemical structure and STM image of a polythiophene wire adsorbed on a Au (111) surface (left), and light emission spectra of a suspended polyhtiophene wire in a gold-gold STM junction (right).
(b) Chemical structure and STM image of thiophene-porphyrin copolymer wire adsorbed on a Au (111) surface (left), and light emission spectra of a suspended copolymer wire in a gold-gold STM junction (right).

odborný garant: *Ing. Pavel Jelínek, Ph.D.*