Waveguide-plasmon polaritons in photonic crystal slabs with metal nanowires

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Photonic crystals [1,2] are periodically modulated systems which demonstrate a large potential for light controlling. New possibilities to manipulate the properties of photonic crystals are open if the photonic resonances in the system interact with optically active electronic resonances. Examples are the so called polaritonic photonic crystals, i.e., photonic crystals containing nanostructured semiconductors with optically active excitons [3,4] or metals [5,6].

The optical properties of a photonic crystal slab made of periodic arrays of gold nanostructures, nanodots [5] and nanowires [6] on top of a dielectric waveguide are discussed. It is demonstrated [6] that the coupling between the quasiguided modes [7] in photonic crystal slab and the localised plasmons in metal nanostructures results in the formation of a strongly coupled waveguide-plasmon polariton. The formation of the new quasiparticle manifests itself in the strong anticrossing between quasiguided modes and plasmon resonances in the measured as well as calculated optical spectra. The effect opens new possibilities for photonic band gap engineering in metallic-dielectric photonic crystals.

In this talk, the physics of the waveguide-plasmon polariton will be discussed: the characteristic features of the optical response, the resonant energy and damping dispersions, the electromagnetic near-field distributions. The comparison with the system without the guided modes in the dielectric substrate will be done.

References:

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