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Optical properties of plasmonic networks

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In this paper we discuss the optical properties of plasmonic networks based on noble materials, in the context of optoelectronic applications. The studied networks consist of bent silver nanowires, obtained using wet-chemistry as well as of silver nanowires fabricated directly on a substrate using photo-chemical reaction. While the first type of structures are mono-crystalline, which ensures long-range energy propagation, the latter can be prepared in any arbitrary shape.

The experimental results demonstrate propagation of plasmon excitations launched in the telecom wavelength range by rare-earths-doped nanocrystals coupled with silver nanowires. We show precise control of plasmon propagation simply by tuning the polarization of a laser or by spatial positioning of the excitation beam. Exact orientation and value of the *k*-vector for plasmon can by monitored through Fourier (Back Focal Plane) microscopy.

At the same time, plasmonic interactions result in an increase of the emission of nanocrystals located in the vicinity of the nanowires, mostly due to enhanced radiative emission rates (Purcell effect). By applying polarization-resolved microsecond Fluorescent Lifetime Imaging Microscopy, we demonstrate that orientation of the emitting dipole relative to the nanowire is crucial for efficient luminescence enhancement and effective plasmon activation.

Finally, we apply recently developed microscopic configuration based on two objectives, to investigate energy propagation within plasmonic networks. We proved that energy can be transmitted for distances reaching tens of micrometers without significant losses.

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