Ordered lattices of plasmonic nanoparticles investigated by microellipsometry

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Planar lattices of plasmonic nanoparticles, especially on substrates with their own resonances, have many degrees of freedom and are, probably, the most tunable plasmonic structures, the optical properties of which depend on material and geometrical parameters of the nanoparticles, type and the period of the lattice, the substrate, and the strength of the interactions with substrate resonances [1,2]. Additionally, the orientation of the lattice relative to the direction of the exciting light affects the interparticle interactions and, correspondingly, the optical properties of the system. The latter is proved by the consideration of the symmetry and calculation of lattice sums.

It was demonstrated that ellipsometry is a suitable method for the investigation of plasmonic structures providing not only amplitude but also phase information [3,4]. Moreover, microellipsometry with a spatial resolution of a few micrometers is appropriate for the investigations of ordered lattices of plasmonic nanoparticles, which are usually restricted in size because of the preparation by electron-beam lithography. It allows not only the influence of the substrate, ordering of nanoparticles, geometrical parameters, or the lattice orientation on the optical properties to be demonstrated, but also the dispersion of different electromagnetic modes of the system to be restored and the interaction and splitting of these modes to be exhibited.

The details of the optical properties of ordered lattices of plasmonic nanoparticles on different substrates revealed by microellipsometry are discussed in this presentation.

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