SINGLE NANOHOLES WITH GOLD NANOPARTICLES A NOVEL TOOL IN NANOOPTICS

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Nanoholes, small optical apertures with diameters below the wavelength of light; represent interesting optical properties caused by diffraction at the surface and plasmon resonance of the surface conductive electrons. The optical behaviour of these nanoscale structures are usually discussed as a setting of nanoholes in an array[1] with small period between the holes. This leads to integral optical effects, which investigated for the use in nanooptics. Our goal of research is to observe the optical effects of single nanoholes in combination with metal nanoparticles.

Nanoholes and metal nanoparticles are known for their unique optical properties. Metal nanoparticles, especially gold nanoparticles, have a strong absorption and scattering in the visible range of light. Nanoholes in plasmonic materials instead are known for extraordinary transmission of light. The combination both nanostructures have interesting novel characteristics, like the enhanced transmission of light through nanoholes with gold nanoparticles in comparison to nanoholes without particle[2]. This enhancement not only appears in the optical near field, but also in the far field and therefore in can be detected by standard optical methods. Here we present our results obtained by different methods of investigation. The methods for this investigation are optical microscopy, optical spectroscopy and ultramicroscopic methods, like atomic force microscopy (AFM), near field scanning microscopy (SNOM). This all is use to understand the process of light enhancement by nanoparticles, which are located in the nanoholes. This method gives use different kind of information we use to build a physical model of the process.

The understanding of the process is necessary for the targeted application. In the future, combination such nanostructures can maybe using for the cost-effective and highly parallel detection of single molecule binding reactions in bioanalytics.

References:

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Figures:

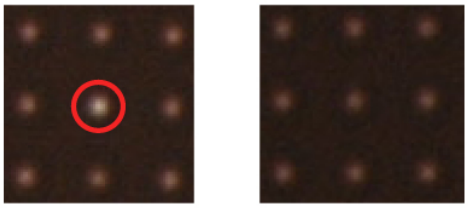

Fig. 1. : Transmission images of nanoholes. Left nanoholes filled with different values of nanoparticles, right holes without particles