Near and far-field optical characterization of Fischer projection patterns

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The scattering and absorption of light by small metallic particles (dimension $\sim \lambda$) is strongly related to the plasma collective behavior of free electrons, usually called plasmon, and has been investigated in theoretical and experimental terms [1] [2] [3] [4].

We have done several investigations to try to understand how the size, material and geometry of nanoparticles, produced by the method developed by U. Ch. Fischer [5], influence the scattering and absorption of light in the visible range.

In order to characterize the optical properties of those particles a combined Confocal / SNOM microscope was used. The light intensity measured by Confocal Microscopy was detected in three different modes: reflection, transmission and through a total-internal-reflection. The SNOM is based on a cantilever instead of tapered fiber. It allows a better control of tip-sample distance through a mechanism common to AFM. The SNOM measurements have been done in transmission mode.

Several different materials have used to produce Fischer projection patterns, of the same size and using the same type of substrate, in order to compare distinct behavior among metals.

The scattering dependency on particle orientation face incidence direction was carried out using the Confocal Microscope, to detect the scattered light through a total-internal-reflection (TIR). This allows a comparison between reflected and scattered light by TIR in same region and for different wavelengths and polarizations. Strong dependencies of scattered light by TIR on particle orientation have been found, as well as some dependencies on wavelength, material and polarization.

A SNOM characterization has also been done for several Fischer-patterns of different sizes and materials. A comparison with the results obtained by Confocal Microscopy for particles of larger size can therefore, be done between near and far-field.

Acknowledgments. We acknowledge the TMR-network NanoSNOM Contract Number ERBFMRXCT98-0242, and the Faculty of Sciences and Technology of the New University of Lisbon for financial support, WiTec GmbH for technical support and the Department of Solid State Physics for experimental facilities.

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