O 42: Methods: Scanning Probe Techniques III

Time: Wednesday 15:45–16:30 Location: H41

O 42.1 Wed 15:45 H41

Infrared Nanofocus Maps Sub-10 nm Particles — •Antonija Cvitkovic[1], Nenad Ocelic[1], Javier Aizpurua[2], Reinhard Guckenberger[1], and Rainer Hillenbrand[1] — [1]Max Planck Institute of Biochemistry, Am Klopferspitz 18, D-82152 Martinsried, Germany — [2]Donostia International Physics Center, Paseo Manuel Lardizabal 4, 20018 Donostia San Sebastian, Spain

Infrared spectroscopy is a powerful tool for material identification based on molecular vibrational fingerprints. However, due to extremely weak scattering cross sections at infrared wavelengths, far-field analysis of individual nanoparticles has not been possible so far.

We demonstrate nanoscale resolved infrared imaging of sub-10 nm gold particles by scattering-type scanning near-field microscopy (s-SNOM). Our s-SNOM is basically an AFM, with the metallized probing tip additionally illuminated by IR light (λ=10 μm). Due to an optical antenna-effect, light is concentrated at the apex of the tip forming a wavelength-independent nanoscale focus. In order to make a detection of sub-10 nm particles possible, we use highly reflecting or polariton resonant materials as sample carriers. That way a strong tip-substrate near-field interaction intensifies the nanofocus illuminating the particles, resulting in the enhanced optical contrasts [1].

Our results already promise a wide application potential in high resolution imaging of nanoscale objects (e.g. gold biolabeling). Combined with spectroscopic mapping, our method opens the door to label-free chemical identification of individual nanocrystals or biomolecules.

[1] A. Cvitkovic et al, Phys. Rev. Lett. 97, 060801 (2006)

O 42.2 Wed 16:00 H41

Plasmons in metallic bilayer wave guides — •Andreas Englisch, Stefan Griesing, and Uwe Hartmann — Institute of Experimental Physics, Saarland University, P.O. Box 15 11 50, D-66041 Saarbruecken

Plasmons constitute a strongly confined electromagnetic field. Plasmon-guiding metal stripes in a planar geometry exhibit a spatial extent of the electromagnetic field of the order of the decay lenght in the dielectric environment (several hundreds of nanometers) perpendicular to the metal surfaces. Cross coupling of different plasmon paths can thus not be avoided for smaller distances. A new geometry is introduced, which consists of two metal films separated by a dielectric layer. The theoretically predicted confinement is now limited by the decay length given for the metal films (50-100 nm). It is possible to construct junctions of arbitrary angles between the plasmon paths. The results of calculations of the field distribution and the power flow are presented as well as those of measurements by Scanning Near-Field Optical Microscopy. The potential of the given geometry to affect the propagation properties of the guided plasmons by a small change of the boundary conditions will be discussed.

O 42.3 Wed 16:15 H41

Elektrische Charakterisierung von Halbleiterstrukturen mittels Electrostatic Force Microscopy — •Markus Ratzke[1], Mario Birkholz[2], Joachim Bauer[2], Detlef Bolze[2] und Jürgen Reif[1] — [1]LS Experimentalphysik II, BTU Cottbus, IHP/BTU JointLab, Konrad-Wachsmann-Allee 1, D-03046 Cottbus — [2]IHP (Institut für innovative Mikroelektronik), lm Technologiepark 25, D-15236 Frankfurt (Oder)

Eine Möglichkeit, elektrische Parameter von Halbleiteroberflächen zu bestimmen, ist die Messung der elektrostatische Kraft zwischen dem leitfähig beschichteten Cantilevers eines Atomkraftmikroskops und der Probe. Verfahren wie Scanning Kelvin Probe Microscopy (SKM) und Scanning Capacitance Microscopy (SCM) erlauben dabei eine Abbildung von Potential- und Ladungsträgerverteilung mit Auflösung im Nanometerbereich.

Wir berichten über die Ergebnisse an n+p-Dotiergittern, die mittels CMOS-Technologie in die Oberfläche von Silizium-Wafern eingeschrieben wurden. Die erreichten Strukturbreiten lagen im Bereich zwischen 100 und 200 nm. Es wurden Potentialdifferenzen zwischen den unterschiedlichen Dotierbereichen von 100 mV ermittelt, was ca. der Hälfte des berechneten Wertes entspricht. Mittels numerischer Lösung der Drift-Diffusions-Gleichungen konnte gezeigt werden, dass der fehlende Potentialbetrag mit der Beleuchtung der Probe während der Messung zu erklären ist. Es ist festzustellen, dass die die genutzten Methoden trotzdem sehr gut geeignet sind, nanoskalige Halbleiterstrukturen in zukünftigen Technologieknoten zu charakterisieren.