

Scattering-type scanning near-field optical microscopy (s-SNOM) as a versatile tool for optical imaging and spectroscopy with nanoscale spatial resolution

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Near-field methods are a means of optical investigation without the spatial resolution limitations that are conventionally determined by the diffraction limit of light[1] which is a tremendous benefit for the investigations of nanostructures with radiation in the IR to THz region. This talk will show how we implemented the method in our neaSNOM microscope and give an overview of applications that were realized in different fields.

We implement nearfield imaging as an s-SNOM with broadband reflective optics that admit illumination light from the visible to THz. Our interferometric detection method allows us to detect both optical amplitude and phase at the same time and efficiently suppress background[2]. Applications range from the monochromatic chemical mapping of filler distributions in polymer composites[3] to the imaging of polariton modes[4]. Broadband sources can be employed for nano-FTIR spectroscopy, combining the chemical identification of soft matter nanoscale structures – e.g. the compositions of a human hair or polymer blends[5] – with a spatial resolution <20 nm. Other applications include the characterization of charge carrier densities in semiconductor devices[6].

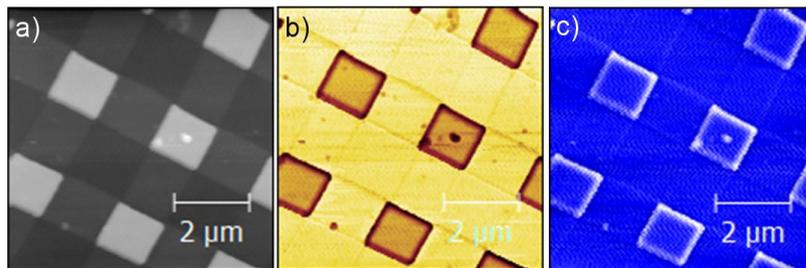


Fig. 1: a) AFM topography and b) near-field amplitude and c) phase measured at 8.5 K sample temperature. The images demonstrate the high stability of the setup.

Finally, this talk will introduce our latest breakthrough in the field of near-field optics: cryogenic near-field optical microscopy using our closed-cycle-cooled cryo-neaSNOM. With this new approach it is possible to investigate materials at temperatures <10 K which opens up exciting new opportunities to study low-energy surface processes (fig.1[7]).

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