Infrared nanoscopy of complex composite samples via scattering-type scanning near-field optical microscopy.

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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 which is a tremendous benefit for the investigations of nanostructures with radiation from the visible over the IR and to THz region. This talk will show how this AFM-based method can be used for correlation microscopy to combine optical imaging and spectroscopy with standard scanning probe modes to extensively characterize both inor-ganic and organic samples.

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. Interferometric methods allow background-free monochromatic optical mapping as well as broadband nano-FTIR spectroscopy, both at AFM resolution.

The broad-band optics make it possible to perform optical correlation at different wavelengths and the AFM platform enables the correlation of these optical images with other data channels, such as AFM topography, as well as more specialized AFM modes, such as Kelvin probe force microscopy.

The method has been successfully used to characterize the chemical composition and dielectric properties of a broad range of materials, including soft matter samples, such as polymers and dry biomaterials, but also a wide range of inorganic materials and material systems. This includes the investigation of the nanoscale composition of different mineral samples, as well as the identifiction of organic materials on rock samples.

This talk will introduce the working principle and implementation of the method and show examples of nanoscale analysis of different complex material systems, such as, for example, grains of cometary dust.