nano-FTIR and correlation nanoscopy for organic and inorganic material analysis

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Scattering-type Scanning Near-field Optical Microscopy (s-SNOM) is a scanning probe approach to optical microscopy and spectroscopy that achieves a spatial resolution below 20nm. s-SNOM exploits the strong confinement of light at the apex of a sharp metallic AFM tip to create a nanoscale optical hot-spot. Analysing the scattered light from the tip enables the extraction of the optical properties (dielectric function) of the sample directly below the tip, yielding nanoscale resolved optical images simultaneous to topography or local spectroscopic information about a specimens reflectivity and absorption in the infrared regime [1,2]. This allows direct material identification on the 10nm length scale.

In latest s-SNOM applications, the combined analysis of complex nanoscale material systems by correlating near-field IR spectra with information obtained in a wider spectral range (VIS to THz frequencies) has gained significant interest. For example, the material-characteristic nano-FTIR spectra measured for nanoscale Acetaminophen (Paracetamol) particles can be directly compared with nanoscale resolved tip-enhanced Raman spectra (TERS) obtained on the very same sample location [3]. Further, correlative measurements of the near-field optical response of semiconducting samples like Graphene (2D) or functional SRAM devices (3D) and Kelvin Probe Force Microscopy (KPFM) measurements reveal complementary quantitative information about the local conductivity in engineered nanostructures.

Consequently, s-SNOM systems have the potential to characterize complex material systems by different near-field and AFM-based methods at the nanoscale for a wide field of different applications, ranging from doped semiconductors, plasmonic wave-guides, 2D materials, metamaterials and polymeric and biological samples.

Recently, s-SNOM imaging and spectros-copy have been realized also at cryogenic temperatures [4].

References

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Figure

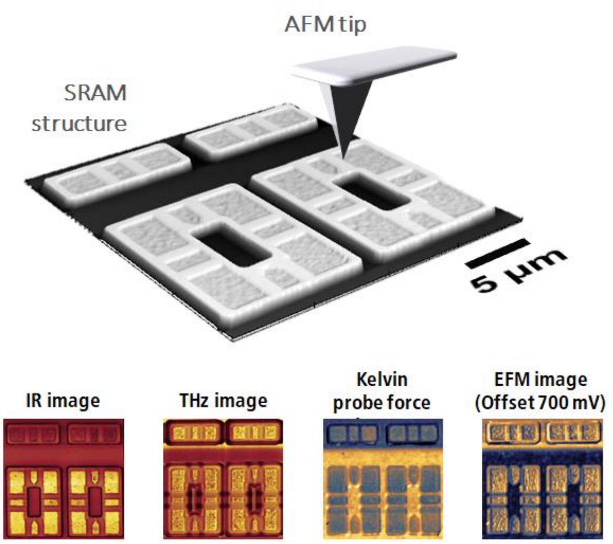

Figure: Correlation nanoscopy on SRAM sample, with optical IR and THz response as well as KPFM and EFM image.