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attocube systems AG | Business Sector Nanoscale Analytics | Product Line neaspec
Eglfinger Weg 2 | 85540 Haar | Germany | Tel.: +49 89 420 797 - 0
info@attocube.com

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IR-neaSCOPE

nano-IR absorbtion imaging & spectroscopy

NANOSCALE ANALYTICS
advanced imaging & spectroscopy

Redefining AFM-IR Technology

innovative nanoscale infrared analysis

IR-neaSCOPE is designed for nanoscale analysis that only requires measurements of IR absorption. It detects laser-induced photothermal expansion in the sample using mechanical AFM-IR detection. Requiring no IR detector and interferometry, *IR*-neaSCOPE provides a cost-efficient solution most suitable for samples with large thermal expansion coefficients (e.g. polymers, biomaterials, etc.). *IR*-neaSCOPE delivers IR absorption imaging, point-spectroscopy and hyperspectral imaging. It is fully upgradeable to *IR*-neaSCOPE^{+s} for advanced capabilities and access to a larger variety of sample material classes.

Infrared analysis with AFM resolution

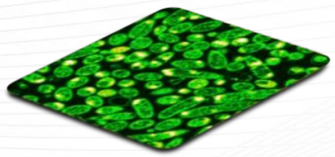
IR-neaSCOPE

- artefact-free absorption measurement
  → by decoupling efficiently optical from mechanical sample properties
- maximum performance without sample damage
  → by accurate focusing of all illumination power onto the tip
- high-quality results independent of user expertise
  → using intuitive software with a guided user interface

Highlighted Use-Cases

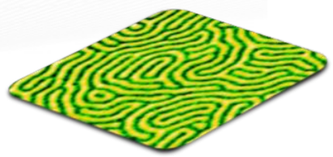
polymer and biology research

neaSCOPE users unravel the complexities of polymers and biological materials at the nanoscale, expanding our knowledge and inspiring innovations that promise to revolutionize key research fields and transform crucial industries.



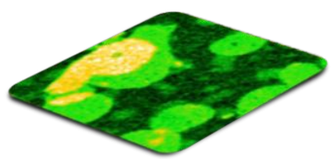
Bacteria

Investigate inclusion bodies in bacteria using label-free identification of proteins, lipids, and DNA.



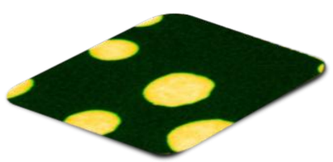
Block Co-Polymers

Engineer strong & flexible materials with unique properties for applications in automotive, electronics, and packaging.



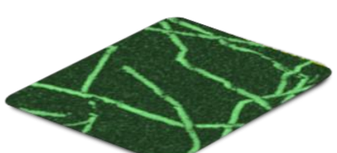
Protein Monolayer

Analyze the secondary structure of protein monolayers to boost advancements in biomaterials engineering for degenerative brain diseases.



Polymer Heterostructures

Develop novel materials for organic photovoltaics, light-emitting diodes, field-effect transistors, and gas separation.



Nano-Cellulose

Study individual nanocellulose particles to advance the creation of biocompatible materials and biosensors or engineer advanced polymer nanocomposites.

Tapping AFM-IR+

technology for nanoscale IR analysis

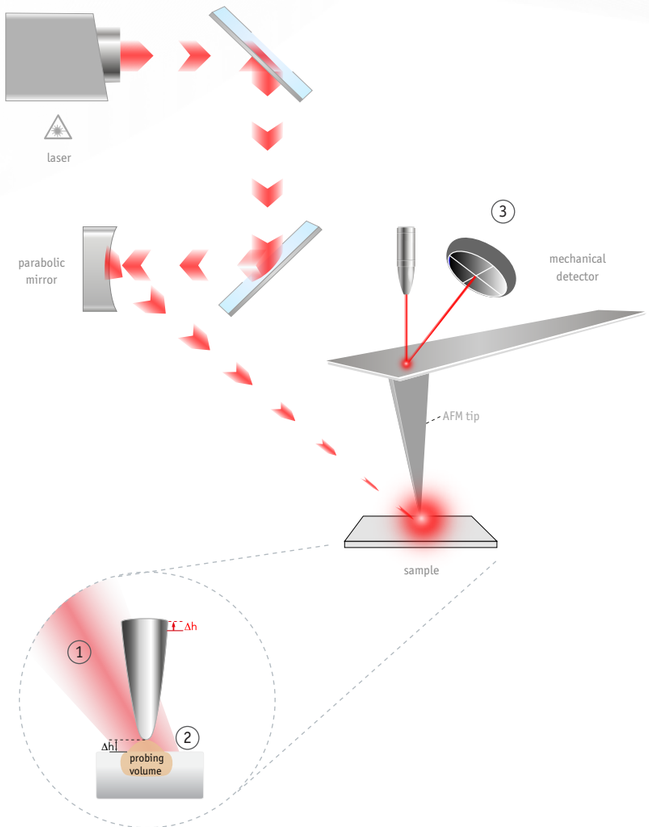
AFM-IR (Atomic Force Microscopy InfraRed) is a family of techniques based on detecting mechanical response of the AFM cantilever upon pulsed illumination of sample with IR light. AFM-IR family includes tapping and contact AFM-IR, primarily utilized for sample absorption mapping and spectroscopy of materials with relatively large absorption coefficient (polymers, biomaterials, etc.).

Challenge

All AFM-IR techniques require reliable suppression of mechanical crosstalk resulting from intrinsic coupling between IR response and tip/sample mechanics due to AFM detection of both signals.

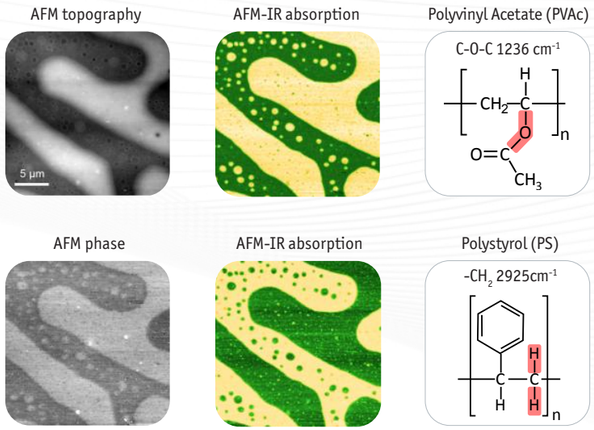
Solution

attocube tapping AFM-IR+ utilizes unique active bimodal operation for reliable suppression of artificial contrast due to mechanical talk, enhancing surface sensitivity & lateral resolution.



Basic Probing Principle

1. focus pulsed IR laser light onto sample
2. illuminated sample absorbs IR radiation and thermally expands, exerting force on the AFM tip and stimulating cantilever motion
3. cantilever motion is detected using advanced AFM technology, delivering thermal expansion maps and spectra for spectroscopic IR analysis

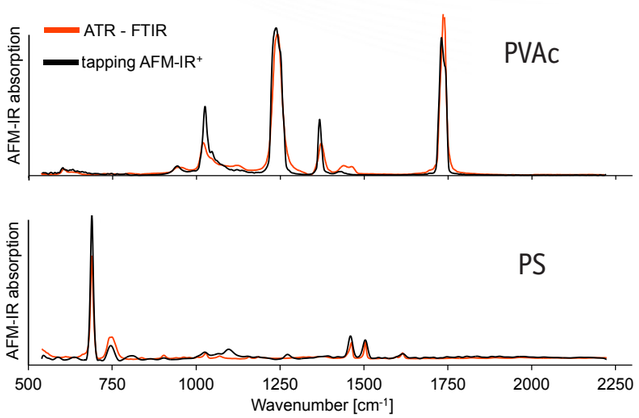


Nanoscale mapping with chemical sensitivity

Tapping AFM-IR imaging enables mapping of chemical components by tuning a mid-IR laser to material-specific vibrational resonances.

Chemical ID at the Nanoscale

Tapping AFM-IR spectroscopy provides nanoscale chemical identification by sweeping a tunable IR laser and comparing resulting photothermal absorption spectra with conventional IR references.



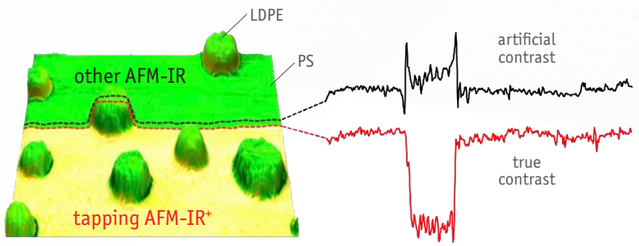
Market-Leading Performance

by superior AFM-IR technology

True IR Absorption Measurement

without artificial mechanical contrast

IR-neaSCOPE enables reliable tracking of AFM cantilever resonance to clearly separate infrared signal from the mechanical tip-sample interaction, offering accurate true chemical contrast between different materials, essential for cutting-edge research & industrial applications.

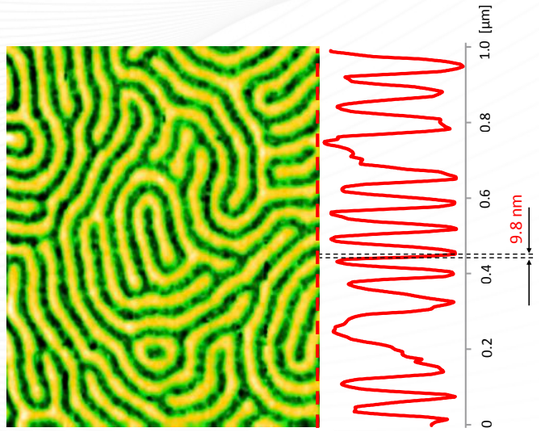


AFM-IR image of phase separated PS-LDPE polymer film

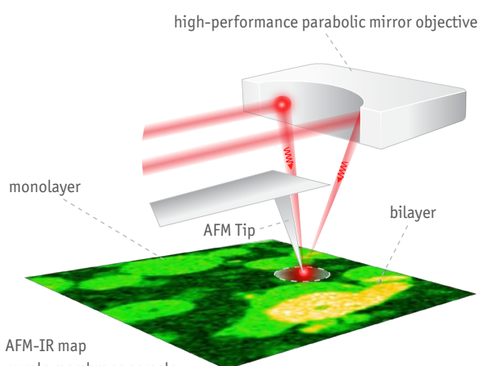
High Resolution Chemical Imaging

limited only by the AFM-tip size

neaSCOPE routinely provides resolutions below 10 nm and sensitivity down to a single monolayer. This level of resolution brings chemical analysis of materials to an unparalleled degree of detail, thereby advancing scientific understanding and technological development in a wide range of nano-IR applications.



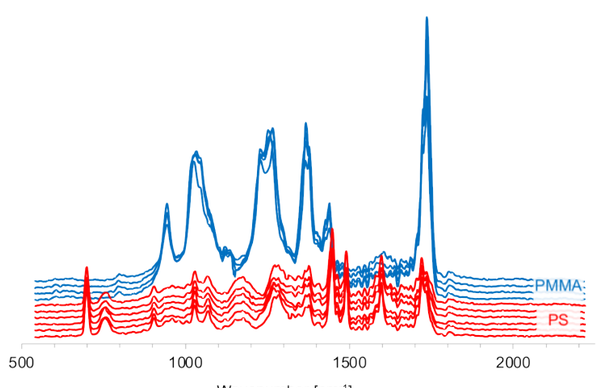
AFM-IR image of PS-PMMA block copolymer



Maximum Performance without Sample Damage

by accurately focusing all illumination power onto the tip

The *IR*-neaSCOPE high-performance dual-sided objective delivers precise beam focusing and high-quality measurements even at low illumination power levels. This feature is crucial for minimizing sample damage and tip contamination in sensitive nano-IR applications, as showcased in this protein monolayer example.



Fast & Broad Spectra with Unmatched Quality

by AFM purposely designed for high-precision measurements

IR-neaSCOPE delivers complete mid-IR absorption fingerprints spectra at the nanoscale with unprecedented speed and quality, measuring >1600 cm^{-1} in less than 4 seconds.

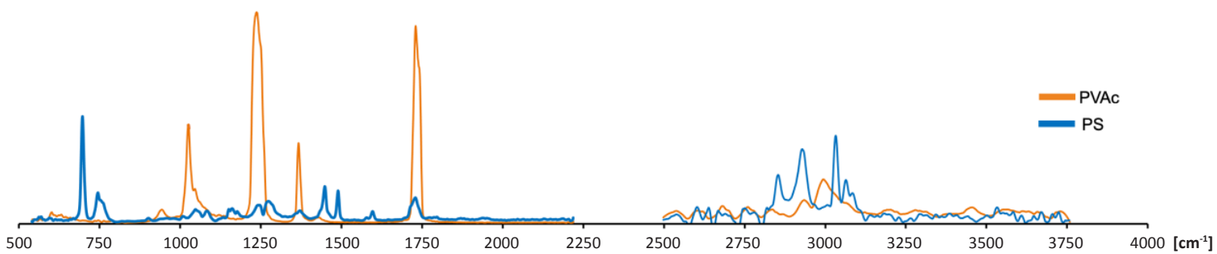
Outstanding Results with Minimum Effort

pioneering hardware and intuitive software

Unmatched AFM-IR Spectral Coverage

by integrated advanced ultrabroad tunable lasers

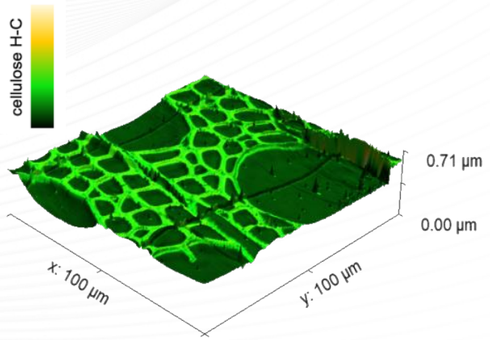
neaSCOPE can be equipped with a fully integrated widely tunable mid-IR OPO that provides a nearly continuous coverage in the entire spectral range of ca. 1.4 µm – 18 µm unmatched by any other single laser source used in nano-IR.



Large Scan Size within Minutes

using best-in-class sample positioners

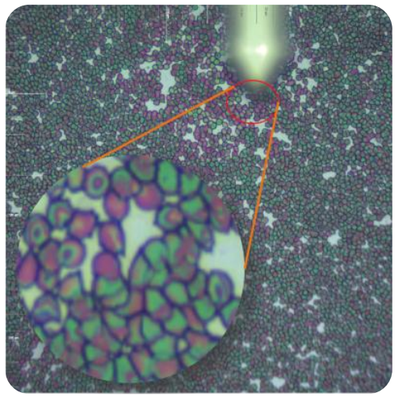
neaSCOPE AFM sample scanner effortlessly images areas up to 100x100 µm² while automatically adapting the scan speed depending on the sample topography, thus increasing the AFM tip lifetime.



High-Quality Results independent of User Expertise

using intuitive software with guided user interface

neaSCOPE revolutionizes microscopy with an intuitive software interface designed for efficient, goal-oriented operation. Paired with state-of-the-art automated hardware, the neaSCOPE microscope empowers even new users to conduct complex tasks with ease.



Optical microscope image of red blood cells

Simplified ROI Targeting

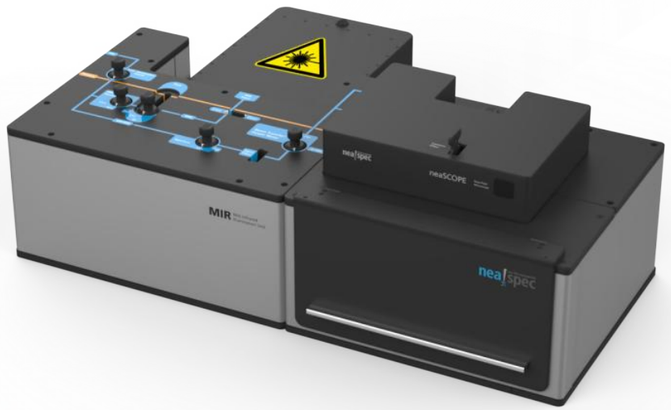
enabled by a high-res inspection optical microscope

neaSCOPE features an integrated widefield optical microscope with diffraction-limited optical resolution of ca. 750 nm and 0.8 mm field of view, facilitating detailed sample inspection and straight forward identification of regions of interest.

IR-neaSCOPE with Flexible Product Configuration

enabled by the modular design

neaSCOPE's modular design guarantees a tailored approach for your applications and accommodates future needs. Select the laser (coupled by MIR optics module) suitable for your specific requirements and add upgrades for more focused results. Consider the s-SNOM upgrade to enhance versatility, ensuring compatibility with all material types.



QCL Configuration

Flexible choice of spectral coverage in the mid-IR fingerprint range depending on the application needs.

QCL 1x Chip
1360 - 1800 cm^{-1}

QCL 4x Chip
e.g. 800 - 1800 cm^{-1}

wOPO Configuration

Provides extensive coverage of the mid-IR spectral range and beyond: Ideal for analysis of organic and inorganic materials.

wOPO
570 - 7140 cm^{-1}

Product Upgrades

Position Sensors
autofocus with 50 nm precision

High NA
faster imaging & improved quality

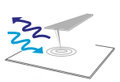
Z-Range Scanner
for samples with high topographic profile ≤ 8 µm

AFM Bundle
relevant AFM modes for all-around sample characterization

SDK
custom mode development and source integration

Technology Upgrade

By adding near-field hardware and software modules (NIM, RDM, and PsHet), the system can be upgraded to s-SNOM mode.



s-SNOM
Suitable for all materials classes incl. organic, inorganic, 2D, semiconductors, etc.