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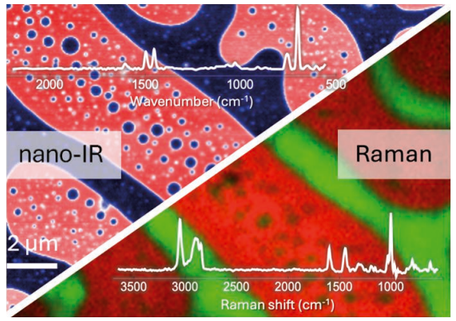
IRa-SCOPE

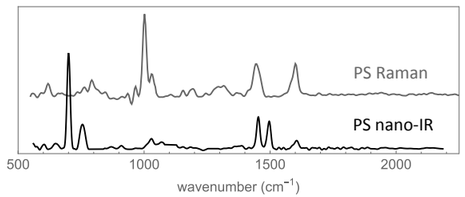
multidimensional vibrational analysis at micro- & nano-scales

NANOSCALE ANALYTICS
advanced imaging & spectroscopy

Correlative Raman & nano-IR spectroscopy

seamless integration of measurement modes enables comprehensive nano-analysis





Micron-Sized MOF Crystallites

Drop casting Metal Organic Framework particles (MOF F@ZIF-L) filled with fluorophores result in isolated crystallites with ca. < 3 µm size distribution on a Si surface.

Hyperspectral Raman mapping reveals MOF specific Raman bands (e.g. 1460 cm^{-1}) that depict a homogeneous crystalline structure. Interestingly, Raman spectroscopic signatures matching Fluorescein (e.g. 1414 and 1570 cm^{-1}) confirm that fluorophores are concentrated at crystallite edges.

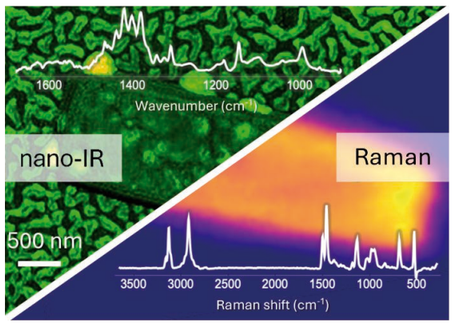
IRa-SCOPE nano-IR spectroscopy of the very same crystallite shows the characteristic signature of MOF F@ZIF-L, in excellent agreement with its FTIR references. However, imaging at 1258 cm^{-1} with 10 nm spatial resolution reveals that that the sample is covered by small lamellae, which show spectroscopic signature of PVAc-PVA copolymer – an otherwise unrecognized contaminant.

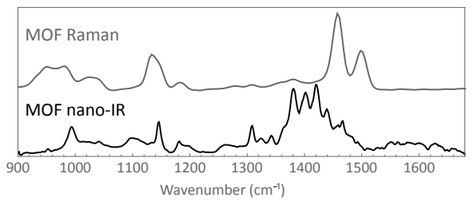
Heterogeneous Polymer Blend

A ca. 50-70 nm thin PS-LDPE polymer film on Si substrate shows clear phase separation of materials.

IRa-SCOPE equipped with confocal Raman reveales characteristic spectral signatures of the PS and LDPE polymers enabling their chemical identification as well as visualizing their distribution with a spatial resolution of ca. 300 nm.

Changing the instrument mode to nano-FTIR allows for rapid imaging of exactly the same sample region at specific vibrational modes. E.g. imaging at 700 cm^{-1} absorption line of Polystyrene with sub-10 nm spatial resolution revealed sharp material interfaces and even smaller LDPE islands that are not visible in the Raman map. Further, measuring sample nano-FTIR spectra enables nanoscale chemical identification and, combined with Raman, significantly improves accuracy of chemical identification.

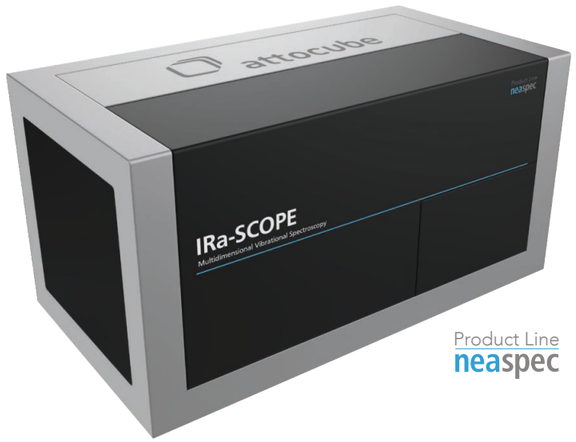




IRa-SCOPE

three powerful spectroscopic imaging modes in one instrument

IRa-SCOPE enables comprehensive spectroscopic material analysis and chemical identification with micro- to nanometer resolution by seamlessly merging modern Laser-Direct Infrared (LDIR) reflection absorption spectroscopy, state-of-the-art confocal Raman micro-spectroscopy, and high-sensitivity nano-IR technologies such as nano-FTIR and AFM-IR imaging & spectroscopy.



Product Line
neaspec

New Era in Vibrational Analysis at Multiple Length Scales

Multidimensional Vibrational Spectroscopy

Integrates µ-IR, nano-IR and Raman with top-quality AFM for multi-scale surface characterization in one instrument.

Correlative nano-IR Capabilities

Combines nano-FTIR and AFM-IR imaging & spectroscopy for best performance on all sample types.

Reliability & Ease of Use

Sample-centric workflow and intelligent instrument automation for maximum focus on sample analysis.

Designed for Applied Research

Routine all-around spectroscopic material analysis and chemical nano-identification with minimal user effort.

IRa-SCOPE

technical specifications

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General Specifications	
integrated correlative modes	high performance nano-IR, confocal Raman, micro-IR, AFM
optical inspection	integrated dual objective (20x & 100x)
infrared optics	patented high-NA dual-sided® parabolic mirror (NA=0.5)
system operation	automated measurement mode switching, instrument setup, and sample ID recognition
nano-IR Spectroscopy	
nano-FTIR	reflectivity and absorption nano-spectroscopy & chemical mapping based on patented interferometric near-field detection
tapping AFM-IR	absorption nano-spectroscopy and chemical imaging based on patented heterodyne AFM signal detection
tunable QCL (nano-FTIR & AFM-IR)	coverage of mid-IR fingerprint 950 – 1725cm^{-1} (ca. 5.8 - 10.5 µm)
widely-tunable OPO (nano-FTIR & AFM-IR)	coverage of mid-IR fingerprint & functional groups 625 - 7140 cm^{-1} (ca. 1.4-16 µm)
tunable QCL (AFM-IR only)	coverage of mid-IR fingerprint (760 - 1860 cm^{-1}) and CH-region (2700 - 3000 cm^{-1}) or silent region (2000 - 2400 cm^{-1})
Confocal Raman Micro-Spectroscopy	
objective	LWD 100x objective for confocal Raman micro-spectroscopy
VIS laser for Raman	up to 2 lasers (532 nm, 785 nm)
CCD + spectrograph	back illuminated CCD (1024x255 px, 26x26 µm pixel size), 328 mm focal length, F/4.1 aperture, fiber-coupled, on-axis quad grating turret incl. 4 gratings
IR Micro-Spectroscopy	
mode of operation	Laser Direct Infrared (LDIR) spectroscopic imaging in transflection geometry
AFM Microscope	
available AFM modes	AFM, PFM, KPFM, cAFM, TipForce (nano-mechanical property mapping)
closed loop scanner	high stability 100 µm x 100 µm x 8 µm, typ. AFM RMS z-noise < 80 pm
Add-ons & Accessories	
AFM probes	contamination-free nano-IR probes for accurate spectroscopic chemical identification
environmental control	housing purging, sample temperature control
microfluidic liquid cell	in-*situ* nano-FTIR analysis in liquid environment

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