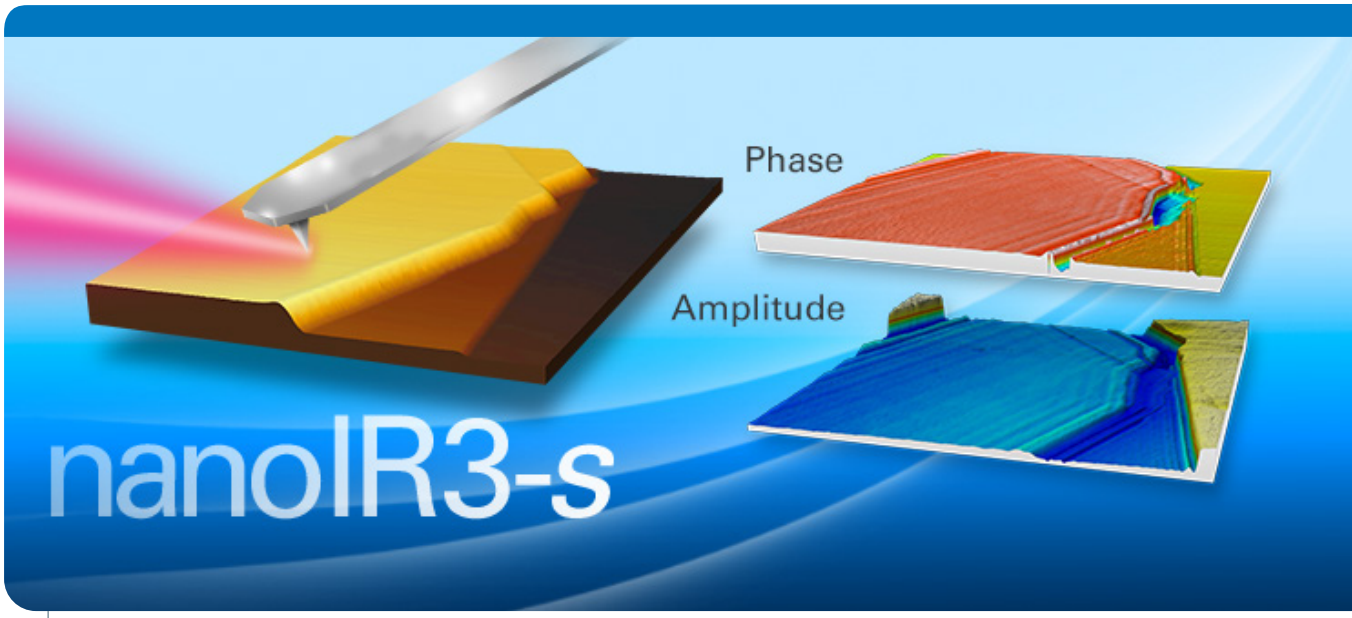


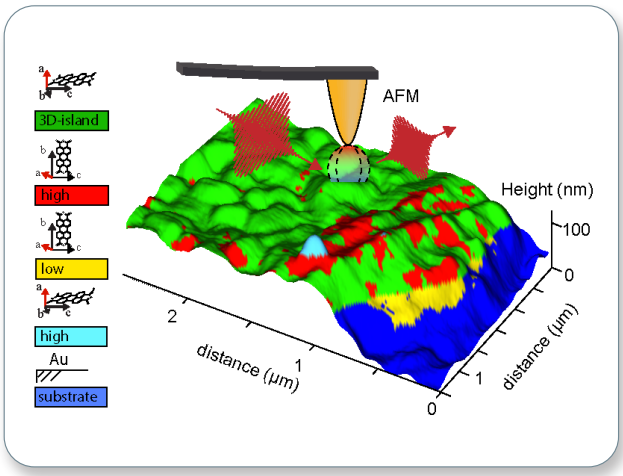

# nanoIR3-s Nano-FTIR Spectroscopy

- Highest Performance s-SNOM and AFM Imaging

The nanoIR3-s system combines scattering scanning near-field optical microscopy (s-SNOM) and nanoscale IR spectroscopy (AFM-IR) with an integrated atomic force microscope (AFM), all in a single platform. Building upon the legacy of Anasys technology leadership in AFM-based nano-optical characterization, nanoIR3-s provides nanoscale IR spectroscopy, chemical imaging, and optical property mapping with 10-nanometer spatial resolution demonstrated on 2D material samples. The system also enables AFM topographic imaging and material property mapping with nanometer-scale resolution, making it an ideal instrument for correlative studies across a wide range of material science applications.

### The nanoIR3-s System Features:

- Femtosecond broadband nano-FTIR spectroscopy
- Complementary s-SNOM, and AFM-IR techniques
- Fully featured, high-resolution AFM with electrical, mechanical, and thermal modes




Correlative analysis of spatial map reconstructed from separate correlated AFM and chemical measurements reveal molecular orientation of vacuum-deposited PTCDA defects.
*Science Advances*, 2 (10), e1601006 - E. A. Muller, et al.

## Complementary Nanoscale Techniques

### s-SNOM

Using patented techniques for s-SNOM, the near-field amplitude and phase of the scattered light is measured. This can be done while the probe is scanning across the sample surface to create near-field optical images simultaneous with the topography image, or the probe can be positioned at a fixed location and the wavelength of the source changed to provide near-field spectra. POINTspectra is a patented capability that provides both spectroscopy and chemical imaging for CW QCL Laser operation.

### Tapping AFM-IR

Tapping AFM-IR uses the same photothermal detection mechanism as resonance-enhanced AFM-IR, but uses tapping AFM mode operation as the sensing mechanism. A specially designed Tapping AFM-IR probe is driven at different harmonic modes/resonances in tapping mode, sensing photothermal expansion using different harmonic modes. Tapping AFM-IR provides lower AFM probes forces on the sample and is able to achieve higher spatial resolution chemical imaging to 10 nanometers or below, depending upon the sample type.

### Resonance-Enhanced AFM-IR

The resonance-enhanced AFM-IR component of the instrument functions by illuminating the sample (top down) with a broadband, pulsed, tunable mid-IR laser. The pulsed radiation is selectively absorbed by the sample, causing rapid and transient local expansion, which is detected by the resulting mechanical deflection of the AFM probe. The resulting IR absorbance spectra can be directly related to FT-IR absorbance spectra, allowing for straightforward interpretation, and are searchable against existing IR spectral database libraries.

### Mechanical Property Mapping, Nanothermal Analysis and Electrical AFM Modes

In addition to nanoscale IR spectroscopy, nanoIR3-s has the capability to measure contact resonance frequencies of an AFM cantilever using the Lorentz Contact Resonance technique (LCR) to map variations in a sample's mechanical properties. Additionally, there is the option to image local thermal properties via the nanoTA technique for quantitative measurements of thermal transition temperatures at nanoscale spatial resolution.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## Modes

| | |
|---|---|
| Chemical Imaging Modes | Tapping AFM-IR; FASTspectra (AFM-IR); FASTmapping (AFM-IR); Hyperspectral Imaging; s-SNOM |
| AFM Modes | **Standard**: tapping; contact phase; force calibration; lateral force; EFM/MFM<br>**Optional**: NanoTA; SThM; LCR; C-AFM; KPFM |

## Key Laser Options

| | |
|---|---|
| POINTspectra QCL Laser | 6 or 4 chip continuous wave/pulsed with 950-1900 $cm^{-1}$ range for s-SNOM and AFM-IR, additional wavelengths available upon request |
| Single/Multiple Chip QCL Laser | Single or multi-chip continuous wave/pulsed with different spectral ranges for s-SNOM |
| CO2 Laser | For use with s-SNOM |
| Visible 632.8 nm HeNe Laser | 10 mw and optics package for integration into nanoIR3-s |
| 1550 nm NIR Diode Laser | 5 mw and optics package for integration into nanoIR3-s |

## AFM Performance

| | |
|---|---|
| Z Noise | <130 pm RMS |
| XY Scan Range | 50 µm x 50 µm |
| Z Scan Range | >4 µm |
| Scan Resolution | ≤1024 x 1024 pixels |
| XY Scan Stage | Flexure with capacitive closed-loop sensing |
| Tip Positioning Accuracy | ±10 nm |

## Sample Size and Movement

| | |
|---|---|
| Sample Size | <25 mm dia max |
| Sample height | <10 mm max |
| XY Stage Range | 8 x 8 mm motorized |
| Z stage Range | >5 mm motorized |

## Optical Microscopes

| | |
|---|---|
| Illumination | Brightfield |
| CCD Resolution | 1.5 µm 5 MP |
| Digital Zoom | 3X |
| Objective | 10X |
| Field of View | ~900 x 600 µm max;<br>~450 x 300 µm min |