

# Nano-Spectroscopy Solutions

AFM-Raman, TERS, NSOM  
Chemical imaging at the nanoscale



# Raman-AFM and TERS Made Easy!

Since its introduction in the early 80's, Scanning Probe Microscopy (SPM) has quickly made nanoscale imaging an affordable reality. The technique provides a continuously growing variety of surface analysis methods for the physical characterization of materials, yet label-free chemical sensitivity is still challenging.

On the other hand, optical spectroscopy has provided a unique way to determine the structure and chemical composition of molecules for decades and is a method of choice for the analysis of nano-materials despite its diffraction-limited spatial resolution.

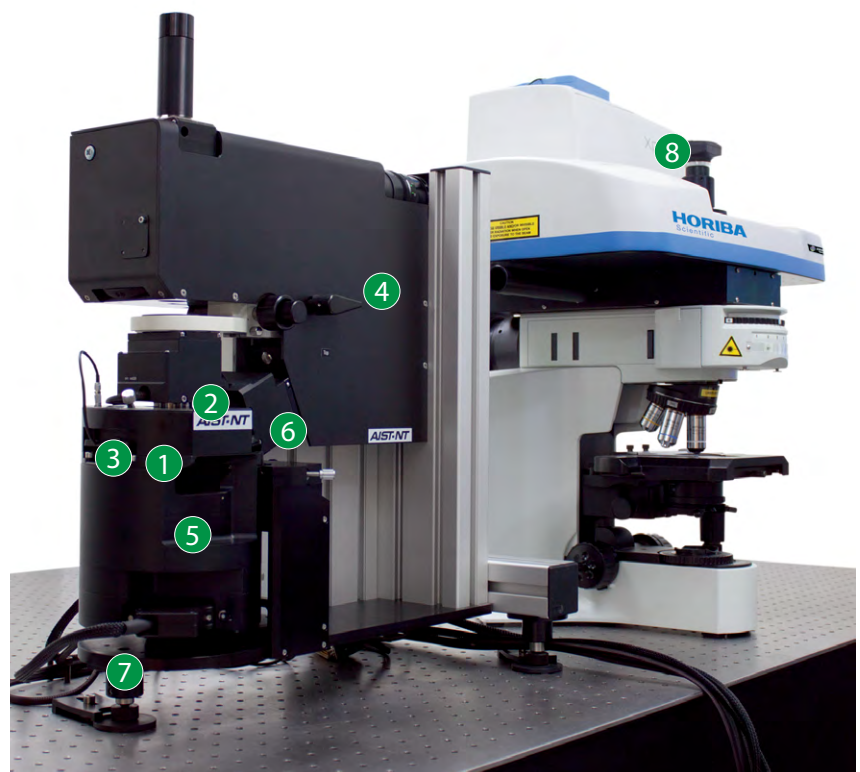
The two techniques together make up an attractive and unique tool, yet integrating such different instrumentation is challenging. Today, with over a decade of experience in this exciting field, we have refined the technique to its utmost with uncompromised performance in mind to bring you a tool that is not only extremely powerful and versatile, but is also so easy to use, fast and reliable that generating outstanding data is rendered effortless.

## Reliable Results

- Fully automated cantilever alignment insuring reproducible optimization of the AFM parameters from one tip to the next and from one user to another. (1) (5)
- Reliable repositioning of the probe on the sample within seconds. (1) (8)
- Drift compensated sample scanner with high resonance frequency brings reproducible images over long periods of time thanks to low vibration sensitivity. (5)
- Raman laser alignment by piezo driven closed-loop objective scanner: shortest distance to the focus point for minimum drift. (6)
- Visual confirmation of the Raman laser alignment with independent video imaging, SPM detection and Raman mapping. (8)

## Versatile

- Numerous SPM modes including AFM, STM, tuning fork, NSOM.
- Full range of Raman excitation lasers including red and NIR without interferences thanks to a 1300 nm AFM feedback diode. (1)
- Up to 3 spectroscopic detectors and 20 SPM channels.
- High resolution sample scanner from nanometers to full scan range. (5)
- Top down and oblique Raman detection for optimum resolution and throughput in both co-localized and Tip-Enhanced measurement modes. (2)
- Full control through one workstation, yet SPM and spectrometer can be operated independently.





1300 nm AFM laser feedback

## Powerful

- High numerical aperture objectives from both top and side for best co-localized spatial resolution and best TERS collection efficiency.
- High-throughput optics and spectrometer.
- High spectral resolution with the LabRAM HR spectrograph.
- Broad range of detection wavelengths, from deep UV to Infrared.
- Simultaneous SPM and spectroscopic measurements.
- Powerful processing software suite for both SPM and spectroscopic data, including Multivariate Analysis and spectral database lookup.



High efficiency top down and side coupling



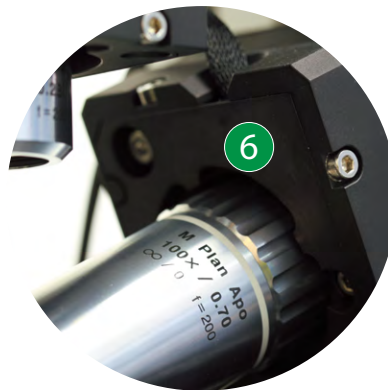
Compact holder for easy probe exchange



Dual optical scheme, easy switching



High resonance scanner, auto tip-alignment and tuning



Closed-loop, short path-length Raman laser alignment for long-term stability



High performance without active vibration isolation



Visual confirmation of Raman laser alignment in all modes

## Simple and Fast

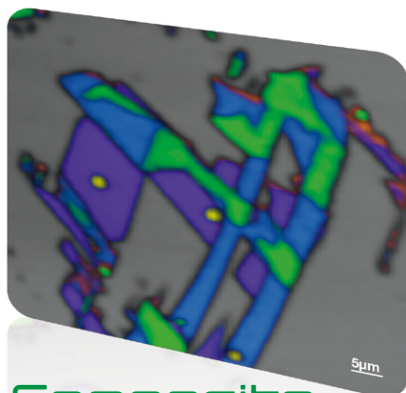
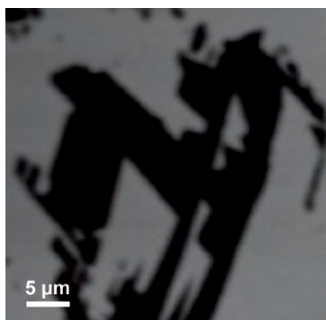
- One-click cantilever alignment, frequency tuning and optimization, requiring no manual adjustments.
- Easy cantilever exchange without affecting the sample.
- Fast and intuitive Raman laser to AFM tip alignment.
- Ultra-fast simultaneous SPM and Raman measurements.

# The Ultimate Tool for Physical and Chemical Characterization

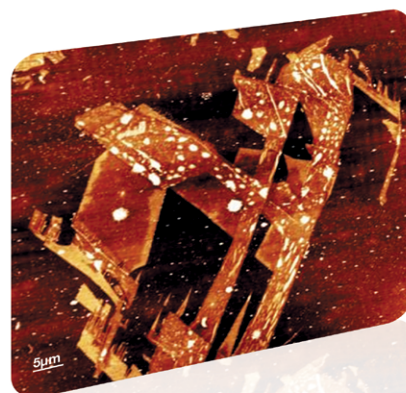
## Raman-AFM

Full range of SPM modes and simultaneous spectroscopy

Raman Silicon

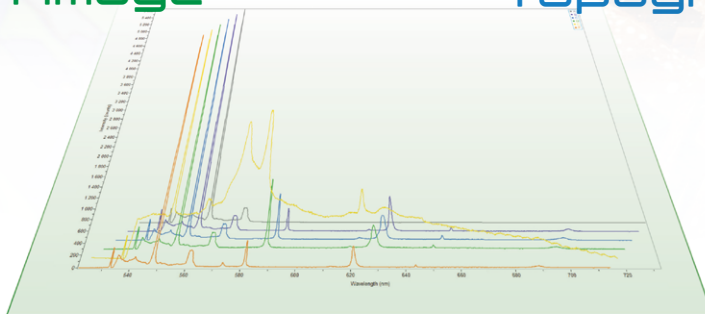
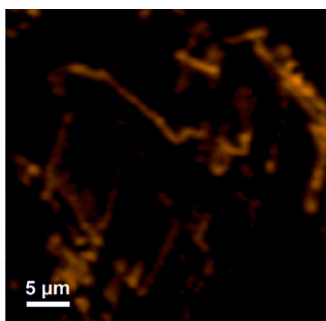


Composite  
Raman image



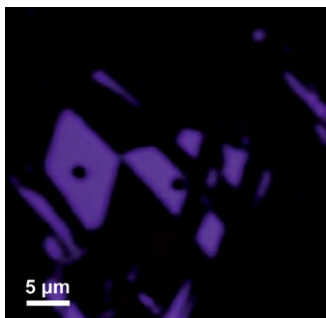
AFM  
Topography

Raman Graphene  
with Defects

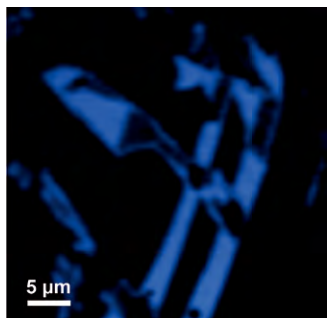


Graphene CLS Spectra

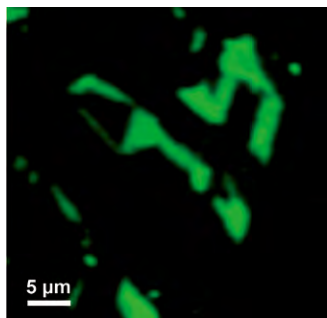
Raman Single  
Layer Graphene



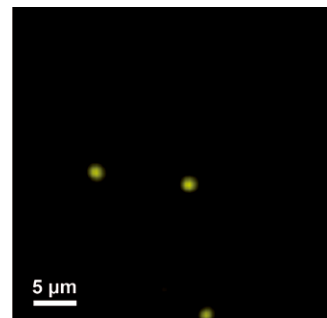
Raman 2-layer  
Graphene



Raman 3-layer  
Graphene



Raman Amorphous  
Carbon

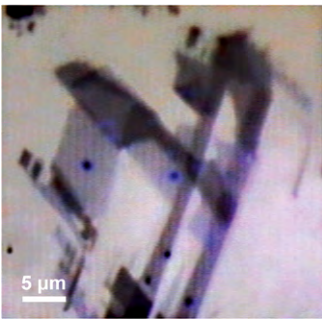


## Full range of SPM modes and simultaneous spectroscopy

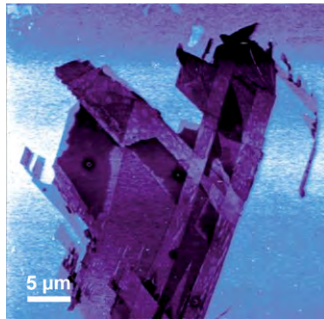
## Main Applications

- Biological structures
- Graphene
- Carbon nanotubes
- Nanowires
- Polymers
- SERS substrates
- Semiconductors

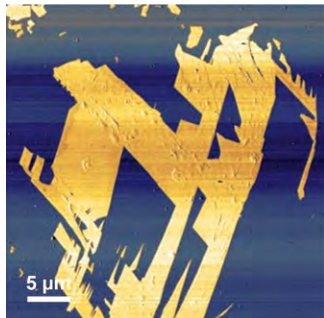
AFM Optical  
Image 100 %



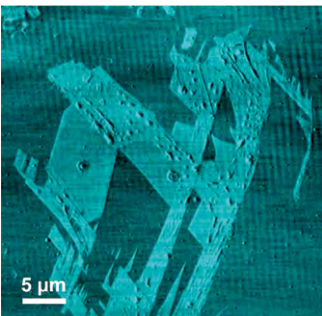
AFM Contact Potential  
Difference



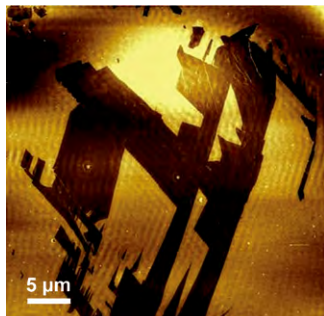
AFM Capacitance



AFM Phase



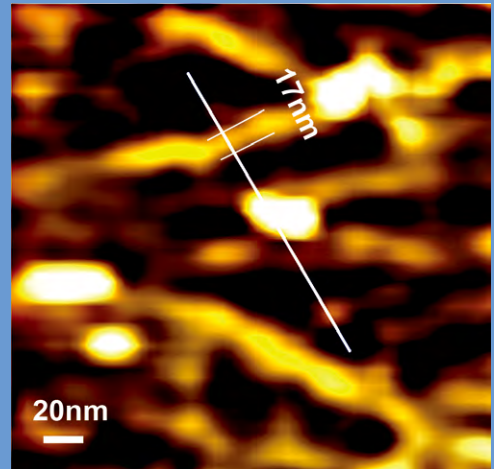
AFM Friction



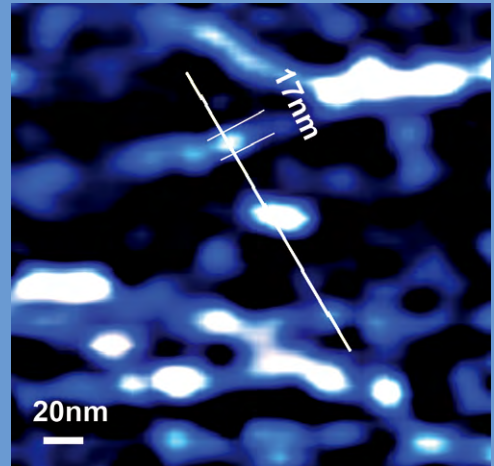
## TERS

Label-free chemical  
characterization with  
nanoscale resolution

SWCNT STM Image

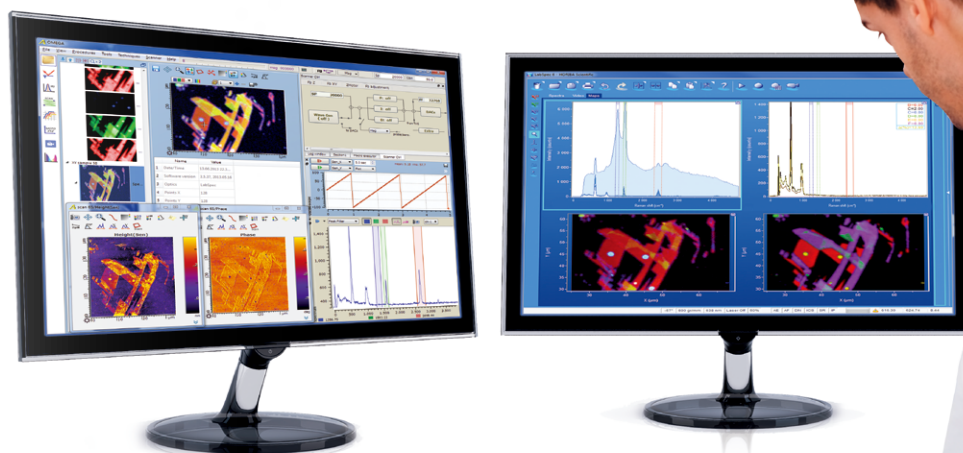


SWCNT TERS Image G Band

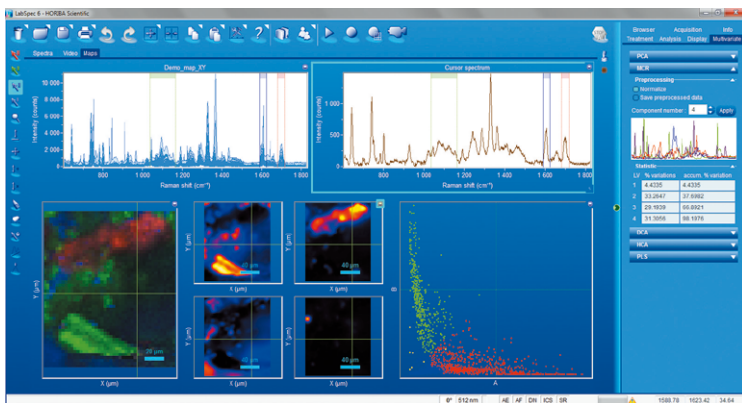


# Integrated Software

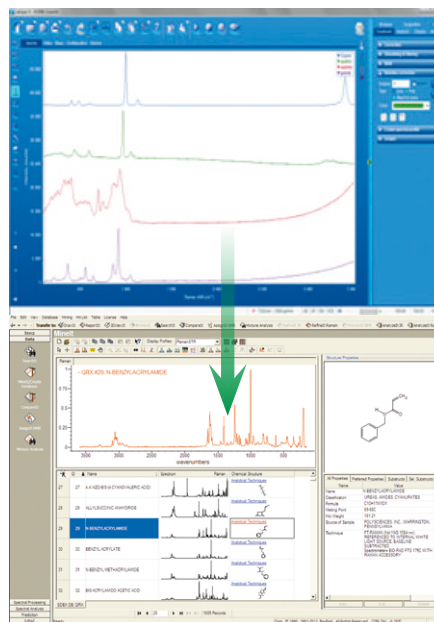
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$\lambda = (325 \text{ nm} - 1064 \text{ nm}) P \leq 500 \text{ mW}$   
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\* Laser safety classifications depend on individual systems and options



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