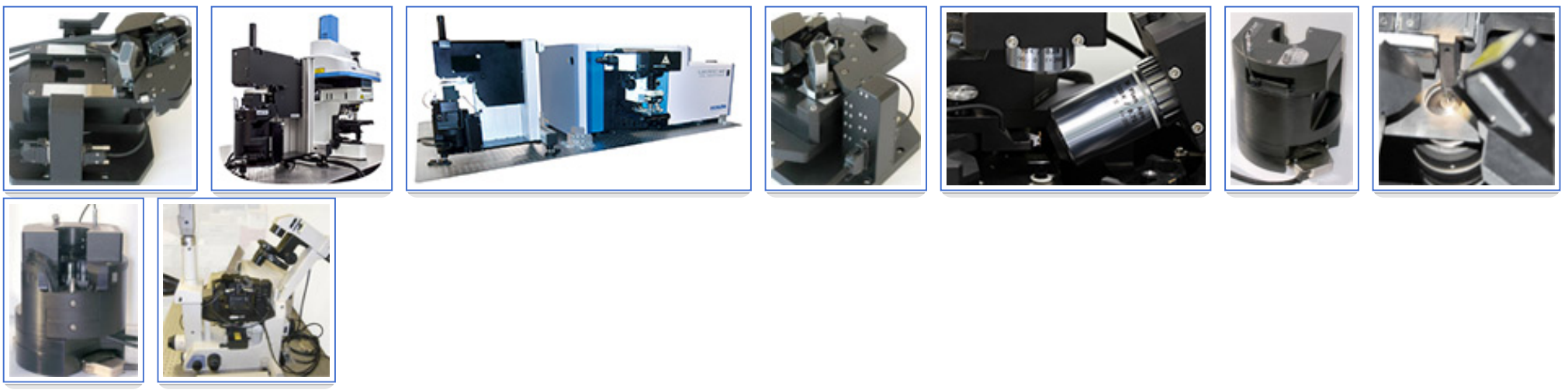
AIST-NT
Advanced Integrated Scanning Tools for Nano Technology

OmegaScope™ 1000



The OmegaScope 1000 is a state-of-the-art turn-key solution that combines confocal NanoRaman/ Fluorescence spectroscopy and ultra resolution multi-range research AFM enabling TERS (Tip Enhanced Raman Scattering) mapping. It is available in both transmission and reflection configurations providing direct top, bottom and side optical access. The flexibility of the OmegaScope platform offers almost endless possibilities in correlation of high spatial resolution Raman and AFM data.

Main features

- No interference of AFM registration laser with Raman excitation laser
- Direct (below Raman objective) pathway to cantilever
- Easy, quick and repeatable cantilever's adjustment
- Vibration stability, Acoustic stability, Fast scanner with high resonant frequencies
- Automated AFM registration system adjustment
- Ease of sample replacement
- Top, side and bottom optical access
- Top, side and bottom objective scanners
- Built-in DFM measuring mode with PLL
- STM, Conductive AFM and SNOM options

No inteference of AFM registration laser with Raman excitation laser

1300 nm AFM laser does not interfere with the most popular UV, visible and near-IR Raman excitation lasers (364-830 nm) and eliminates any parasitic influence on VIS light-sensitive biological and semiconductor samples.

Direct (below Raman objective) pathway to cantilever

The OmegaScope system has the AFM and Raman optical channels completely separated. Such independence does not limit the required wavelength of Raman laser and simplifies a lot the whole system adjustment in comparison with the systems where the AFM laser comes through the same high aperture objective as the Raman excitation laser. The user can easily re-focus the high aperture objective without any additional re-adjustment of the AFM laser-to-cantilever setup. The design of the OmegaScope also provides much more AFM stability and less sensitivity to any vibrations and acoustic noise.

Easy, quick and repeatable cantilever’s adjustment

The excitation Raman laser to cantilever’s tip adjustment has never been so easy and quick before due to the fixed AFM laser design. Moreover, as soon as a new cantilever of the same type is installed, the same spot (within a few microns repeatability) on your sample surface can be easily found and scanned without any extra searching steps.

Automated AFM registration system adjustment

The SmartSPM and Combiscope scanning probe microscopes are the core of the reflection or transmission configuration of the OmegaScope system accordingly and at the same time are the first SPMs with the automated/motorized laser-cantilever-photodiode alignment designed from the ground up for coupling with Raman spectrometers.

Vubration stability, Acoustic stability, Fast scanner with high resonant frequencies

Fast response time, low drift and metrological traceability are what makes the AIST-NT AFM platform design and scanner able to stand out in front of the competitors . The best in the industry flexure based closed loop scanner with 100x100x15 micron scan range allows measurements of large areas and in the same time provides the true molecular resolution imaging. The high mechanical stiffness of the scanner and the whole AFM is the key to the outstanding OmegaScope performance without active vibration protection, which is very important for AFM-Raman applications when the use of active vibration protection is impossible or economically unreasonable. These unique properties also allow the realization of special and more complicated scanning algorithms such as Top mode. In this mode the probe is lifted up above the sample surface between scanning points. In each

scanning point the probe is approached back to the surface. The scanning signal is measured right after the tip oscillation amplitude reaches the set threshold. This way it makes it possible to avoid any lateral force interactions and secure very expensive TERS probes, but at the same time keep the scanning rate up to 1 Hz.

Ease of sample replacement

The OmegaScope AFM platform design allows changing samples with the AFM head and cantilever holder in place. It seriously improves the reliability of TERS experiments and protects the system from possible operator's mistakes during such kind of routine procedures.

Top, side and bottom optical access

to the tip-sample area is provided to be able to explore the full capabilities of TERS using IR, VIS and UV high NA planapochromat objectives (top objective: up to 0.7 NA; side objective: up to 0.55 NA), which enable confocal detection of optical signal from the sample surface in a wide spectral range and the minimum size of excitation laser spot area. The properly designed side optical channel of the OmegaScope system plays an extremely important role in successful TERS experimentation as it provides a much more significant Z component of the optical field and effectively excites the Plasmon resonance in the tip-sample junction.

Top, side and bottom objective scanners

To perfectly align the AFM tip and Raman laser beam, the flexure-guided closed loop XYZ objective scanners can be installed in the top, side and bottom channels. Moreover, such solution provides the highest possible resolution, long-term stability and alignment automation, plus a wider spectral range with the less number of optical components in the light input/output system and consequently the less waste of useful optical signal.

Built-in DFM measuring made with PLL

The Dynamic Force Microscopy (DFM) mode comes as the standard option of the OmegaScope system. A frequency modulation (FM) detector for this mode is designed by utilizing the phase-locked loop (PLL) circuit built-in in the AIST-NT's controller. Using DFM one can reliably maintain the minimal tip-sample interactions (i.e. operation in the field of attractive forces) which can appear very crucial for successful TERS and Scanning Near-field Optical Microscopy (SNOM) experiments.

STM, Conductive AFM and SNOM options

Simultaneously with spectroscopy measurements OmegaScope can be equipped with the unique module, using which one can measure local currents in AFM or STM in three linear ranges (1 nA, 100nA and 10 uA). These ranges can be switched within the software, where for each of them the required bandwidth can be selected from 100Hz to 7 kHz. The conductive module noise level of 60 fA in the measuring range up to 1 nA and 1300 nm AFM laser just sets the new standard for conductivity measurements in the field of photovoltaics.
In addition to the exceptional flexibility of the OmegaScope AFM-Raman system, the SNOM option based on the tuning fork feedback design can be easily included. Besides the standard SNOM experiments, you may follow the classics of nano-optics, especially apertureless SNOM, as Prof. Lukas Novotny and, for example, set up the system for near-field fluorescence imaging using a metal tip illuminated with femtosecond laser pulses of proper polarization.