Veeco

di MultiMode

The World's Highest-Resolution SPM

- Superior Scanning Performance
- Complete Range of AFM Techniques
- Integrated Software Control

di MultiMode

Proven Performance and Unmatched Flexibility

The Digital Instruments MultiMode® is the world's highest-resolution and most application-proven commercial scanning probe microscope (SPM). User-friendly, powerful software and a compact hardware design allow the MultiMode SPM to easily acquire data from micro- to atomic-scale images. Its proven productivity, flexibility, and reliability have made it the gold standard in materials, life sciences, and polymers research.

- Variety of available scanners
  Offers flexibility of scan sizes
  Delivers application-specific accuracy
- Over 10 operating modes
  Provides flexibility of applications
  Performs complete range of SPM techniques
- Top-view optical head
  Allows easy setup
  Permits sample viewing during imaging
- Compact, rigid design
  Delivers convenience and ease of use
  Produces low-noise images

The World's Highest Resolution

Every facet of the MultiMode system electronics and mechanical design has been optimized for the highest resolution, including a short mechanical path, rigid vibration-free construction, and ultralow noise level electronics. The powerful controller delivers 16-bit resolution on all three axes with three, independent digital-to-analog converters per-axis. The high resolution and productivity of the MultiMode has led to more scientific publications than all competitive SPMs combined.

Superior Scanning

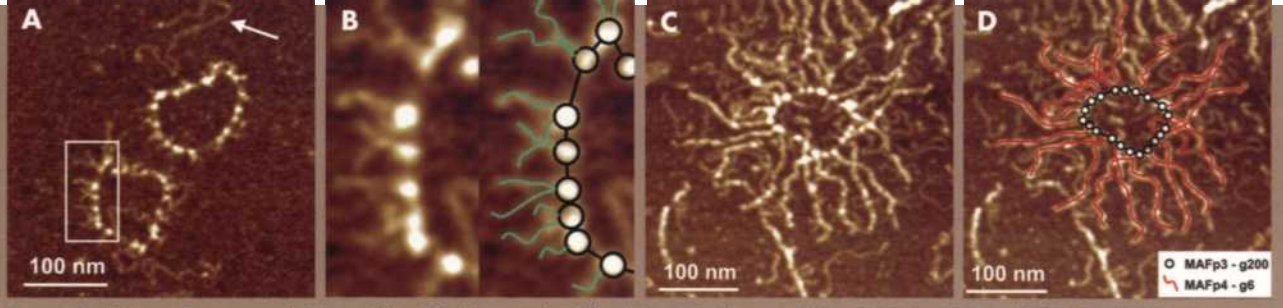
The MultiMode system features multiple scanners that permit the user to tailor the system for individual research. Scanners with large scan ranges up to 120 microns on the X–Y axes, and a Z range up to 6 microns, as well as high-resolution scanners with 0.5 microns X–Y axes and submicron Z range are available. The vertical-engage "JV" and "EV" scanners let you position the tip at any point on the surface without adjusting for lateral movement of the tip during approach. Additionally, the MultiMode PicoForce has a closed-loop Z axis for advanced force-curve measurements.

Incorporating a host of proprietary design features, these scanners are constructed of a combination of piezoelectric materials that minimizes X,Y, and Z cross-coupling and the effects of nonlinearity and hysteresis, while maintaining calibration throughout the full vertical range. Scanner calibration and linearization are maintained (regardless of the scan size, offset, or direction) by software control, providing the user with easy, direct access to all aspects of scanner operation.

The MultiMode has the ability to scan in fluids such as water, solvents and buffers at temperatures up to 250°C.

Phase image of poly(ethylene terephthalate) at 230C. 1.6μm scan.

Height of polystyrene-b-polyvinylpyridine in methanol. 1μm scan.



Aggregation factors of sponges: A. Rings with g-200 glycan and rod-like chains. B. Close-up of A. C & D Localiztion of MAFp 3 and MAFp 4.

Images courtesy of J. Jarchow, et al., J. of Structural Biology, 132, 2000, 95-105.

Operational Excellence

The MultiMode can be controlled with either the industry-standard NanoScope® IIIa controller or the next-generation NanoScope IV controller. The NanoScope IV features ten-times-faster scanning, as well as increased functionality, bandwidth, flexibility, and expandability, making it the most advanced SPM controller in the world. Innovative microactuated probes utilize nested feedback loops to move the probe in the Z direction at unprecedented speeds. The controller also incorporates Quadrex lock-in detection technology which provides quantitative phase-measurement capabilities.

Through the patented, programmable technique of TappingMode, the MultiMode allows routine imaging of samples that were once considered impossible to image successfully. By lightly "tapping" the tip on the surface during scanning, TappingMode eliminates lateral, shear forces, which improves image quality. Additionally, fragile samples can be easily scanned without risk of damage, while making possible the highest resolution. Other features include a fully automatic, proprietary tip approach that prevents hard collisions between the probe and sample surface, and a visible, safe laser for easy setup. The MultiMode delivers the finest, nondestructive tip-sample interaction control available.

Unsurpassed Flexibility and Functionality

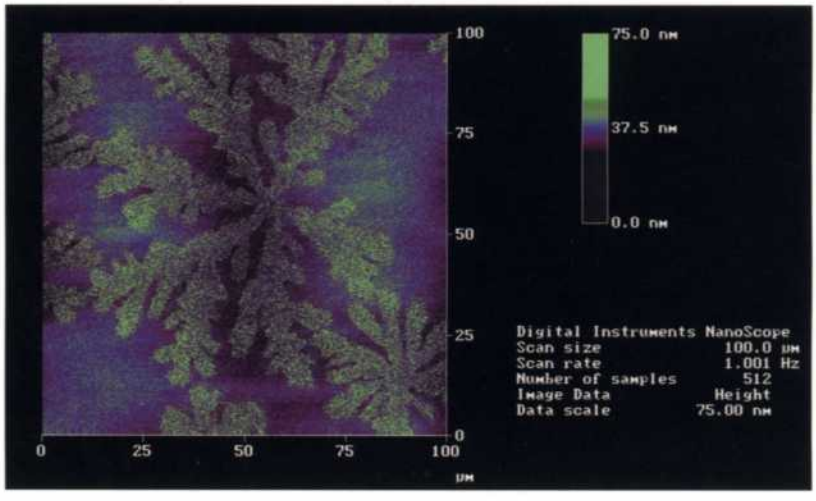
Fifteen years of SPM experience and thousands of hours of customer input have gone into our fully integrated software package. The NanoScope image analysis and presentation software contains powerful algorithms for the measurement and presentation of research results. Unlike competitive systems, full software functionality is available with the microscope. Images can be viewed in two- and three-dimensional representations, with a variety of color schemes.

With the "Auto Program" feature, an off-line macro routine can be easily created to perform a series of modification and analysis steps. The results are stored in files that can be printed or exported as ASCII files for use with other software packages. Furthermore, advanced customization of experiments is made possible via an optional signal access module.

Unlimited Application Expandability

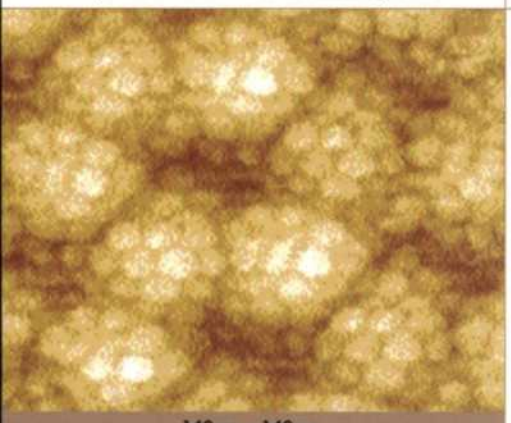
The MultiMode performs a full range of SPM techniques for surface characterization of properties like topography, elasticity, friction, adhesion, electrical and magnetic fields:

- TappingMode AFM
- Contact Mode AFM
- Phase Imaging
- Lateral Force Microscopy (LFM)
- Magnetic Force Microscopy (MFM)
- Scanning Tunneling Microscopy (STM)
- Force Modulation
- Electric Force Microscopy (EFM)
- Scanning Capacitance Microscopy (SCM)
- Surface Potential Microscopy
- Force-Distance and Force-Volume Measurements
- Nanoindenting/Scratching
- Electrochemical Microscopy (ECSTM and ECAFM)
- PicoForce Force Spectroscopy
- Tunneling AFM (TUNA)
- Conductive AFM (CAFM)
- Scanning Spreading Resistance Microscopy (SSRM)
- and many more

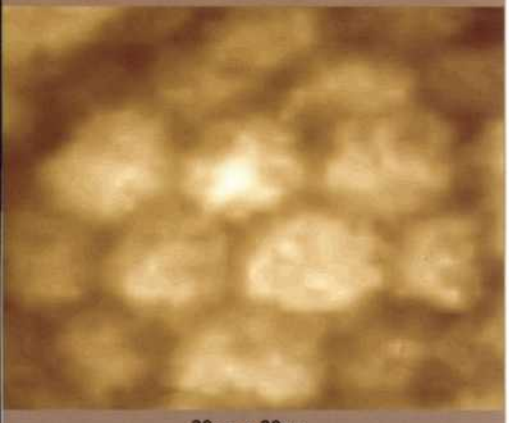


Galactocerebroside film deposited on mica and imaged in liquid. Ben Ohler et al. Journal of Structural Biology, 2001, 133, 1, 1-9.

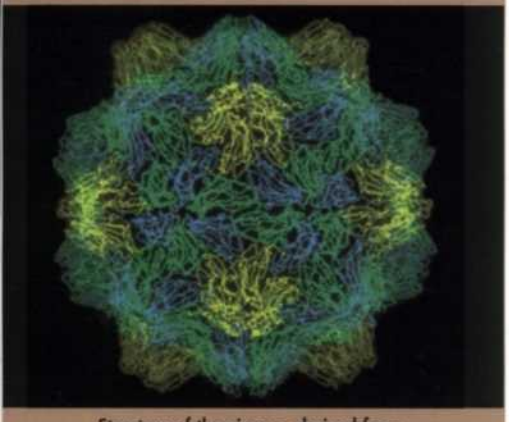
Turnip Yellow Mosaic Virus visualized by AFM.



140nm x 140nm



38nm x 38nm



Structure of the virus as derived from X-ray diffraction analysis.

Images courtesy of A.J. Malkin, et al., Journal of Structural Biology, 127, 35-43, 1999.

MultiMode Specifications

PERFORMANCE

- **Microscope:** – MultiMode SPM head; choice of scanners (see Table 1)
- **Noise:** – <0.3Å RMS in vertical (Z) dimension w/ vibration isolation
- **Sample size:** – ≤15mm diameter; ≤5mm thick
- **Tip/cantilever holders:** – Tapping mode/contact mode in air (std);
  – Tapping mode/force modulation in fluid (optional);
  – Force modulation in air (optional); electrical field (optional);
  – Scanning thermal (optional—requires large sample head or additional application modules);
  – STM converter (optional);
  – Low-current STM converter (optional); contact mode fluid cell (optional);
  – Electrochemistry AFM or STM fluid cell (optional);
  – Electrochemistry tapping mode fluid cell (optional)
- **Vibration and Acoustic Isolation:** – Silicone vibration pad provided and acoustic cover (std);
  – Vibration isolation tripod (optional); vibration isolation table (optional);
  – Integrated vibration isolation table and acoustic enclosure (optional)

HARDWARE/SOFTWARE OPTIONS

- **Optical viewing system:** – Provides vertical view of tip and sample surface w/ optical microscope, color CCD camera, and color monitor;
  – Two models available w/ max. magnifications of 800X and 450X
- **Signal Access Module™:** – Provides access to every input and output signal between controller and microscope
- **Extender™ or Quadrex electronics module:** – Provides phase and frequency detection hardware for Phase Imaging, MFM, EFM
- **MultiMode w/large sample head:** – Accommodates samples ≤30mm diameter and 6mm thick
- **Heater:** – Provides sample heating for biological applications, polymers and other materials
- **Environmental Chamber:** – Allows purging of environment at atmospheric pressure when scanning with gases
- **Nanoindenting/scratching option:** – Provides software, cantilever holder, and diamond-tipped cantilever for nanoindenting/scratching experiments
- **Electrochemistry package:** – Required for electrochemical STM/AFM
- **ADC package (ADC5):** – Increases to five ind. ±10V ADCs; front-panel BNC connectors for frame and line synchronization pulses (included in NS4)
- **Nonmagnetic option:** – Consists of magnet removal from microscope scanner for MFM measurements of low-coercivity samples and applied fields
- **Application modules:** – SCM, TUNA, SSRM and CAFM

Note: Performance specifications are typical and subject to change without notice.

Scanner	Lateral (X-Y) Range	Vertical (Z) Range
AS-0.5, AS-0.5MF ("A")	0.4µm x 0.4µm	0.4µm
AS-12, AS-12MF, AS-12NM ("E") • AS-12V, AS-12VMF ("EV")	10µm x 10µm	2.5µm
AS-130, AS-130MF, AS-130NM ("J") • AS-130V, AS-130VMF ("JV")	125µm x 125µm	5.0µm
PF-50	40µm x 40µm	20µm

Table 1 MF= Magnet Free, NM= Non-Magnetic, V= Vertical engage

Worldwide Customer Support from the Industry Leader

Veeco Instruments Inc. provides solutions for nanoscale applications in the worldwide semi-conductor, data storage, telecommunications/wireless and scientific research markets. Our Metrology products are used to measure at the nanoscale and our Process Equipment tools help create nanoscale devices. Veeco's manufacturing and engineering facilities are located in New York, New Jersey, California, Colorado, Arizona and Minnesota. Global sales and service offices are located throughout the United States, Europe, Japan and Asia Pacific.

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