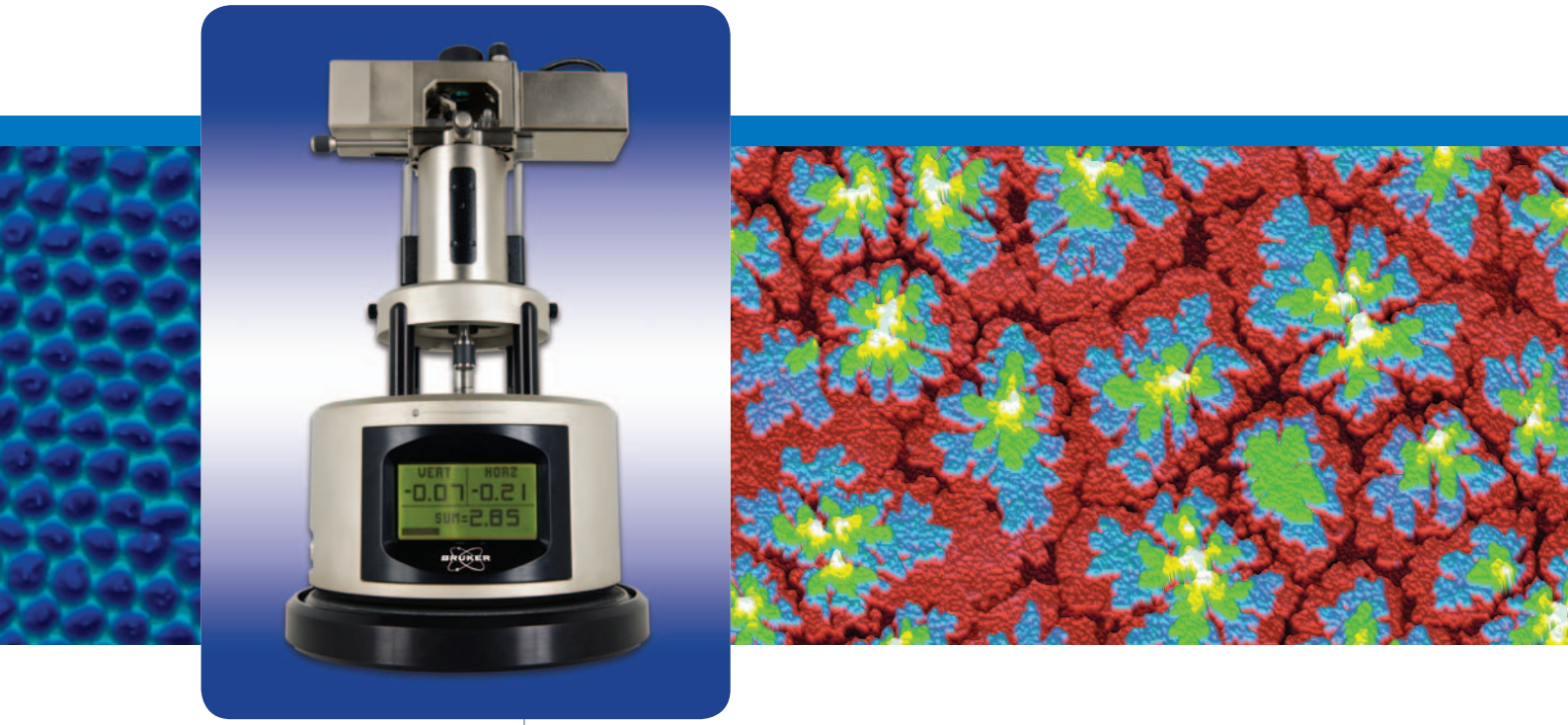


MultiMode 8

- The Benchmark for High-Performance AFM, Now with High-Speed ScanAsyst

Atomic Force Microscopy

Innovation with Integrity

Discover How the Legendary MultiMode AFM Keeps Getting Better

The MultiMode® 8 incorporates new features and accessories that may surprise you, taking the legendary MultiMode platform to even higher levels of performance, speed, and ease of use.

The MultiMode is the world's most field-proven atomic force microscope (AFM), with thousands of systems installed worldwide. Its success is based on its superior resolution and performance, its unparalleled versatility, and its proven record of productivity and reliability.

Today's MultiMode 8 greatly surpasses previous generations. Bruker's new Peak Force Tapping™ technology has enabled exclusive new operating modes that deliver new information, superior ease of use, even higher performance, and new levels of speed and productivity.

Easier Expert-Quality Results

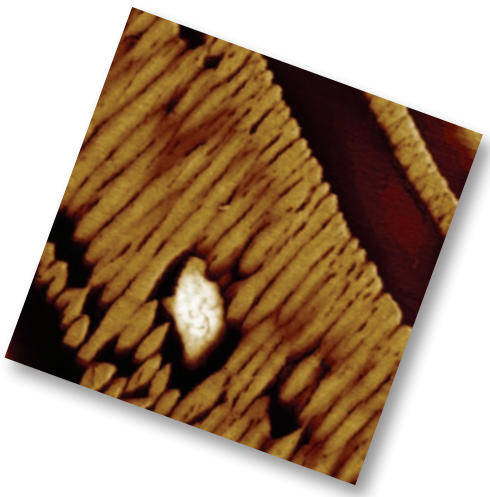
- Bruker's exclusive ScanAsyst® mode offers automatic image optimization for faster, more consistent results. It will continuously adjust scan rate, setpoint and gains to obtain the highest quality image.
- Imaging in fluid has never been easier. There's no need for cantilever tuning and ScanAsyst continuously monitors the tip-sample interaction force, thereby eliminating setpoint drift.

New, Quantitative Imaging Modes

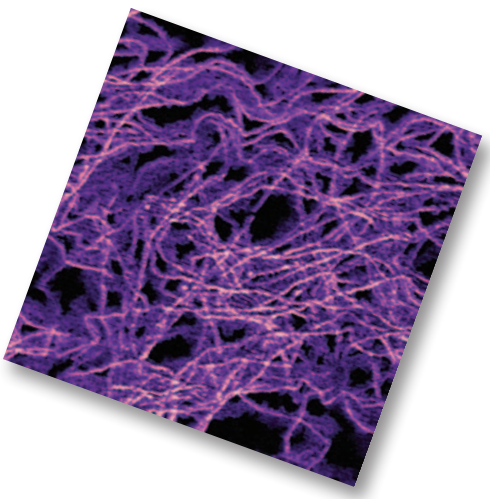
- PeakForce QNM® enables direct mapping of nanomechanical properties, including elastic modulus, adhesion and dissipation, at high resolution and normal scan rates. The data channels are quantitative and unambiguous, unlike conventional phase imaging and some competing multi-frequency techniques.
- PeakForce TUNA™ enables quantitative conductivity mapping on delicate samples that can't be imaged with conventional conductive AFM.

New Fast Scanning Technology

- ScanAsyst-HR is now available, enabling fast scanning on the MultiMode 8. Enjoy up to 20X faster survey scan rates and up to 6X faster scans with no loss of resolution.



Modulus map of polydiethylsiloxane (PDES) imaged using PeakForce QNM. Image shows a 3µm scan area where the modulus varies from 1.5-15 MPa.



PeakForce TUNA current map of poly(3-hexylthiophene) (P3HT) organic conductive nanowires using 3V bias. Image shows a 3µm scan area where the current varies from 0-80 pA.

Highest Performance and Resolution

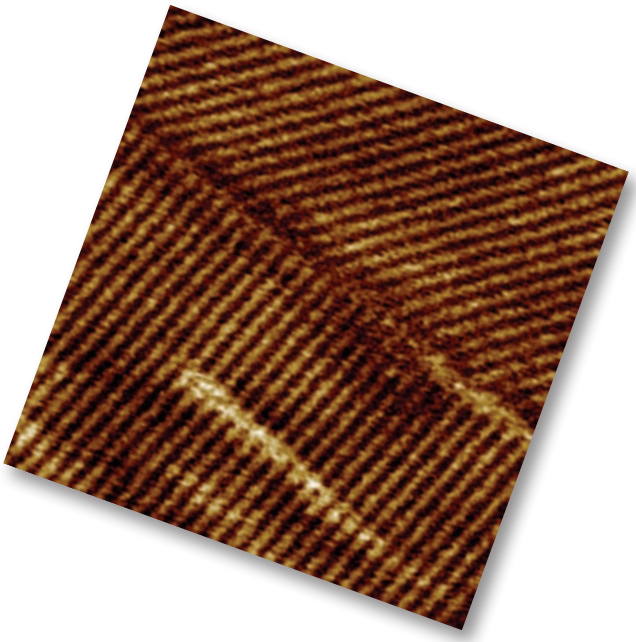
- It's no coincidence that many of the highest resolution AFM images published are done using MultiMode AFMs.
- The compact, rigid mechanical design of the MultiMode 8 ensures the lowest noise and highest resolution, even on the toughest samples and in challenging environments.
- State of the art NanoScope® V controller electronics offer exceptionally low noise along with unmatched bandwidth and processing power for the most demanding applications.
- Bruker's exclusive Peak Force Tapping technology enables exceedingly low tip-sample interaction forces— even lower than is possible with TappingMode™.

Versatility to Excel at Every Application

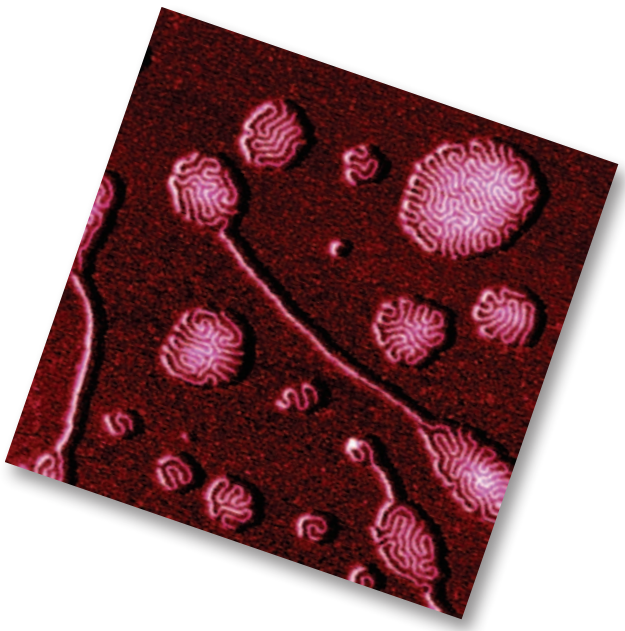
- The MultiMode 8 is equally well suited for imaging in both air and fluid. It's the ideal AFM for high-resolution imaging for both materials science and life science applications.
- Whether it's heating to 250°C, cooling to -35°C, or imaging sensitive samples at <1ppm water and oxygen in a glovebox, the MultiMode 8 is available with a full range of temperature and environmental control accessories.
- The MultiMode 8 includes a large variety of standard operating modes and many unique capabilities to characterize everything from mechanical to electrical properties at high resolution.

Exceptional Productivity and Reliability

- It's a simple fact that more high-impact AFM research has been published using MultiMode systems than any other AFM model.
- The reliability of the MultiMode is backed by a worldwide network of dedicated applications and support engineers.



$C_{36}H_{74}$ alkane layer imaged using ScanAsyst-HR. The 150nm scan area was imaged at 6.5Hz while maintaining high resolution.



Polymer brush structures imaged using ScanAsyst-HR. Scan size 1µm imaged at 5Hz. (Sample courtesy of S. Sheiko, University of North Carolina, Chapel Hill).

"The MultiMode can't be beat when it comes to resolution, reliability and ease of use. It's a favorite of over 600 users here in our imaging facility who come from many diverse research backgrounds."
— Gajendra Shekhawat, Northwestern University

Best Performance on Challenging Samples

The MultiMode 8 Is Designed for Performance

The remarkable performance of the MultiMode 8 is the result of both its superior mechanical design and the industry's lowest noise control electronics.

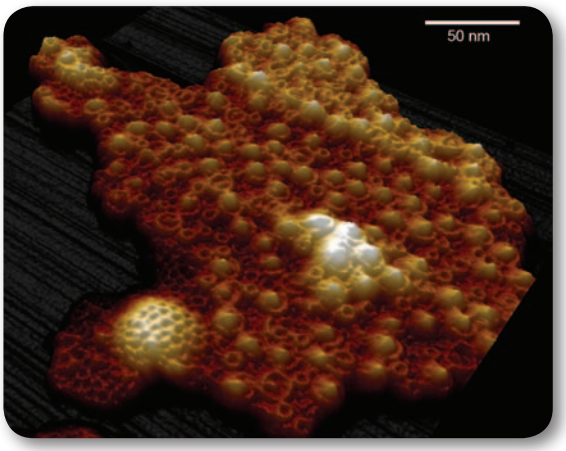
A compact, rigid mechanical design is critically important for high-resolution imaging because performance is strongly influenced by the length of the mechanical path between the sample and the AFM probe. Shorter paths offer greater immunity to acoustic and vibrational noise and are less susceptible to the effects of thermal drift. These considerations are the basis for the seemingly simple, yet high-performance design of the MultiMode 8.

The AFM control electronics are also a vital factor in system performance. The fifth-generation NanoScope V controller features an advanced digital architecture with high bandwidth, low-noise data acquisition and unmatched data processing capability. This allows Bruker to offer the most advanced and powerful new features in the industry, such as the revolutionary ScanAsyst and PeakForce QNM modes.



Proven Results on Real-World Samples

The performance of the MultiMode 8 has been proven on a wide range of samples, from delicate polymer samples to ultra-soft biological membranes. You can find examples in thousands of published research articles from Bruker scientists and our customers. Be careful when evaluating competitors' claims, especially those that sound too good to be true. Demand proof-of-performance on samples that are relevant to those you intend to investigate. Obtaining atomic resolution on a hard, flat, homogeneous, pristine crystal face such as mica, HOPG or calcite is a far different (and less commonly useful) task than achieving high resolution on real-world samples that are often soft, sticky and heterogeneous. Performance on one sample type is not always a good predictor of performance on another.



Rhodobacter sphaeroides PufX^{-} mutant photosynthetic membrane imaged in fluid with TappingMode. Image courtesy of Peter Adams and Neil Hunter, University of Sheffield, UK. See: Adams et al. Biochim. Biophys. Acta. 1807, 1044 (2011).

"Peak Force Tapping on the MultiMode 8 is an incredibly easy way to achieve high-resolution AFM images!"
— Daniel Müller, ETH Zurich

Faster and More Productive at Every Step

Productivity Doesn't Mean Just Scanning Faster

The speed of an AFM is better measured in terms of time to data than in raw line scan rates. What matters most is the total time from loading your sample to walking away with good data. So every step from probe loading to final image processing contributes to the overall productivity of an AFM. The MultiMode 8 makes each of these steps as quick and easy as possible.

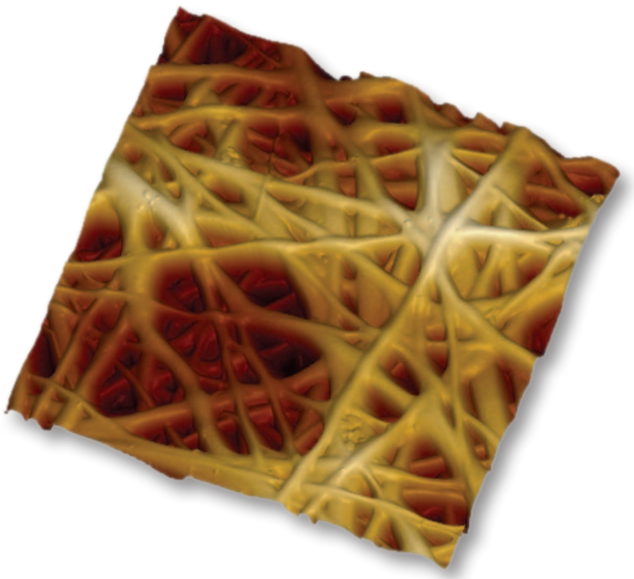
NanoScope Software Is Designed for Usability

A key contributor to the productivity of the MultiMode 8 is the powerful yet intuitive NanoScope software. The new Experiment Selector quickly sets up the software for your desired measurement. Decades of Bruker experience have been distilled into custom workspaces that are pre-configured to get you started quickly. With a click of a button you can switch between a streamlined interface suitable for routine measurements to an expert interface that presents all of the advanced options. New NanoScope Analysis software provides all of the offline analysis tools you need to go from raw data to publication-ready images. What's more, we've made it available to every member of your lab with no per-user license fees.

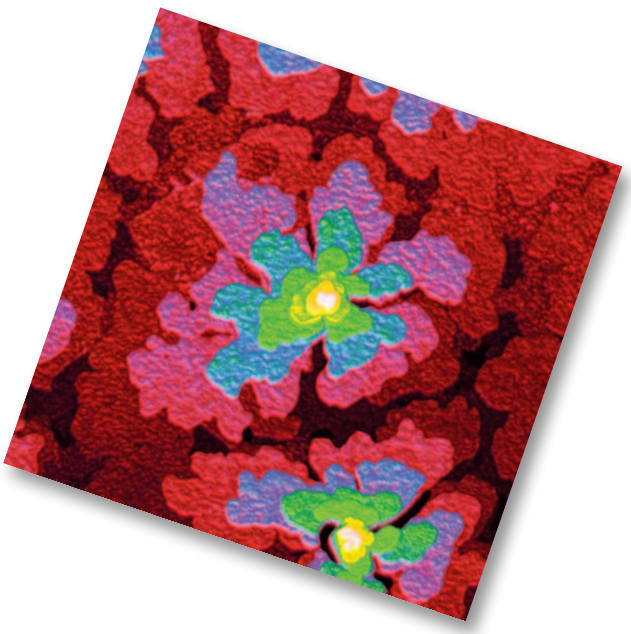
ScanAsyst Ease of Use, Performance, and Speed

ScanAsyst dramatically simplifies obtaining high-quality images. It accomplishes this with algorithms that can automatically optimize imaging parameters, including setpoint, gains and scan rate. This feature makes operation faster and more convenient for both AFM novices and seasoned AFM researchers. ScanAsyst also yields higher performance. Unlike TappingMode and other AC modes, ScanAsyst is based on Bruker's exclusive Peak Force Tapping technology, which allows direct control of the tip-sample interaction force at ultra-low levels. This helps protect delicate samples and preserve the sharpest possible tip.

Now ScanAsyst can achieve faster scan rates on MultiMode 8 too. The ScanAsyst-HR option delivers up to 20X faster survey scan rates and up to 6X faster scans with no loss of resolution while operating in air. This is a true, real-world fast scanning benefit that doesn't come with a prohibitive upfront cost or higher probes expense. You simply get the same high-resolution images in about a one-sixth of the time.



Cell culture substrate imaged with ScanAsyst-HR. Scan size 8µm, scan rate 1Hz. Sample is extremely challenging to image with conventional AC modes even at much slower scan rates.



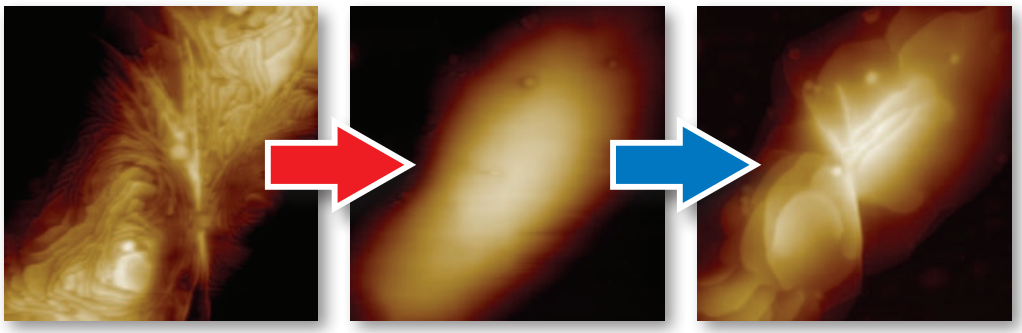
Pentacene layers grown on an HMDS-treated silicon oxide surface. Each layer is 1.7nm thick, corresponding to the width of a single pentacene molecule. The 2µm scan area was imaged at 6Hz with ScanAsyst-HR.

Accessories to Enable Advanced Applications

The success of the MultiMode platform has been made possible by a long list of supporting accessories and modes that enable advanced applications. This has helped MultiMode users excel in virtually every field of study.

Temperature and Environmental Control

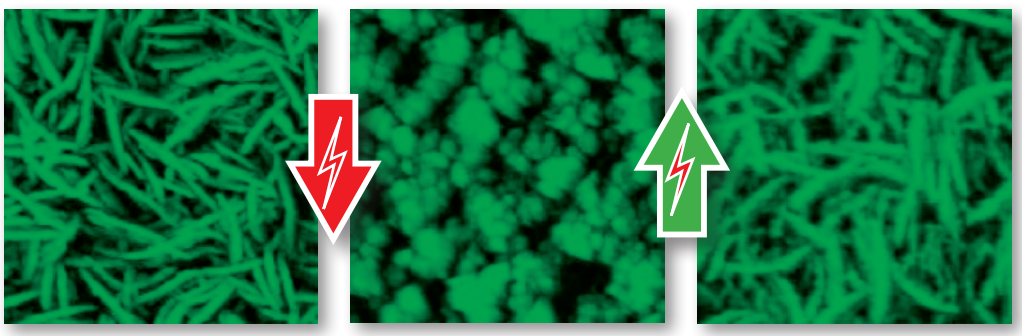
The MultiMode 8 is available with both sample heating and sample cooling capabilities. The low-range option enables heating and cooling between -35 and 100°C in either air or fluids. The high-range option heats up to 250°C and is often used to study polymer phase transitions. It is unique in that it allows both gas purging to prevent sample oxidation and tip heating to prevent tip contamination. Finally, there's a heater focused on life science applications, which heats to up to 60°C in air or fluids. Environmental control accessories are available both integrated with the heater/cooler options or as separate environmental chambers.



Poloxamer tri-block copolymer (BASF Pluronic™) sample imaged with ScanAsyst-HR. Starting at room temperature (left), the sample melts upon heating to 60°C (middle), and then recrystallizes upon cooling to 55°C (right). Scan sizes 3µm, imaged at 10Hz.

Electrochemistry and STM

The MultiMode 8 supports a full suite of accessories for electrochemistry (EC) research. It can be configured for both EC AFM and EC STM, as well as for Bruker's exclusive Scanning Electrochemical Potential Microscopy mode. Now these capabilities are also available in a controlled glovebox environment at <1ppm water and oxygen for advanced energy storage (e.g., lithium ion battery) and energy generation (e.g., organic photovoltaics) research.



Vanadium pentoxide thin film imaged using TappingMode at a scan size of 5µm. The film was used as the positive electrode in a lithium micro-battery and examined in its original, pristine condition (left), after the first discharge (middle), and after the subsequent charge (right). Even this single charge/discharge cycle irreversibly changes the film structure. (Images courtesy of B. Fleutot, H. Martinez, B. Pecquenard, J.B. Ledeuil, A. Levasseur, and D. Gonbeau, University of PAU, France.)

Did You Know the MultiMode 8 Can Do That?

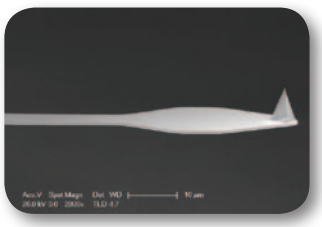
Over the years, many new features and accessories have been developed for the MultiMode platform, including some major additions in just the last year or two. You might be surprised by some of the new capabilities:

Improved Fluid Operation and Fluid Compatibility



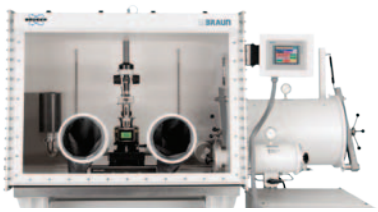
The MultiMode 8 now features liquid resistant scanners. You can feel confident operating in fluid, in fact, Bruker includes a warranty against fluid damage. Both open-cell and closed-cell operation with perfusion are supported. Various o-ring materials are available to support the widest range of fluid compatibility.

Bruker Probes Enable New Scan Modes



Bruker is the only AFM manufacturer that has a fully functional nanofabrication center specifically used to design and manufacture AFM probes for both conventional AFM and exclusive new Bruker scan modes. Bruker AFM Probes offers a full line of silicon, silicon nitride, and specialty probes. Most recently, new probes (right) were engineered to enable faster scanning with the new ScanAsyst-HR mode. New PFTUNA probes are also available for the recently released PeakForce TUNA mode. For more information visit www.BrukerAFMprobes.com

Turnkey Glovebox Solution for Demanding Environmental Control



Some advanced materials are sensitive to oxygen and/or water, notably organic photovoltaics and lithium ion cathode materials. These materials demand an environment where both water and oxygen can be maintained at <1ppm. Bruker's turnkey glovebox is the perfect solution when a simple purged chamber is not sufficient.

"The PeakForce QNM data are absolutely outstanding and incredibly close to those that we can back-estimate via elastic models for multi stranded fibrils. We now really have rock-solid evidence on the stiffness of these fibrils, and for Bruker very remarkable evidence of how reliable the PeakForce QNM can be."

— Raffaele Mezzenga, ETH Zurich
See: Adamcik et al. Applied Physics Letters 98, 193701 (2011)

This is just a partial list of available modes and accessories:

General Imaging Modes:
ScanAsyst
Peak Force Tapping
TappingMode
Contact Mode
PhaseImaging™
Torsional Resonance Mode (TRmode)
Lateral Force Microscopy (LFM)
Scanning Tunneling Microscopy (STM)

Life Science and Fluid Imaging Applications:
Liquid Resistant Scanners
Small Volume Fluid Exchange

Material Property Characterization:
PeakForce QNM
Nanoscale Thermal Analysis
Scanning Thermal Microscopy
Nanoindentation
Force Volume Imaging
Force Modulation
Piezoresponse Force Microscopy

Electrochemistry:
Universal Bipotentiostat
EC AFM
SECPM
EC STM

Temperature and Environmental Control:
Ambient to 60°C Heater
-35 to 250°C Heater-Cooler
Atmospheric Hoods

Electrical and Magnetic Property Characterization:
Surface Potential Mapping
Electric Force Microscopy (EFM)
Magnetic Force Microscopy (MFM)
LiftMode™
PeakForce TUNA
Conductive AFM (CAFM)
Tunneling AFM (TUNA)
Scanning Spreading Resistance Microscopy (SSRM)
Scanning Capacitance Microscopy (SCM)

MultiMode 8 Specifications

Configuration Options

SPM Controller Heads (select one)	**Standard** – supports all modes except application modules; **Application module ready** – supports optional application modules; **Non-magnetic application module ready** – supports use in magnetic fields
Scanners (select at least one)	**AS-0.5 scanner** – 0.4µm x 0.4µm XY and 0.4µm Z range; **AS-12 scanner** – 10µm x 10µm XY and 2.5µm Z range (non-vertical engage); **AS-12VLR scanner** – 10µm x 10µm XY and 2.5µm Z range (vertical engage), features improved liquid resistance and 4-year warranty against liquid damage; **AS-130VLR scanner** – 125µm x 125µm XY and 5µm Z range (vertical engage), features improved liquid resistance and 4-year warranty against liquid damage; **AS-12NM scanner** – 10µm x 10µm XY and 2.5µm Z range (non-vertical engage), features non-magnetic construction for use in magnetic fields; **AS-130NM scanner** – 125µm x 125µm XY and 5µm Z range (non-vertical engage), features non-magnetic construction for use in magnetic fields; **PicoForce scanner** – 40µm x 40µm XY and 20µm Z range, features large, closed-loop Z range for force spectroscopy applications; **MMAFMXYZ** – 100µm x 10 µm XY and 15µm Z range, closed-loop operation in XY and Z, not recommended for imaging in liquids
Standard Accessories	Included with all MultiMode 8 system configurations: – **OMV**, Optical microscope with 10X objective for viewing tip, sample, and laser, (video output is displayed within NanoScope software); – **Probe holde**r for most imaging applications in air, includes tip bias connection; – **Probe holder** for torsional resonance mode (TRmode); – **MFM starter kit** with probes and training samples; – **Calibration grating** for scanner calibration; – **Selection of common probe types**
Optional Accessories	Optionally available with all MultiMode 8 system configurations: – **Probe holder** for most imaging applications in liquids; – **ScanAsyst-HR probe holder** to enable high-speed ScanAsyst imaging in air; – **PeakForce QNM technology** for quantitative mapping of material properties; – **Sample heater** with ambient to 60°C range (compatible with all scanners above); – **Sample heater-cooler** with -35 to 250°C range (includes integrated scanner with 125µm x 125µm XY and 5µm Z range); – **Environmental control hood** for imaging in inert gases or under controlled humidity; – **STM head**, standard and ultra-low current versions; – **Universal bipotentiostat** for electrochemistry applications (ECAFM and ECSTM); – **PeakForce TUNA application module**; – **Conductive AFM (CAFM) application module**; – **Tunneling AFM (TUNA) application module**; – **Scanning Spreading Resistance Microscopy (SSRM) application module**; – **Scanning Capacitance Microscope (SCM) application module**; – **Nanoindentation** with diamond indenter probe; – **Force modulation probe holder** for force modulation imaging in air; – **Signal Access Module** for input/output access to analog control and data signals
Vibration Isolation* (select one or customer-supplied equivalent)	**VT-102**, air table, 24in. square x 31in. tall (requires compressed air); **VT-50**, passive isolation platform, 16.75in. square x 8.5in. tall (no air required); **TRVI**, tripod with elastic cord isolated platform (OMV cannot be placed on platform); *Please request a copy of the facility requirements from your local sales manager

System Specifications

Imaging Noise Level	<0.3Å RMS (Z noise using TappingMode in air at zero scan size)
Maximum Sample Size	15mm diameter x 5mm thick
Regulatory Certification	CE compliant
Laser Classification	Class 2M, 1mW maximum at 690nm (IEC and US CDRH)



Note: Configuration options and system specifications are subject to change without notice.

Acknowledgements: Thanks to Bruker scientists Dr. Natalia Erina, Dr. Stefan Kaemmer, and Dr. Chunzeng Li for images contained herein.

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