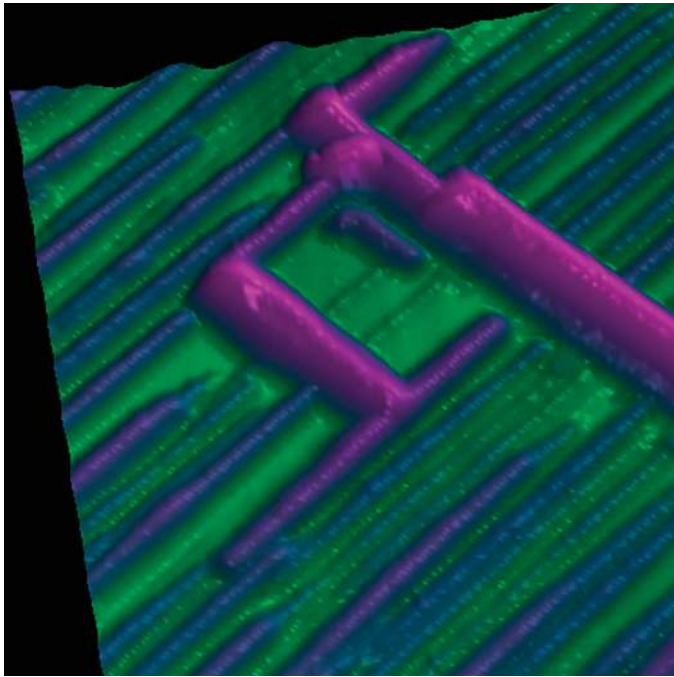
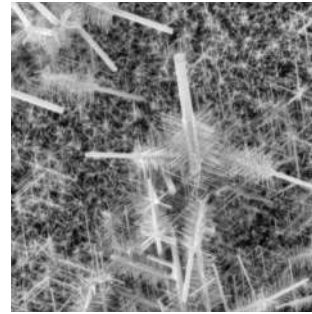


Keysight Technologies

Advanced Nanomeasurement Solutions



## Advanced Nanomeasurement Solutions for Research, Industry & Education



### Keysight Technologies meets your unique nanomeasurement requirements with a variety of flexible scientific-grade solutions

Whether your application requires a high-resolution system that offers modularity and cross-platform compatibility for atomic force microscopy (AFM) and scanning probe microscopy (SPM), a nanoindenter or universal testing machine (UTM) optimized for high-precision nanomechanical characterization, or a compact, low-voltage system that delivers exceptional field emission scanning electron microscopy (FE-SEM) performance, Keysight Technologies, Inc. is committed to providing the right state-of-the-art instrumentation for your work.

When you choose Keysight, you're choosing a reliable partner with a long history of nanomeasurement innovation. Keysight was the first to offer SPM for imaging in fluids and controlled environments, a technological legacy that continues to manifest itself in a wide range of superior solutions for in-fluid and soft-sample imaging. We hold more than 40 AFM-related patents and our leading-edge R&D is committed to the pursuit of advancements that will make atomic force microscopy easier to use. More than 2,500 peer-reviewed papers have been published using Keysight AFM technology, further validating its high performance and versatility.

The pedigree of our nanomechanical test instrumentation is equally impressive. For instance, the seminal paper authored by Warren Oliver and George Pharr has now surpassed 5,000 citations, making it the most frequently cited paper for nanomechanical properties of materials.

Every Keysight nanomeasurement solution is backed by a team of knowledgeable application scientists and technical service personnel, all of whom strive to provide outstanding support to our customers around the world. We offer invaluable application expertise for life science, materials science, polymer science, electrochemistry, and cross-disciplinary nanoscale research.

**Our driving goal is to help you be the first to see, the first to understand, and the first to publish!**

## The Keysight Atomic Force Microscope Solutions

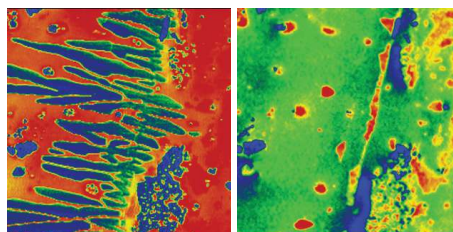
### Keysight 9500 AFM Series

The 9500 AFM seamlessly integrates revolutionary new software, a new high-bandwidth digital controller, and a state-of-the-art mechanical design to provide unrivaled scan rates at 2 sec. per frame and truly astonishing ease of use. In addition to completely redefining the user experience for atomic force microscopes, this intelligently conceived system delivers the superior performance and flexible functionality that scientists and engineers have come to expect from Keysight Technologies.



#### Advantages

- New NanoNavigator software with workflow-based GUI
- Quick Scan for ultrafast scanning (120 lines/sec, 2 sec/frame)
- Auto Drive automatically sets all parameters within seconds
- Mobile app allows remote monitoring of system operation
- New high-bandwidth digital controller ensures high-speed precision
- 90  $\mu\text{m}$  closed-loop scanner delivers atomic resolution



10 sec/frame scanning of a polydiethylsiloxane (PDES) on silicon. Left image at 25 °C, right at 46 °C.

#### Applications

- Materials science
- Life science
- Polymer science
- Electrical characterization

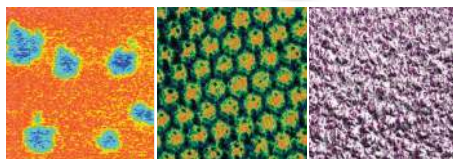
### Keysight 7500 AFM Series

The Keysight 7500 AFM establishes new functionality, versatility, and ease-of-use benchmarks for nanoscale measurement, characterization, and manipulation. This next-generation system extends the forefront of atomic force microscopy, offering 90  $\mu\text{m}$  closed-loop scanning atomic resolution, industry-leading environmental control, ultra-high-precision temperature control, an unrivaled range of electrochemistry capabilities, and much more. The clever, compact design of the 7500 gives researchers quick, convenient access to their samples. A half-dozen distinct AFM imaging modes are supported by the system's standard nose cone, which can easily be interchanged with specialized nose cones as needed, extending capability effortlessly.



#### Advantages

- Atomic scale imaging with closed loop 90  $\mu\text{m}$  scanner
- Exceptional environmental and temperature control
- Superior scanning in fluids, gases, and ambient conditions
- Single-pass nanoscale electrical characterization
- Unprecedented electrochemistry (EC) capabilities
- Standard nose cone supports expanded set of imaging modes



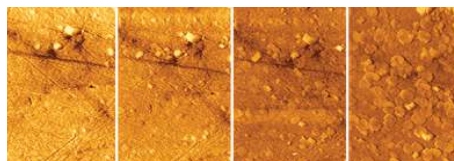
KFM SP channel image (left), conducting polymer on AU substrate (center), 3D CSAFM WTi image (right).

#### Applications

- Life science
- Materials science
- Polymer science
- Electrochemistry
- Nanolithography

## Keysight 5500 AFM

The Keysight 5500 is a powerful multiple-user research system for AFM. In addition to atomic-scale resolution, true modularity enables you to add capability-enhancing options as the need arises. An intelligent design permits the simple integration of numerous imaging modes and easy-to-use, application-specific sample-handling plates. Our balanced-pendulum, top-down multipurpose scanners – both open and closed loop – come in a range of sizes, all offering outstanding linearity and accuracy.



Corrosion study of a polished metal surface.

### Advantages

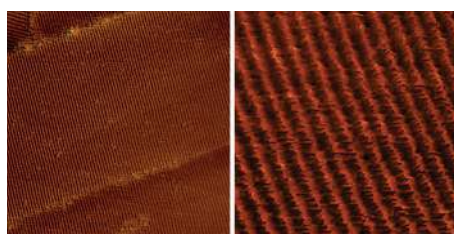
- The utmost flexibility from a highly modular system
- Exceptional environmental and temperature control
- Superior scanning in fluids, gases, or ambient conditions
- High resolution over a large scan range
- Convenient vertical sample approach

### Applications

- Life science
- Materials science
- Polymer science
- Electrochemistry
- Nanolithography

## Keysight 5600LS AFM

The versatile 5600LS is the world's only commercially available AFM that allows high resolution imaging of both large samples (in air) and small samples (in air, or in liquid under temperature control) with an AFM or STM scanner. Samples up to 8 inches in diameter and 30 mm tall are easily accepted by the 200 mm vacuum chuck. The 5600LS also accommodates a 300 mm vacuum chuck and a 2 inch multi-wafer vacuum chuck.



AFM topographic image of  $n\text{-C}_{36}\text{H}_{74}$  on graphite. Left: Scan size: 350 nm × 350 nm. Right: Scan size: 55 nm × 55 nm.

### Advantages

- Fully addressable and programmable 200 mm x 200 mm stage
- Atomic-resolution imaging of small samples using an AFM or STM scanner
- Simple point-and-shoot AFM imaging based on optical view
- Accurate location mapping ensures reproducibility

### Applications

- Electronic materials
- Semiconductor
- Storage media
- Materials science
- Polymer science

## Keysight 5500ILM AFM

The ILM adapter combines high-resolution AFM imaging with the direct optical viewing capability of an inverted light microscope to provide both atomic force and optical microscopy data. Designed to allow the 5500 AFM to sit on top of an inverted microscope and under the top illumination pillar, the Keysight 5500ILM delivers excellent optical contrast in its images. It also enables a wide range of complementary techniques, such as fluorescence resonance energy transfer (FRET), darkfield, and brightfield imaging.



Left: E-coli bacteria. Right: MAC Mode image of a living endothelial cell in water.

### Advantages

- Simultaneous AFM and optical (or fluorescence) imaging
- Easy imaging in fluids via MAC Mode and sample plates
- Design gives users open access to sample plates
- Enhanced AFM flexibility through modular options

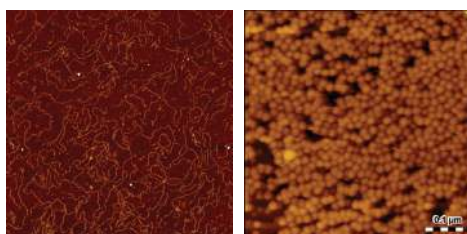
### Applications

- Life science
- Polymer science
- Nanobeads

## Keysight 7500ILM AFM

The Keysight 7500 inverted light microscope (ILM) system combines the power of a high-resolution atomic force microscope (AFM) with the direct optical viewing capability of an inverted optical microscope.

The Keysight ILM offers unparalleled performance and ease of use for imaging in fluids and extends AFM utility. Atomic force and optical (or fluorescence) microscopy data can be obtained simultaneously with the Keysight ILM. The ILM's patented mounting design incorporates a rigid structure that provides the low noise floor needed to obtain sub-nanometer resolution. Keysight's QuickSlide sample-loading mechanism and a flexible sample-handling plate make sample preparation easy. The AFM is mounted on the QuickSlide assembly, allowing the user to change samples and/or solutions without affecting the alignment of the AFM or the optical microscope.



MAC Mode images of DNA. Scan size 2  $\mu\text{m}$  (left) and protein ferritin, scan size 0.1  $\mu\text{m}$  (right).

### Advantages

- Top down, tip scanning design enables intuitive, effortless setup and imaging
- Inverted optical view, open-top viewing access, and top illumination provide superior optical contrast
- Patented MAC Mode option provides gentlest, nondestructive AFM imaging of delicate samples in fluid
- Sample-handling plates available to facilitate easy imaging in fluids or ambient air
- PicoTREC option delivers real-time, simultaneous topography and molecular recognition imaging

### Applications

- DNA
- Cell biology
- Proteins
- Polymers
- Thin films

## Extended Your AFM Capabilities with Keysight's Options for Materials & Life Sciences

### SMM Mode

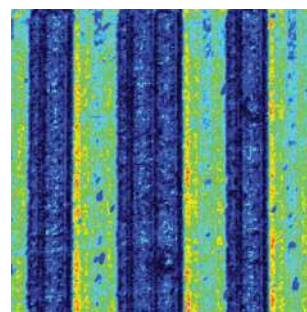
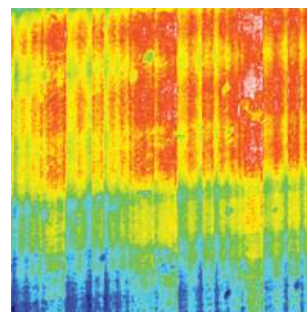
Keysight Technologies' unique scanning microwave microscopy (SMM) Mode combines the comprehensive electrical measurement capabilities of a vector network analyzer (VNA) with the outstanding spatial resolution of an AFM. SMM Mode outperforms traditional AFM-based scanning capacitance microscopy techniques, offering far greater application versatility, the ability to acquire quantitative results, and the highest sensitivity and dynamic range in the industry.

### Advantages

- Provides exceptionally high spatial and electrical resolution
- Enables complex impedance (resistance and reactance), calibrated capacitance, dopant density and topography measurements
- Works on all semiconductors: Si, Ge, III-V (e.g., GaAs, InAs, GaN), and II-VI (e.g., CdTe, ZnSe) – does not require oxide layer

### Application

- Semiconductors
- Polymers
- Ceramics
- Metals
- Organic films



SMM images of SiGe: capacitance (top), and dC/dV amplitude (bottom).

### SECM Mode

The AFM combined with SECM Mode is a seamlessly integrated technology package that enables scientists to perform scanning electrochemical microscopy (SECM) on conductive and insulating samples. This new Keysight mode has been designed to provide ultimate performance as well as supreme ease of use.

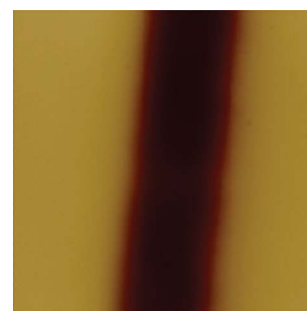
At the technological core of the SECM mode is the novel EC SmartCart, an easy-to-handle cartridge that combines a nanoelectrode with a pre-mounted AFM tip. EC SmartCart probes come pre-tested and ready-to-scan for AFM-SECM applications.

### Advantages

- Performs highly localized electrochemistry via a nanoelectrode combined with a specialized probe
- Customized SECM nosecone designed to be used with EC Smart Cart
- Hours of setup time eliminated, so data can be collected immediately

### Applications

- Homogeneous and heterogeneous electron transfer reactions,
- Surface modification,
- Analysis of thin films
- Screening of catalytic material
- Corrosion process studies



Topography (top) and SECM (bottom) images of an Au/Si sample recorded in 1 mM FeMethanol solution/0.1 MKCl with a combined AFM-SECM probe biased at 240 mV vs. Ag/AgCl.

## MAC III/Auxiliary Signal Access

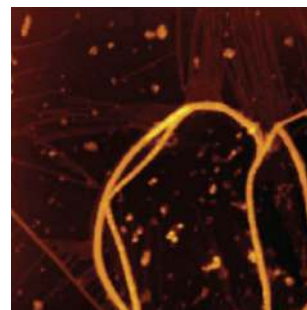
Keysight's MAC Mode III is a technique for AFM that has been designed for imaging extremely delicate samples in high resolution. MAC Mode III enables imaging of sub-molecular structures for local mechanical properties and electromagnetic response. For advanced electrical characterization the auxiliary signal access box, enables single-pass, high resolution imaging with AC Mode, Kelvin force microscopy (KFM) or electric force microscopy (EFM), piezo force microscopy and higher harmonic modes of the cantilever – all simultaneously.

### Advantages

- Allows one-pass multichannel detection for high resolution EFM and KFM
- Three configurable lock-in amplifiers afford superb versatility
- Multifrequency range, up to 6 MHz, allowing higher harmonic modes
- Built-in Q-control further enhances the resonance peak

### Applications

- Electrical characterization
- Polymers
- Biology



CdTe nanowires. Topography image (top), surface potential (bottom). Scan size 2  $\mu\text{m}$ .

## PicoTREC

PicoTREC is a system that allows researchers to quickly identify molecules that are engaged in binding events and generate a recognition map along with an AFM topography image of the sample. The system enables many advanced AFM spectroscopy applications such as force-distance studies, generates surface adhesion and molecular recognition profiles.

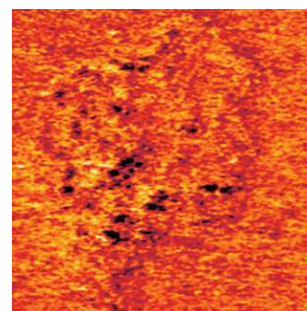
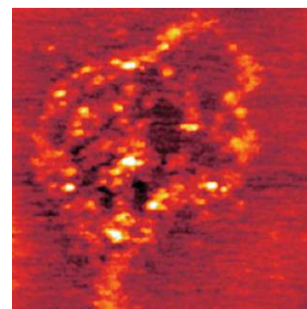
### Advantages

- Identifies molecules and regions involved in binding events
- Screens compounds/molecules by binding interactions
- Improves speed and precision of results

### Applications

Interactions of

- Antibody-antigen
- Ligand-receptor
- Drug-receptor
- DNA-protein
- DNA-DNA



PicoTREC imaging of the micropatterned avidin molecules. Topographic image (top), and corresponding recognition image (bottom).

## AFM Options & Accessories

We offer a wide selection of AFM options and accessories, each of which quickly extends the capabilities of your Keysight atomic force microscope

*With our modular platform, these components are simple to integrate.*

Among the most useful of all of Keysight's AFM accessories is MAC Mode. This patented option provides industry-leading performance for in-fluid and soft-sample imaging, allowing you to capture sub-molecular structures that cannot be resolved with any other AFM technique. Advanced MAC Mode III provides three lock-in amplifiers and allows single-pass imaging concurrent with KFM/EFM. It also supports the use of higher resonance modes of the AFM cantilever, enabling higher harmonics and the collection of additional information about mechanical properties of the sample surface.

Another important AFM accessory is Keysight's exclusive scanning microwave microscopy (SMM) mode, the first and only technique to combine the calibrated, complex electrical measurement capabilities of a performance network analyzer with the high spatial resolution of an atomic force microscope. This mode enables complex impedance (resistance and reactance), calibrated capacitance, calibrated dopant density, and topography measurements.

Additional accessories include our industry-leading environmental isolation chamber (EIC), which lets you control humidity levels, monitor and control oxygen levels, and control the low of reactive gases during experiments; open- and closed-loop multipurpose scanners, interchangeable nose cones, and PicoTREC molecular imaging.(KFM) or electric force microscopy (EFM), piezo force microscopy, SECM mode and higher harmonic modes of the cantilever – all simultaneously.



### Options/Accessories

- STM
- SECM
- MAC Mode
- MAC Mode III
- SMM Mode
- Environmental Control
- Multipurpose Scanners
- Nose Cones
- Sample Plates
- PicoTREC
- Temperature Control
- Pico Image Software
- Break-out Box
- Glove Box
- Acoustic Isolation Chamber
- Liquid Cells
- Vibration Isolation
- Video Microscope
- Consumables

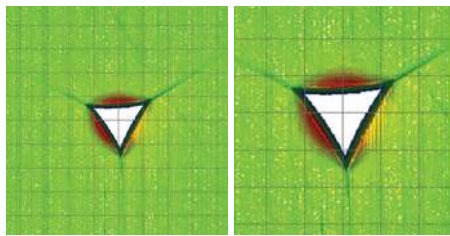




## Nanomechanical Test Equipment

### Keysight Nano Indenter G200

The Nano Indenter G200 is the most accurate, flexible, user-friendly instrument commercially available for nanomechanical testing. Electromagnetic actuation allows unparalleled dynamic range in force and displacement. The G200 lets researchers measure Young's modulus and hardness in compliance with the ISO 14577 standard. It also enables measurement of deformation over six orders of magnitude (from nanometers to millimeters). Users are able to quantify the relationship between structure, properties, and performance of their materials quickly and easily with minimal sample preparation. Express Test allows the Nano Indenter G200 to be operated in controlled-force or controlled-displacement mode. Testing is simple, just "point-and-shoot".



### Advantages

- Award winning Express Test for ultrafast testing capabilities (up to 100 indents at 100 different surface sites in 100 seconds)
- Accurate, repeatable results compliant with ISO 14577
- Unparalleled dynamic range in force and displacement
- Dynamic properties characterization via continuous measurement of stiffness by indentation depth

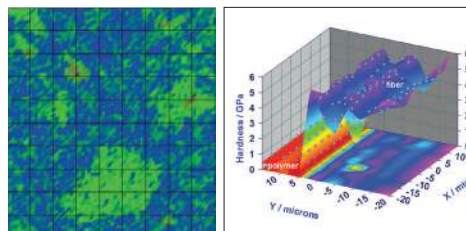
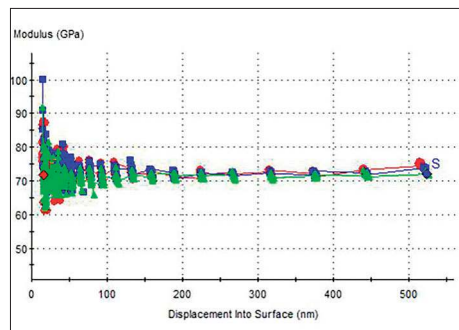
### Applications

- Semiconductor
- Thin films
- MEM structures
- Hard coatings
- DLC films
- Biomaterials

### Keysight Express Test for the G200

A recent recipient of the prestigious R&D 100 Award, Keysight's Express Test option enables the world's fastest nanoindentation for mechanical-properties mapping. This technology, which has been designed and optimized for exclusive use with the Nano Indenter G200, delivers high-precision data on a wide variety of materials. The Express Test option is compatible with all DCM II and XP heads and translation stages.

Achieve ultrafast testing capabilities (up to 100 indents at 100 different surface sites in as little as 100 seconds). Express Test allows the G200 to be operated in controlled-force or controlled-displacement mode. Perform area calibration and Young's modulus in minutes.



### Advantages

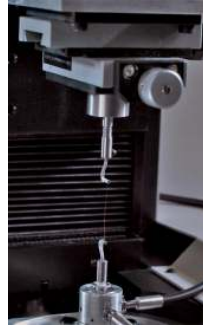
- Ultra-Fast indentation
- True mechanical-properties maps
- Rapidly evaluates Young's modulus and hardness with robust statistics
- Histograms automatically generated
- Negligible thermal drift

### Applications

- Metals
- Glasses
- Ceramics
- Structural polymers
- Thin films
- Low-k materials

## Keysight T150 UTM

The T150 UTM is a state-of-the-art universal testing machine that offers researchers a superior means of nanomechanical characterization by utilizing a nanomechanical actuating transducer head to produce tensile force. The T150 enables researchers to understand dynamic properties of compliant fibers via the largest dynamic range in the industry and the best resolution on the market (five orders of magnitude of storage and loss modulus).



## Advantages

- Load cell delivers high sensitivity over large range of strain
- Largest dynamic range and best resolution
- Flexibility and upgradability for repeatable or new applications
- Real-time control and easy test protocol development

## Applications

- Dynamic studies of fibers and biological materials
- Tensile and compression studies of polymers
- Yield of compliant fibers and biological materials

## Keysight NanoSuite and NanoVision Software

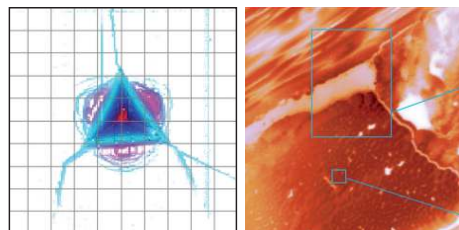
NanoSuite software lets users run tests and manage data with unprecedented ease. Through the elegant and intuitive interface, you can set up and run experiments quickly – changing test parameters as often as desired – with just a few clicks.

NanoVision software allows you to create quantitative high-resolution images using a Keysight Nano Indenter with a high precision closed-loop stage. User can target indentation test sites with nanometer-scale precision, and examine residual impressions in order to quantify material response phenomena.



## Advantages

- Survey scanning of areas up to 500  $\mu\text{m}$  x 500  $\mu\text{m}$
- Custom test development methods
- Superior experiment data analysis
- Simulation mode for offline sample setup, sample runs, method writing, and data analysis
- Quantitative, high-resolution topographical images
- Quantification of pile-up, deformed volume, and fracture toughness



## Nanomechanical Options & Accessories

We offer many options and accessories to enhance the capabilities of your Keysight nanoindentation system or universal testing machine

*Our modular platform makes these components simple to integrate. We continue to optimize advanced technologies as we strive to push performance even further.*

The Keysight Dynamic Contact Module II option, for instance, offers 3x higher loading capability than our original Dynamic Contact Module option. It also offers easy tip exchange for quick removal and installation of application-specific tips, in addition to a wider range of indenter travel. As a fully dynamic indentation head designed for low noise, ultra-low-load mechanical properties characterization, the DCM II extends the range of load-displacement experimentation down to the surface contact level. When applying the Keysight Continuous Stiffness Measurement technique, which provides a means of separating the in-phase and out-of-phase components of the load-displacement history, the DCM II delivers the complete benefits of dynamic nanoindentation testing.

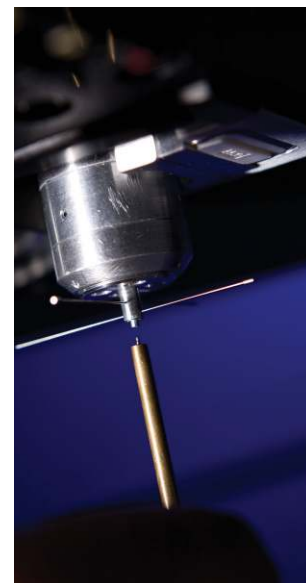
Our popular High Load option, on the other hand, expands the load capabilities of Keysight Nano Indenters up to 10N of force, allowing the complete mechanical characterization of ceramics, bulk metals, and composites. Another popular choice, our Lateral Force Measurement option, provides three-dimensional quantitative analysis for scratch testing, wear testing, and MEMs probing. We also offer a precision heating stage designed specifically for the Nano Indenter G200 (standard XP head configuration) to facilitate the study of materials of interest as they are heated from room temperature to as high as 350 °C.

Keysight T150 UTM users can utilize our Continuous Dynamic Analysis option. This technology offers a direct, accurate measurement of the specimen's stiffness at each point in the experiment, enabling mechanical properties to be determined continuously as the specimen is strained.



### Options/Accessories

- Dynamic Contact
- Module II (DCM II)
- Continuous Stiffness Measurement (CSM)
- High Load
- Lateral Force Measurement (LFM)
- Continuous Dynamic Analysis (CDA)
- Heating Stage
- Nanovision Software
- Express Test
- Indentation Kit
- Consumables



## Keysight FE-SEM for Low-Voltage, High-Performance Imaging

### Keysight's NEW 8500B FE-SEM

The remarkably compact Keysight 8500B field-emission scanning electron microscope (FE-SEM) has been optimized for low-voltage imaging, extremely high surface contrast, and resolution typically found only in much larger and more expensive FE-SEMs. This innovative, technologically advanced system also offers fully integrated energy dispersive spectroscopy (EDS) capabilities, allowing quantitative elemental analysis to be performed on arbitrary points, on a continuous line scan, or in a user-defined regional map. It can detect elements as light as carbon, up to americium.

About the size of a laser printer, this scientific-grade system provides capabilities and performance to researchers in ordinary labs that previously were only available with much larger FE-SEMs installed in centralized facilities. Installation of the new system is quick and simple. No dedicated facilities are required, only an AC power outlet.

The innovative, easy-to-use 8500B embodies the successful miniaturization of the core technology found in a scanning electron microscope. Optimized for low-voltage imaging and sub- 10 nm resolution, its thermal field emission electron source provides high signal-to-noise ratios and consistent, long-lasting performance, while secondary and backscatter electron detection capabilities provide a rich data set for each sample.



### Advantages

- Fully integrated EDS capabilities allow quantitative elemental analysis
- Resolution and imaging equal to that of conventional FE-SEMs
- Variable low voltage (500 to 2000 V) eliminates charging and the need for sample coating
- Programmable X, Y, Z stage allows user to set precise coordinates, scan, and save information
- Compact size enables easy installation in any research lab and does not require special facilities

### Applications

- Polymers
- Thin films
- Biomaterials
- Nonconductive samples
- Energy-sensitive materials
- Glass substrates

## FE-SEM Options & Accessories

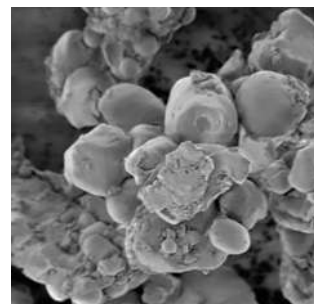
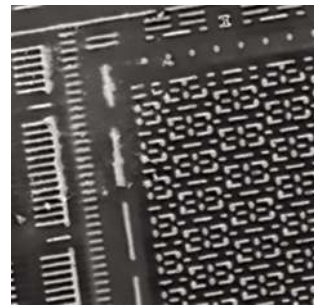
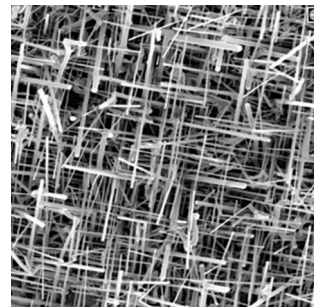
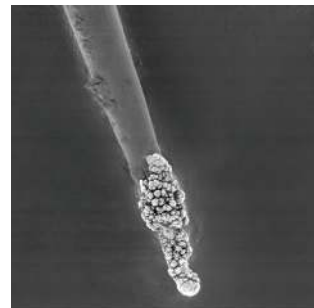
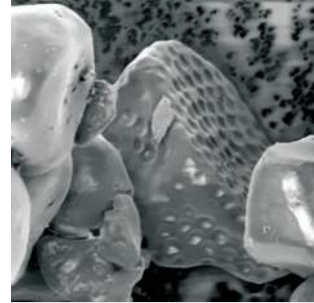
Keysight has created a special SEM startup kit so that when your 8500B FE-SEM is delivered you will have everything you need to start imaging.

The kit includes:

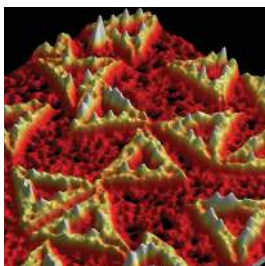
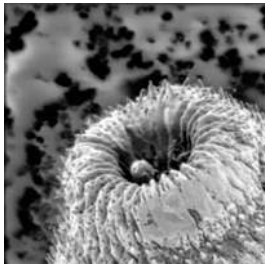
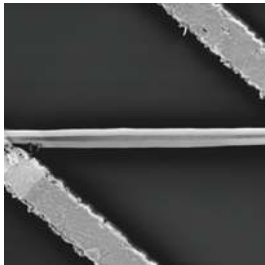
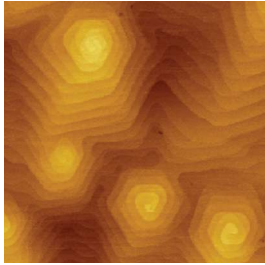
- Specimen mount adapter pin (M4 thread)
- Multi-unit specimen mount (4 x 3.2 mm)
- Package of 100 12 mm Pelco tabs
- Standard SEM pin mounts
- Pelco Swiss style #7 tweezer
- Pelco mount tweezer
- Storage container for SEM mounts
- Specimen holder
- 1/16" ball driver

The following items are also offered for use with the 8500B:

- **Specimen mount adapter pin (M4 thread):** attaches to the sample holder; used to adjust the working distance of the sample mount
- **Standard SEM pin stub mount:** 12.7 x 8 mm pin height; aluminum with grooved edge
- **Tilt cylinder mount:** 9.5 x 9.5 mm, 45° specimen mount (package of 10)
- **Cylinder mount:** 9.5 x 9.5 mm specimen mount (package of 50)
- **Multi specimen cylinder mount holder:** holds up to five 9.5mm cylinder mounts; machined aluminum with stainless steel Allen set screws
- **Multi 4-pin stub holder:** accommodates up to four standard 12.7 mm (1/2") pin stubs, with 3.2 mm (1/8") diameter pin; machined aluminum with stainless steel Allen set screws



## Applications



### Materials Science

Ideal for large and small samples alike, the Keysight 5600LS AFM is a large-stage atomic force microscope compatible with our unique scanning microwave microscopy (SMM) mode, which allows highly sensitive calibrated electrical and spatial characterization. MAC Mode III, which enables Kelvin force microscopy (KFM) and electric force microscopy (EFM), is available on all Keysight AFMs. The 7500 AFM with temperature and environmental control gives users the advantage of dynamic in-situ imaging. Meanwhile, the new Keysight 8500B FE-SEM with EDS allows nanoscale features to be observed on a wide variety of nanostructured materials, including thin films and other energy-sensitive samples, on any substrate.

For nanomechanical testing, Keysight Nano Indenter G200 systems offer accurate and repeatable results compliant with the ISO 14577 standard, along with “low-load first then high-load” capabilities. Additionally, the Keysight T150 UTM enables researchers to understand dynamic properties of compliant fibers and composites via the largest dynamic range and best resolution on the market.

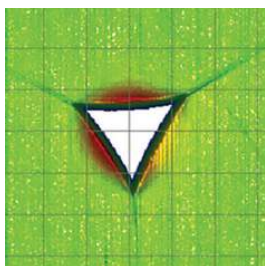
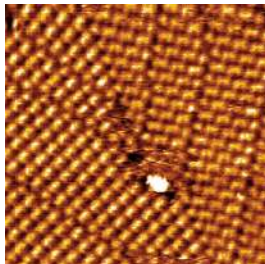
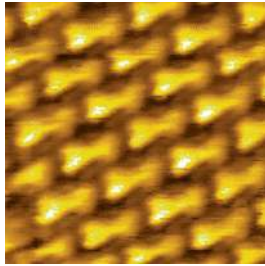
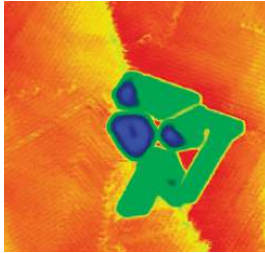
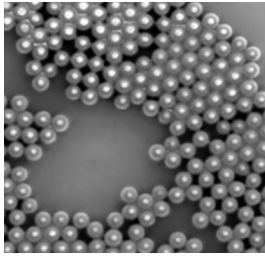
- AFM applications such as electromagnetic measurement
- Nanoindenters and low-voltage FE-SEM for measuring DLC thin films, MEM structures, and nanocomposite fibers

### Life Science

The Keysight 7500/5500 series AFM systems facilitate life science investigations by offering a broad array of capabilities, including unrivaled in-fluid imaging (via patented MAC Mode) and industry-leading temperature/environmental control. As new techniques simplify the preparation and handling of diverse sample types, the use of a powerful class of in-situ AFM techniques is becoming increasingly prevalent in biological research. We now offer both the 7500/5500 on an ILM.

In addition, our new 8500B FE-SEM offers several imaging techniques for enhancing surface contrast and allowing nanoscale features to be observed on a broad range of biomaterials on any substrate, even glass.

- Exceptional in-fluid imaging with MAC Mode
- Real-time recognition imaging with PicoTREC
- Low-voltage FE-SEM imaging of cells, tissue, bacteria, and more



## Polymer Science

Keysight AFMs are used for studying nanoscale composition mapping and materials properties of various polymers under environmental and temperature control. These AFMs adapt to provide phase, friction, and electrical property measurements at atomic-scale resolution over long-range scans utilizing advanced techniques such as MACMode III and high-resolution KFM imaging. What's more, researchers can now take advantage of the capabilities of our new 8500B FE-SEM with EDS, which has been engineered specifically for low-voltage imaging of nanoscale features on polymers on any substrate.

Polymer studies can also benefit greatly from the use of the Keysight Nano Indenter G200 system. These high-precision nanomechanical test instruments are configurable with our low-noise, ultra-low-load Dynamic Contact Module II (DCM II) option, which provides loading capability up to 30 mN max load.

- AFM and low-voltage FE-SEM for studying surface molecular composition of block copolymers, bulk polymers, thin-film polymers, polymer composites, and polymer blends
- Nanoindenters for ultra-low-load nanomechanical testing of polymers

## Electrochemistry

We offer a highly versatile, easy-to-use option for Keysight 5500 and 7500 AFM users who want to conduct studies involving electrochemistry. A single Keysight electrochemistry unit has modules that allow in-situ scanning tunneling microscopy (STM), AFM, and conducting-probe capabilities – without compromising atomic resolution. Our unique environmental chamber protects sensitive samples from harsh elements, controls reactive gases, and provides the flexibility required to control a range of parameters during the course of a given experiment. Now available is the new exclusive SECM mode with quick easy set-up.

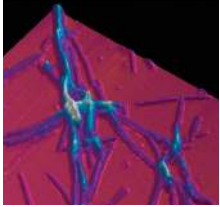
- Imaging in liquids with patented MAC Mode
- Built-in, high-performance potentiostat/galvanostat
- State-of-the-art environmental and temperature control

## Cross-Disciplinary Nanoscale Research

In nanotechnology and nanomanufacturing research, the control, resolution, and adaptability afforded by Keysight enables success in areas including drug discovery, nanotubes, advanced opto-electronic devices, and a diverse range of industrial applications. For example, our AFMs have been used in the development of new approaches to fabricate self-assembled monolayers.

To perform high-precision nanomechanical testing in cross-disciplinary nanoscale research, Keysight Nano Indenter G200 systems are configured for a fully dynamic, ultra-low-load mechanical properties characterization. Additionally, the T150 UTM allows researchers to characterize nanomechanical properties using the largest dynamic range with outstanding sensitivity.

- AFM and low-voltage FE-SEM for nanolithography, nanowires, and nanotubes
- Nanoindenters for structural biomaterials
- UTM for yield, tensile, and compression studies



## Be the First to See, Understand, & Publish

Keysight Technologies nanotechnology measurement division has established itself as a leading provider of atomic force microscopes and nanomechanical testing systems. And, Keysight recently introduced EDS capabilities for its first compact field emission scanning electron microscope (FE-SEM) which will further enhance the portfolio of nano-measurement instruments. Nanotechnology spans many disciplines, including physics, material science, chemistry, life science, computer science/information technology, and electronics.

Keysight is dedication to innovation; trust, respect, and teamwork; and uncompromising integrity. Added to these are speed, focus, and accountability to meet customer needs and create a culture of performance that draws on the full range of people's skills and aspirations. Keysight is in an excellent position to keep our customers at the forefront of this exciting science thanks to development partnerships with Keysight Labs, collaborations with university research programs, and an experienced worldwide staff committed to superior products, science, and service.

Keysight's nanotechnology measurement instrumentation lets scientists image, manipulate, and characterize a wide variety of nanoscale behaviors. Our growing collection of nanotechnology instruments, accessories, software, services, and consumables can reveal clues researchers need to understand the nanoscale world. Our driving goal is to help you be the first to see, the first to understand and the first to publish.

## Nanomeasurement Systems from Keysight Technologies

Keysight Technologies, the premier measurement company, offers high-precision, modular nanomeasurement solutions for research, industry, and education. Exceptional worldwide support is provided by experienced application scientists and technical service personnel. Keysight's leading-edge R&D laboratories ensure the continued, timely introduction and optimization of innovative, easy-to-use nanomeasure system technologies.

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(BP-04-23-15)

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Published in USA, June 24, 2015

5989-6406EN

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