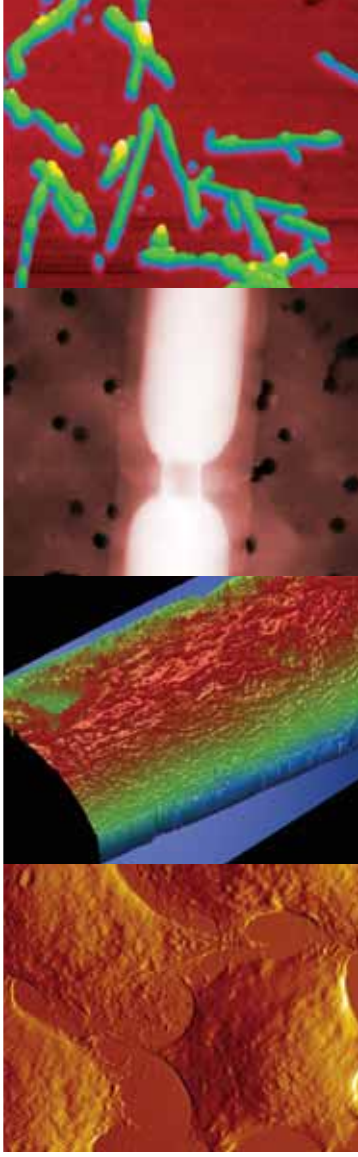
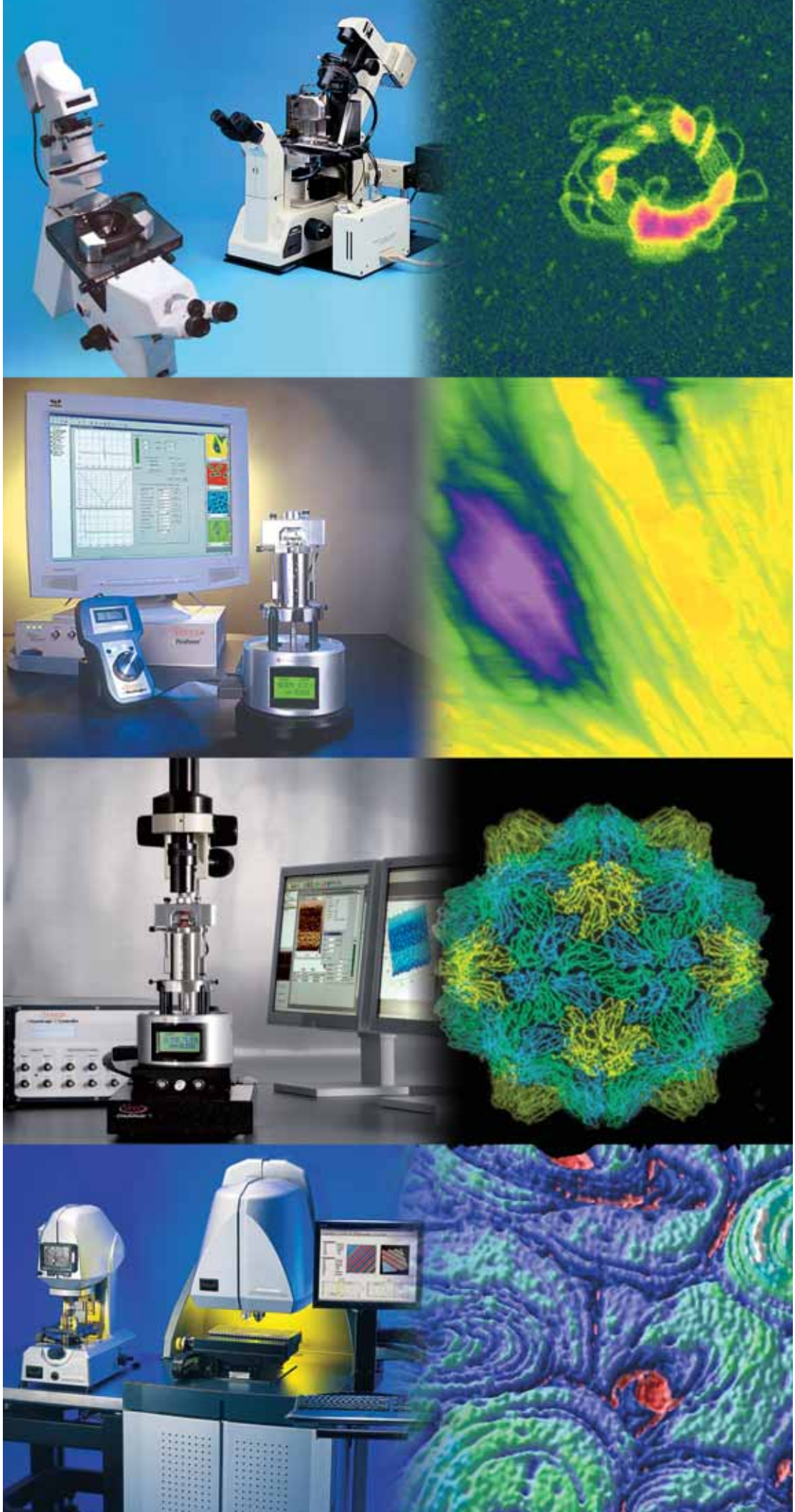



# Comprehensive Solutions for Life Science from the World Leader in AFM and Optical Profiling Systems

Veeco

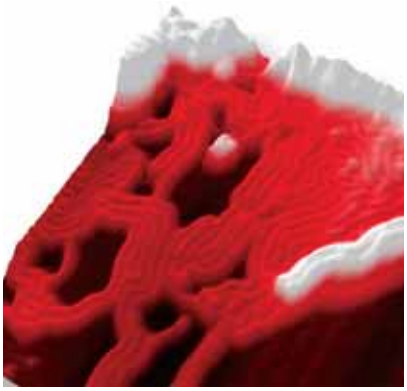
Solutions for a nanoscale world.™



# The Key to Better Bioscience Research

Veeco is the world's leading provider of atomic force microscope (AFM) and optical profiling systems for life science research and production metrology. These advanced, application-focused solutions deliver the highest performance and utility available, thereby facilitating numerous groundbreaking investigations, reducing time to publication, and enabling product manufacture.

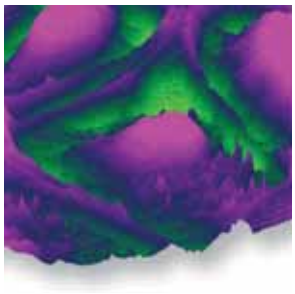
Veeco's cross-functional design teams comprise a rich diversity of knowledgeable, creative professionals, including over 30 PhD scientists. This varied expertise has allowed us to develop an ever-widening array of innovative metrology solutions  to meet the challenges of today's most demanding bioscience applications. Our extensive product line addresses a comprehensive range of sample size, imaging resolution, force spectroscopy, optical integration, 2D and 3D surface visualization and characterization, and environmental control requirements.



Whether your research calls for high-resolution real-time imaging of *in-situ* biomolecules under physiologically relevant conditions, precise single-molecule measurements of intra- or intermolecular interactions, or simultaneous non-contact three-dimensional analysis of the top and bottom surfaces of a drug or implant coating, our AFM and optical profiling systems are ready to help.

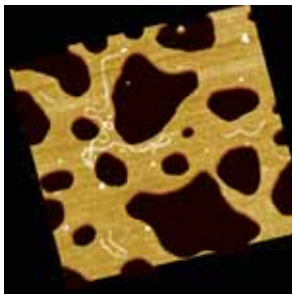
**No matter what your biological research needs, Veeco has the right solution for you!**

# Imagine What We Can Help YOU See

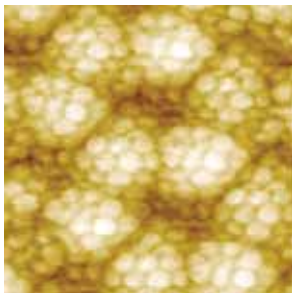


BioScope TappingMode AFM image of **living breast adenocarcinoma (MCF7) cells**. 65µm scan.

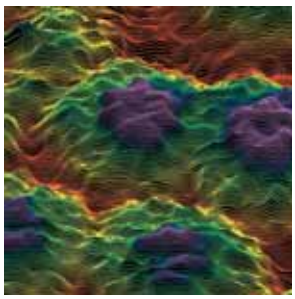
A three-dimensional profile of a **multifaceted insect eye**. Optical profiling reveals high detail of complex life science organisms with a completely non-contact, damage-free measurement. 309µm x 235µm FOV.



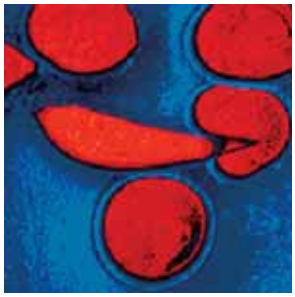
Fluid TappingMode AFM image of **DNA molecules** bound to a cationic lipid bilayer. DNA, which is negatively charged, was not observed to bind to the exposed mica substrate (dark brown areas), which also has a net negative charge at neutral pH. 975nm scan.



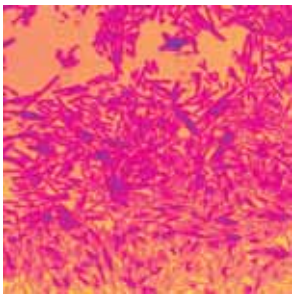
The first direct visualization of the **capsomere structure of the Turnip Yellow Mosaic Virus** (TYMV). The arrangement of these protein molecules is specific to a viral family and thus can be used to identify viruses. 140nm scan. Image courtesy of A. J. Malkin, Lawrence Livermore National Laboratory, CA.



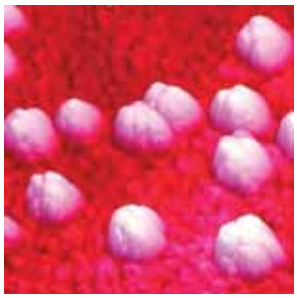
The molecular surface structure of the **protein heptamer GroES** imaged by AFM under physiological fluid. The "crown" structure (purple) and central depression of the GroES molecules are easily observed. 18nm scan. Image courtesy of J. Mou and Z. Shao, University of Virginia, School of Medicine, Charlottesville, VA.



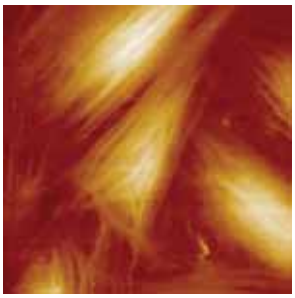
**Normal and sickled human red blood cells.** The rigid contour of the sickled cell (center) contrasts with the normal red blood cells. Three spicules (top left of cell), approximately 0.5 to 1.0µm long, project out from the sickled cell, denoting rearrangement of intracellular hemoglobin molecules. Courtesy of Sansum Medical Clinic, Santa Barbara, CA.



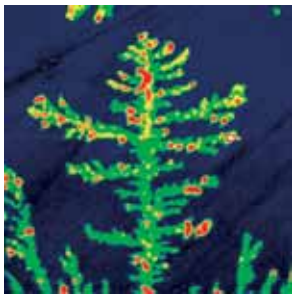
MultiMode TappingMode image of **protein fibrils** grown from Parkinson's Disease related human a-synuclein in presence of 5mM putrescine. 1.8µm scan. Image courtesy of T. Antony, W. Hoyer, G. Heim, D. Cherny, T. Jovin, and V. Subramaniam, Max Planck Institute for Biophysical Chemistry, Germany.



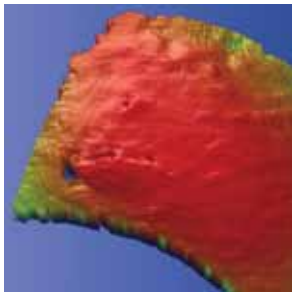
MultiMode image of **Severe Acute Respiratory Syndrome (SARS) coronavirus-infected Vero E6 cell** at 24 hours post-infection. Matured extracellular virus particles are observed on the surface of the infected cell. The surface morphology of the virus particles appear characteristically "knobby". 1µm scan. Image courtesy of Mary Ng Mah Lee, Jason WM Lee, National University of Singapore.



AFM Image of **living endothelial cells** that were grown directly on a Petri dish and imaged on a BioScope using contact mode in liquid. 65µm scan. Sample courtesy of Georges Primbs, Miravant, Inc.



Crystallization of **milk proteins** collectively known as casein, on tooth enamel. The crystals were formed by evaporation from a thin film of aqueous solution (5% protein by weight) and imaged in TappingMode in air. 25µm scan. Image courtesy of Michele Barbour, University of Bristol.



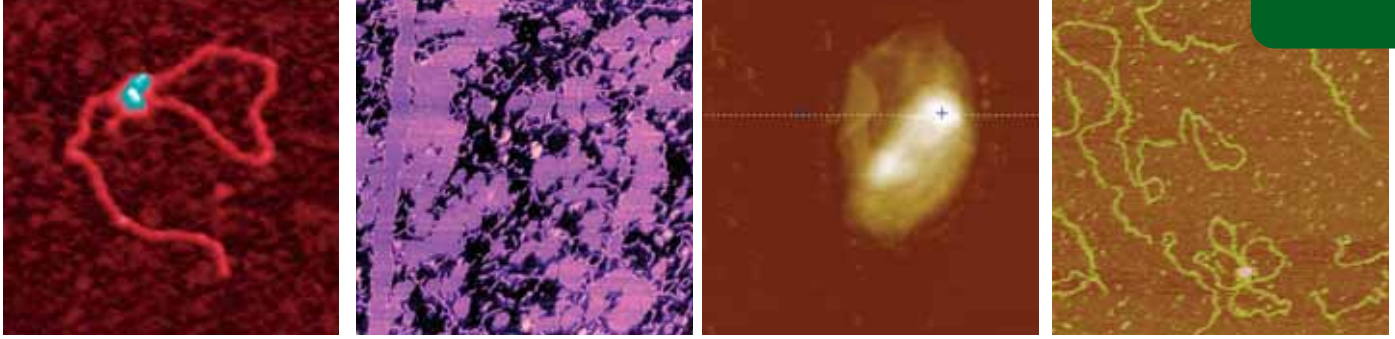
A three-dimensional analysis of an **arterial stent reveals a pin hole** in the coating. Optical profiling provides simultaneous characterization of the top and bottom surfaces of thin films, as well as the surface features of the underlying structure. 120µm x 90µm FOV.

# diBioScope II

## Superior Optical/AFM Capabilities for Advanced Bioscience

The BioScope™ II atomic force microscope has been engineered specifically to facilitate cutting-edge life science studies. This system is ideal for AFM imaging of a broad range of samples under biologically relevant conditions. Designed for advanced biological applications, the BioScope II is fully compatible with high-end commercial inverted microscope systems, including off-the-shelf optical accessories.

The open and ergonomic design of the novel scanner head provides unprecedented optical and physical top-down access to the AFM and sample area. Experimental setup is simplified by a set of enhanced "ease-of-use" features, including a motorized stage and automated approach mechanism for accurate tip-sample alignment, as well as Veeco's unique EasyAlign™ accessory that streamlines cantilever replacement and laser alignment.



## XYZ OPTIMIZATION

The BioScope II XY-scanning sample stage provides a dynamic range of scan sizes for practically any life science study. To permit imaging of taller biological structures, such as cells, the BioScope II offers a Z range greater than 15µm. Meanwhile, an X-Y range that exceeds 150µm lets users better match cell/sample size to scan area and easily correlate AFM data with optical/fluorescence images.

With low-noise closed loop scanning capabilities in all three-axes, the BioScope II allows accurate offsetting to features of interest and routine "pulling" capabilities. Precise positioning of the sample over a 10mm x 10mm range is provided by a motorized X-Y stage under either computer or joystick control.

## OUTSTANDING OPTICAL/PHYSICAL ACCESS

The BioScope II is engineered for easy integration with today's most powerful inverted optical microscopes, thus providing researchers with high-quality data and biosample compatibility.

True top-down optical access afforded by the unique design of the scanner head provides complete compatibility with most off-the-shelf condensers up to 0.55NA, allowing uncompromised use of brightfield, darkfield, phase contrast, and differential interference contrast (DIC) optical microscopy. The AFM sample stage also accommodates high magnification objective lenses, including water and oil immersion objectives, such that optical resolution is not compromised.

The open physical access to the area surrounding the AFM tip and sample also allows for easy addition/exchange of imaging fluids, as well as the potential for introduction of mechanical probes without interfering with the optical pathway.

## OPTICAL/AFM TECHNIQUE INTEGRATION

While the BioScope II can be operated as a stand-alone AFM system, it can also be integrated with a number of more advanced optical techniques, such as epifluorescence, CLSM, TIRF, FRAP, and FRET. These types of "Multimodal" imaging platforms provide a powerful approach for yielding in-situ correlated information on the structure-function relationship of biomolecules and biological processes. A standard 850nm IR laser is utilized for deflection detection, thus effectively eliminating interference with common red-emitting biological fluorophores.

## ADVANCED ENVIRONMENTAL CONTROL

Fast, simple instrument setup improves time-to-results and greatly reduces sample degradation. For studies requiring a more physiologically related environment, the BioScope II offers a soft-sealed perfusion ring. Combined with a magnetically held condensation window, this 'soft-sealed' cell affords control of the liquid/chemical environment, as well as of the gaseous environment above the sample, thereby enabling long-term imaging of oxygen- or pH-sensitive samples such as anaerobic cell types. The 'soft sealed' environment reduces evaporation to facilitate imaging of self-assembly processes and molecular interactions in real-time. For reliable repeated use, the perfusion ring can be safely disinfected by autoclaving.

A fluid heating stage (RT to 60°C) with thermistor feedback is also available for the BioScope II. This stage easily replaces the standard sample stage and can be used alone or in combination with the perfusion cell to maintain live cell samples over long periods of time while imaging. It also enables the study of thermally activated processes such as crystal formation/dissolution and lipid membrane phase transitions.

Image 1: TappingMode AFM image of an individual human DNA complex transcription factor. 252nm scan.

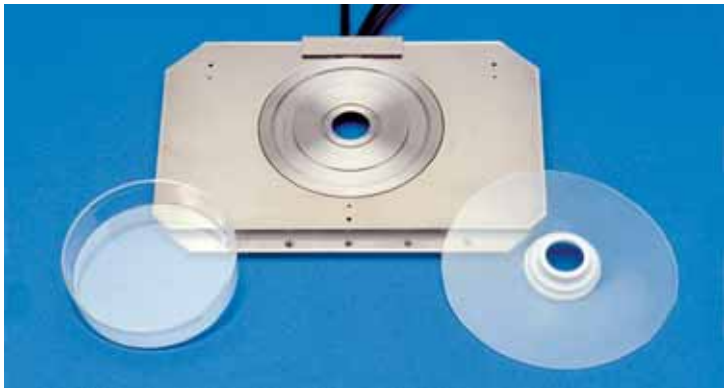
Image 2: Interaction between the A-Beta amyloid protein and a membrane surface. 10µm scan.

Image 3: Cheek epithelial cells imaged using TappingMode in air. 150µm scan.

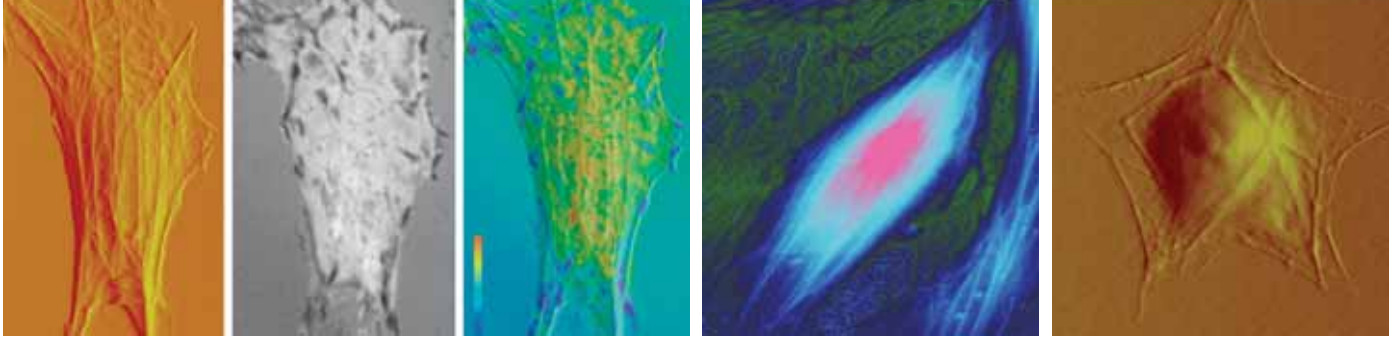
Image 4: DNA molecules. 1µm scan.

# diBioScope SZ

## High-Quality AFM with Exceptional Resolution



Engineered for biological research, the BioScope SZ atomic force microscope is an easy-to-use, single-instrument solution for demanding life science applications. The BioScope SZ combines the superb resolution of a high-power inverted optical microscope with advanced scanning technology and sensored-Z pico-Newton "pulling" capabilities, thus enabling high resolution studies of both the structural and mechanical properties of biomolecules and biomolecular assemblies. Compatible with most high-end commercial inverted optical microscopes, the BioScope SZ delivers impressive power and flexibility as well as familiar sample preparation, mounting, and optical capabilities.



## ADVANCED XYZ SCANNING TECHNOLOGY

The BioScope SZ incorporates Veeco's patented Hybrid XYZ scanner. The Hybrid head combines the benefits of tube scanner technology with a uniquely designed, sensored-Z scanner to deliver unprecedented accuracy in a three-axis closed-loop scanner. These capabilities significantly expand the benefits of the BioScope SZ system, offering a low noise floor and thus high precision for biological pulling techniques. Coupled with closed-loop XY-scanning capabilities researchers can locate a specific feature, zoom in, and then pull or indent (with pico-Newton accuracy) to observe protein folding and unfolding and manipulate single molecules, all with exceptional image quality.

The BioScope SZ's automated sample approach and engagement, combined with the precision of an optional motorized sample stage, make imaging fast, easy, and convenient. A proprietary TrakScan laser-tracking system accurately tracks the probe tip without moving the laser itself, which results in greater stability and the reduction of image bow artifacts. Unlike other scanning-tip designs, TrakScan technology maintains constant forces on the sample, improving the image and measurement quality and further reducing the potential for sample damage.

## OPTICAL/AFM TECHNIQUE INTEGRATION

While the BioScope SZ can be used for stand-alone operation, it is designed for integration with high-end inverted optical microscopes. The rigid AFM sample stage replaces that of the optical microscope and drastically reduces vibration and noise, and greatly improves image quality. The sample stage also accommodates high magnification objective lenses, including water and oil immersion objectives, such that optical resolution is not compromised.

The integration of microscopy techniques expands the capabilities of the BioScope SZ as a "multimodal" imaging platform to provide a powerful approach for yielding in-situ correlated information on the structure-function relationship of biomolecules and biological processes. The BioScope SZ can be combined with optical techniques that utilize optical illumination and detection from beneath the sample, including reflected light brightfield microscopy, as well as more advanced techniques such as epifluorescence, CLSM, TIRF, FRET and FRAP. Users can also integrate custom, top-down illumination utilizing the provided side-angle mirror. The AFM operates from above the sample with an optional concurrent optical and video presentation, so the sample can be viewed as it is imaged.

When necessary, the light-weight BioScope SZ can easily be removed, thus allowing use of the optical microscope for transmitted-light techniques, including transmitted brightfield, darkfield, phase contrast, and differential interference contrast (DIC) microscopy. When atomic force microscopy is needed, the AFM unit is simply replaced on the stage and the tip repositioned with reasonable spatial accuracy.

## ENVIRONMENTAL CONTROL

For studies requiring a more physiologically related environment, the BioScope SZ offers a Fluid Heater Package (for use with 60mm Petri Dishes) that includes a heater sample stage (RT to 60°C) with thermistor feedback that easily replaces the standard sample stage. Combined with an evaporation cover this not only allows in-situ observation of thermally activated processes such as crystal dissolution/formation and lipid membrane phase transitions, it also facilitates imaging of live cells over extended periods of time.

Image 1: Vascular smooth muscle cells (VSMC) imaged by contact mode AFM (a) and IRM (b) overlapping of the two images (c). 46µm x 82µm.

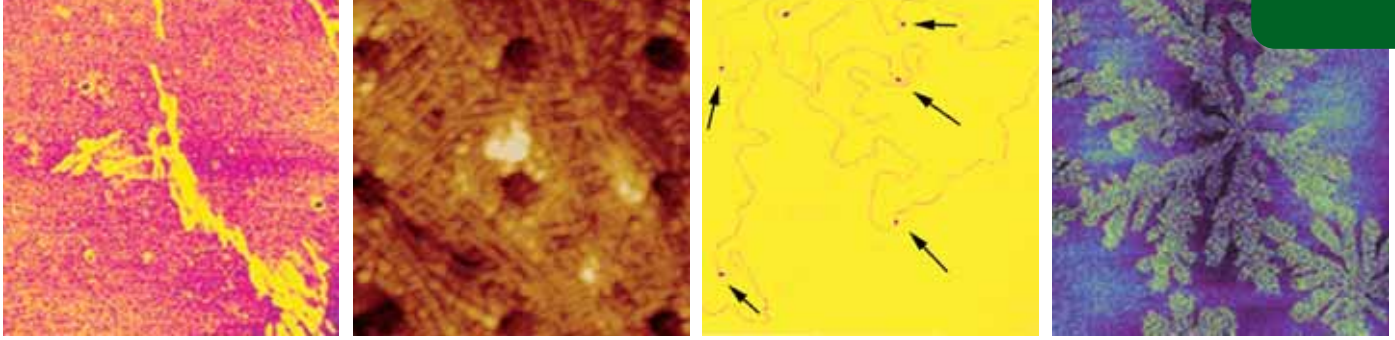
Image 2: Contact AFM (height) of living endothelial cells. 65µm scan.

Image 3: Microvascular endothelial cell isolated from a coronary exchange venule. 76µm scan.

# diMultiMode V

## The Highest-Performance SPM Available for Bioscience

The MultiMode® V represents the next generation of the world's highest-resolution, most application-proven commercial scanning probe microscope (SPM). Its compact hardware design and user-friendly, powerful software allow the MultiMode V to easily acquire high-resolution data on a wide range of biological samples – from single protein molecules and protein crystals to more complex biomolecular assemblies such as protein-membrane interactions, cells and tissue samples. Proven productivity, flexibility, and reliability have made the MultiMode SPM the gold standard in life sciences.



## THE WORLD'S HIGHEST RESOLUTION

Every facet of the MultiMode V system's electronic and mechanical design has been optimized for the highest resolution, including a short mechanical path, rigid vibration-free construction, and ultra-low-noise electronics. The high resolution of the MultiMode has helped lead to more scientific publications than all competitive SPMs combined. The MultiMode V system is capable of performing a full range of SPM techniques on small samples. It is an ideal choice for high-resolution and single-molecule imaging applications.

## SUPERIOR SCANNING

The MultiMode V features multiple scanners that permit each user to tailor the system for individual research. Scanners with large scan ranges up to 125 microns on the X-Y axes and a Z range up to 6 microns, as well as high-resolution scanners with 0.5 microns on the X-Y axes and submicron Z range, are available. The vertical-engage "JV" and "EV" scanners let users position the tip at any point on the surface without adjusting for lateral movement of the tip during approach.

## ENVIRONMENTAL CONTROL

For studies requiring a more physiologically related environment, the MultiMode V offers a choice of heating and cooling packages, depending on the specific requirements of your biological application. These packages provide the appropriate imaging conditions for in-situ observation of thermally activated processes such as crystal dissolution/formation and lipid membrane phase transitions, as well as facilitate imaging of live cells over extended periods of time.

The air/fluid heater package (RT to 60°C) includes a heater element that is simply seated on top of the standard MultiMode scanner. The heat applied to the sample is controlled by Veeco's Thermal Application Controller (TAC) and can be operated in air, liquid, or controlled gaseous environments. When heating is not necessary, the heating assembly is easily removed from the scanner for MultiMode operation under ambient conditions.

The heater/cooler package (-35°C up to 100°C) includes a specially designed scanner, having a nominal XYZ range of 125 x 125 x 5 microns, that is water-cooled to avoid the need for recalibration of the scanner at different temperatures. For heating studies conducted in TappingMode in air, a tip-heater assembly simultaneously elevates the temperature of the tip to prevent condensation formation on the AFM probe.

For Contact Mode and TappingMode AFM imaging in fluid environments, the MultiMode uses a closed fluid cell, consisting of a glass cantilever holder and a silicon o-ring, which form an enclosed fluid environment around the sample. Inlet and outlet ports in the holder provide the ability to exchange liquids (flow cell). This facilitates in-situ adjustment of the pH or ionic strength of imaging solution, as well as the ability to add/remove chemicals or biomolecules for self-assembly studies. For heating and/or cooling studies, a specialized fluid cell not only facilitates close control of fluid flow through the inlet and outlet ports, but also allows monitoring of the local temperature in the region immediately surrounding the sample through a third port using a customer-supplied temperature probe.

Image 1: TappingMode image acquired in air of recombinant human tropoelastin peptide on HOPG. 2µm scan.

Image 2: Polypropylene, Pits ~30nm deep. 2µm scan.

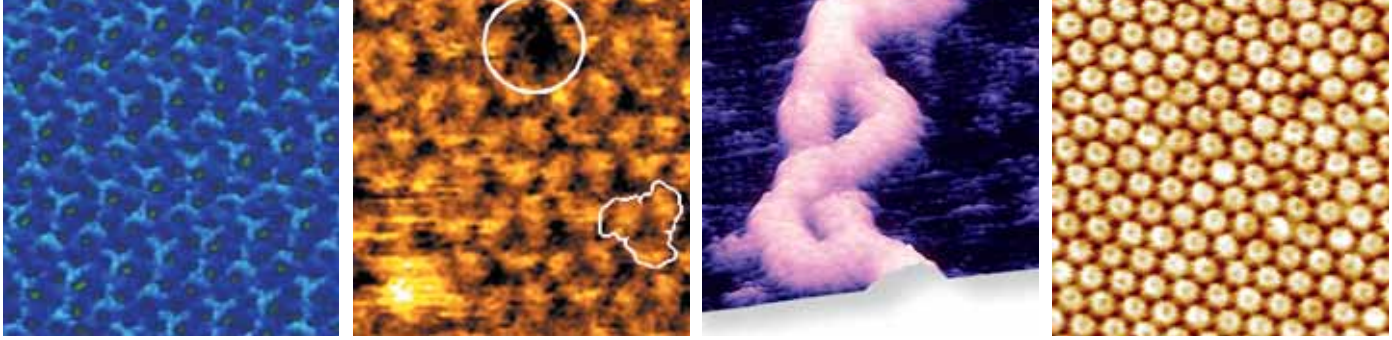
Image 3: Lambda DNA imaged by TappingMode AFM. 1.5µm scan.

Image 4: Lipid film deposited by Langmuir-Blodgett technique on mica. 100µm scan.

# diMultiMode PicoForce

## Industry-Leading “Force Pulling” and Ease of Use

The MultiMode® PicoForce™ brings unprecedented accuracy and flexibility to molecular biology and nanoscale materials research. With its innovative force-measurement features and proven MultiMode SPM technology, the PicoForce is ideally suited for a broad variety of studies, from protein unfolding and antigen-antibody binding to membrane elasticity and adhesion mapping. The modular design of the PicoForce makes it simple for existing MultiMode users to upgrade to this remarkable SPM force-measurement system.



## PERFORMANCE, PRECISION AND RESOLUTION

The PicoForce system offers precise force measurements and high-resolution scanning. The PicoForce scanner incorporates a closed-loop Z axis with a vertical range of 20 microns and an X-Y scan size of greater than 40 microns. The PicoForce scanner completely eliminates piezo creep, hysteresis, and nonlinearity, permitting unprecedented accuracy and precision in nanoscale research. This enables force measurements that are simply not possible with open-loop Z axis scanners.

When used in conjunction with our full line of MultiMode open-loop scanners, however, the PicoForce system is still able to offer the highest-resolution scanning available. MultiMode SPMs have always held the distinction of delivering the best resolution in the industry due to a host of resolution-enhancing design features, such as a short mechanical path, rigid vibration-free construction, and low-noise electronics. With the MultiMode PicoForce, you can easily switch between the PicoForce scanner and standard MultiMode scanners to best match the system's capabilities to your experiment's demands.

## SOFTWARE OPTIMIZED FOR FORCE STUDIES

The PicoForce system comes with version 7 NanoScope® software, which contains application routines designed specifically for force spectroscopy. Based on more than 15 years of SPM experience and thousands of hours of customer input, the NanoScope platform offers extensive functionality while delivering customized analysis for specific force studies, such as single-molecule pulling data. Other software features include automatic cantilever spring constant calibration, user-defined "scripting" for flexible design of experiments, and powerful off-line processing and exporting tools.

## INNOVATIVE OPERATIONAL FEATURES

The handheld PicoAngler™ allows the user to manually explore tip-sample interactions with unprecedented ease. This innovative tool is particularly useful for single-molecule force spectroscopy, providing highly sensitive approach and retraction of the cantilever tip. Via its force-feedback feature, the PicoAngler enables the user to "feel" the force of interaction (e.g., of a molecule stretching and then suddenly unfolding). Four different levels of sensitivity for manual control of the Z axis and force-feedback allow exploration of interactions over a wide range of distances and forces.

In addition, the MultiMode PicoForce system includes a low-noise SPM head that achieves true thermally limited deflection measurements with soft cantilevers. The state-of-the-art head dramatically reduces the periodic noise that sometimes appears in force curves on standard SPM systems, thus eliminating noise that can interfere with force spectroscopy measurements in the pico-Newton range.

Unlike other systems, the MultiMode PicoForce utilizes a fully automatic, proprietary tip approach that prevents tip-damaging collisions between the probe and the sample surface. The MultiMode PicoForce also uses a safer and simpler-to-align laser than competing systems.

Image 1: Periplasmic surface topography of OmpF porin from E. coli. 70nm scan.

Image 2: SPM topograph of the cytoplasmic surface of a wild-type purple membrane. 10nm scan.

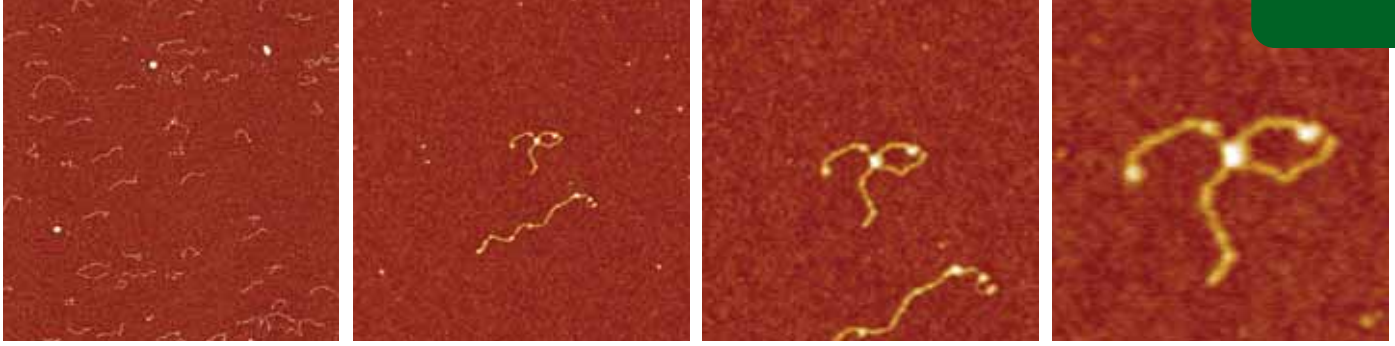
Image 3: Two linear ds DNA molecules overlapping each other. 155nm scan.

Image 4: Bacterial surface coat from Deinococcus radiodurans (HPI layer). 220nm scan.

# diNanoScope V Controller

## Our State-of-the-Art, Fifth-Generation Controller Is Here

Many Veeco systems for the life sciences now utilize our new NanoScope V controller. This controller delivers high-pixel-density images, up to 5120 x 5120, so there's no need to go back and repeat a scan. The high pixel density saves the users time when searching for low-density features distributed over large areas, reduces the need to capture several images at lower pixel densities and eliminates the requirement for offset adjustments to correlate information from multiple images. It also allows observation of large structures and small features in the same scan.



## FAST, DEPENDABLE DATA CAPTURE

The new NanoScope V controller utilizes advanced electronics, including A/D and D/A converters operating at 50MHz, to deliver reliable, high-speed data capture. This state-of-the-art fifth-generation controller allows measurement of tip-sample/cantilever dynamics, enabling researchers to study the influence of mechanical properties on the physics of probe-sample interactions. This is enabling a wide range of new, advanced single molecule pulling experiments.

## FLEXIBLE CONTROLLER FEATURES

The controller incorporates three independent lock-in amplifiers and provides thermal tune measurements of cantilever resonances up to 2MHz. It also affords easy access to most input and output signals through front-panel BNCs. Input data into the controller from an external source (e.g., photomultiplier tube) is supported, as is user access to lock-in amplifiers and to signals to/from a microscope (e.g., XYZ sensors, amplitude, phase).

The NanoScope V captures everything by displaying (and acquiring for analysis) up to eight images in real-time with unprecedented signal-to-noise ratio. Thus, users can collect information about multiple properties of a sample concurrently. For example, this controller allows the user to do Magnetic Force Microscopy (MFM) and tapping while capturing height, phase, and amplitude in the tapping line, as well as frequency and amplitude in the lift line.

## OUTSTANDING SOFTWARE FUNCTIONALITY

Furthermore, the NanoScope V offers both outstanding software functionality and compatibility. An expansive set of functions is provided to control the SPM for custom experiments and nanoscale research. These functions can also be called from many programming languages that can act as a client of Microsoft's Component Object Model (COM).

## EASY-AFM, REMARKABLE SIMPLICITY

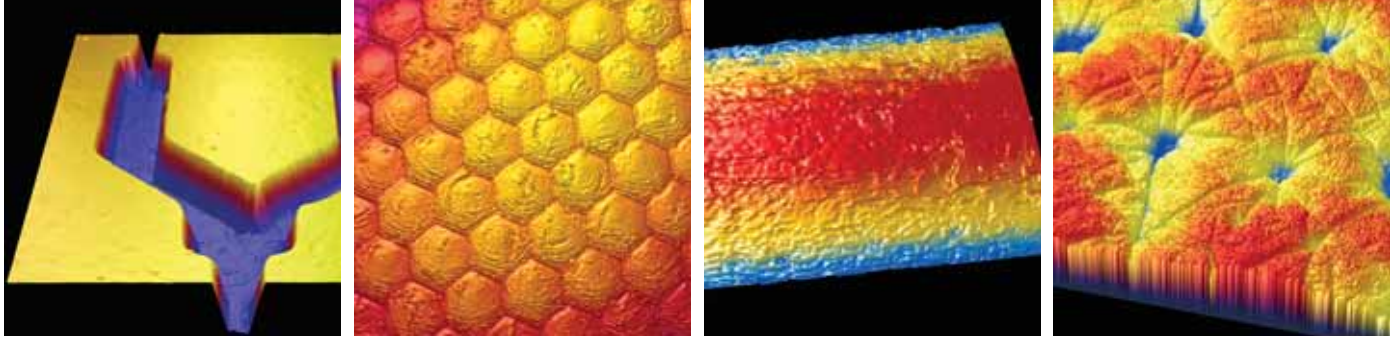
For the ultimate in streamlined operational simplicity, Veeco's Easy-AFM™ offers an intuitive, easy-to-follow graphic user interface for new or infrequent SPM users. It reduces the time for initial setup by engaging the sample with the probe (in air), automatically adjusting the scanning parameters, and obtaining high-quality TappingMode™ images on most samples at a push of a button. Easy-AFM is ideal for multi-user environments.

Images: 5120 x 5120 pixel DNA image and successive offline zooms. 5µm original scan. Zoom areas 1µm, 500nm, and 250nm.

# Wyko NT1100
# Optical Profiling System

## Performance, Accuracy, and Flexibility in a Small Footprint


The cost-effective Wyko® NT1100 optical profiler features an easy measurement setup, fast acquisition, angstrom-level repeatability, and sub-nanometer vertical resolution at all magnifications. As a table-top profiler, it fits easily into any laboratory. A data stitching option adds a motorized stage and support software to rapidly scan large surface areas. The NT1100 system's combination of manual controls, analytical options, and high level of performance make it an ideal tool for research and limited-run production.



## FAST, NON-CONTACT 3D SURFACE CHARACTERIZATION

The NT1100 provides quantitative measurements for surfaces that are rough or smooth, hard or soft, adhesive, deflectable, or otherwise difficult to measure. This system provides a competitive research edge in a vast array of bio-materials investigations, on everything from plastics, polymers, and ceramics to metallic implants and soft tissues.

The basic operation of an optical profiler is to pass white light through a beam splitter, which directs the light to the sample surface and a reference mirror. When the light reflected from these two surfaces recombines, a pattern of interference "fringes" forms that reveals the sample surface, similar to the way topographic lines show elevation on a map. Optical profiling, also known as white light interferometry, is thus a non-contact technique for determining small-scale surface texture and shape.

One of the primary advantages of optical profilometry is its non-contact method. This is a benefit in measuring softer materials and coatings where physical contact runs the risk of altering the surface. This same advantage also allows the NT1100 to "look" through an open structure, for example to measure the internal surface of a stent through its mesh framework. Only optical profiling has this capability. Other surface topography benefits of the NT1100 for bio-research include three-dimensional texture measurements, fast measurement time, high lateral and vertical resolution, high vertical scan range, excellent repeatability, and over two thousand parameters to fully analyze surface shape and quality.

## ADVANCED, POWERFUL ANALYSIS

Wyko Vision® analysis software is standard on all NT Series profilers. This powerful package provides thorough computational analyses, furnishing hundreds of parameters and analysis tools. The easy-to-use Windows®-based package includes Wizards, On-Line Help, and customization functions that speed operation and shorten the learning curve. An intuitive editor enables users to design custom output screens, and user-configurable menus and toolbars match Vision to the users' work. Optional analysis and communication packages even further extend the functionality of the NT Series instruments, delivering remote control of measurements and automation, the generation of custom parameters, and much more.

## ENHANCED MEDICAL DEVICE EFFICACY

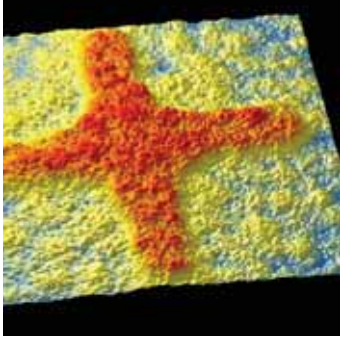
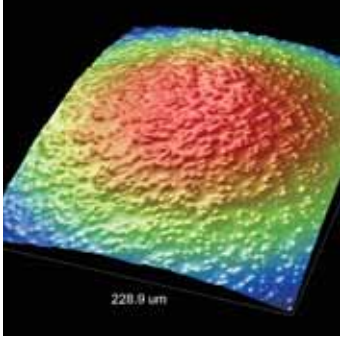
The NT1100 has numerous applications in the characterization of implanted devices and prostheses, ranging from measurements of vascular stents, prosthetic hips and other joint replacements to analyzing the components of dental implants. These devices use a variety of metallic, ceramic and polymeric materials to provide the required combination of structural strength, bio-compatibility, osseointegration, and in the case of joints, low-friction load-bearing surfaces. For example, manufacturers of replacement joints strive to develop tough, long-lasting implants that bond well and cause no biological complications. The NT1100 system's 3D surface characterization has allowed researchers to more accurately investigate the joint materials prior to implantation and also after failure to quantitatively evaluate performance and wear characteristics.

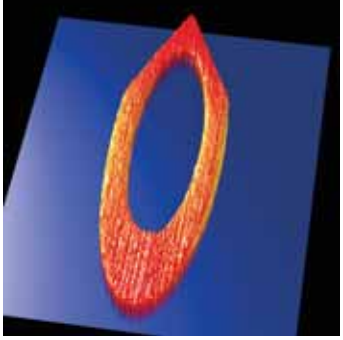
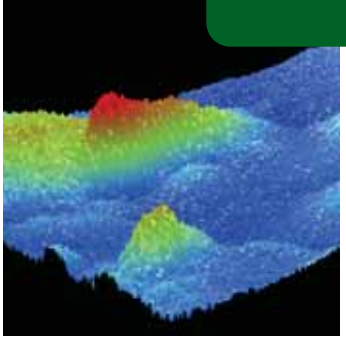
Image 1: Microfluidic channels. 1.9mm x 2.4mm FOV.
Image 2: Grasshopper eye. 309µm x 235µm FOV.
Image 3: Syringe tip roughness. 230µm x 300µm FOV.
Image 4: Human skin tissue. 2.9mm x 3.8mm FOV.

# Wyko NT8000
# Optical Profiling System

## Simply the World's Most Powerful Profiler

The eighth-generation NT8000 is simply the most capable profiler available, combining 100-micron-per-second scan speed, an 8-millimeter scan range, and full automation for demanding biomedical and other production applications. A unique, internal reference signal enables self-calibrating accuracy over the entire scan range. The NT8000 provides non-contact surface measurement of bio-materials, improving the quantification and efficacy of medical implants and device coatings as well as delivering a means of automatically investigating a host of surface characteristics and interactions.

## LEGACY OF INNOVATION AND PERFORMANCE

Veeco optical profiling technology has led research and industry for decades, boasting the world's first white light profiler, the world's first 3D optical profiler, the world's first non-contact profiler using phase-shifting interferometry, and the world's first self-calibrating optical profiler. The NT8000 is the culmination of all these firsts. Wyko Vision analytical software harnesses the many application functions, and renders the NT8000 data easy to understand and utilize in scientific research. The automation-capable system helps shorten the production ramp with highly repeatable, high-volume measurement and the largest available vertical range and scan speed.

## COATING THICKNESS, UNIFORMITY AND ROUGHNESS

Veeco's Film Analysis Application, a Wyko Vision software option, quantifies coating thicknesses from approximately 100 nanometers and above. The package utilizes two algorithms for film measurements. The Envelope algorithm measures film thickness down to about 2 microns, whereas the Fourier Transform algorithm extends the film thickness measurement to less than 0.1 micron. Using these algorithms, researchers and manufacturers are provided a repeatable and simple means of displaying critical parameter data for top and bottom surfaces of a coating or multiple coatings, as well as detailed information about the underlying substrate.

## BIO-MATERIALS FLEXIBILITY

The physical parameters of surface topography and roughness, component dimensions, radius of curvature, and coating thickness are critical factors that impact the successful utilization and medical benefit of the many types of bio-materials that make up implants, coatings, and medical instrumentation. The NT8000 is the ideal system to perform both scientific research on these bio-materials and production QC for manufacturers in life science markets.

For example, inspection of arterial stents must be rapid, accurate, and non-damaging. The NT8000 profiler fits these requirements and can also perform these measurements not only on the outside surface of the stents, but on the inside as well. The system also allows manufacturers to simultaneously measure the coating roughness and thickness, as well as the roughness of the stainless steel below the drug coating. The potential defects the NT8000 characterizes include broken struts, scratches, pits, improperly carved junctions, surface contamination, and incorrect thickness and uniformity of the various coating layers.

Similarly, the major factor affecting long term hip replacement success is the progressive shedding of minute amounts of material from the implant. The resulting wear often causes pain and eventual loosening of the prosthesis, as well as a number of medical complications. The NT8000 profiler has enabled biomaterial advances through investigation of new bearing materials, and there are now several different options when hip replacement surgery is considered. The system has also characterized the bonding surface, allowing a tighter and longer lasting replacement, with a faster patient recovery time.

Image 1: Test site on glucose monitor strip. 1.2mm x 0.9mm FOV.
Image 2: Hip implant, a steel femoral head. 228µm x 304mm FOV.
Image 3: Shape and texture of a syringe tip. 2mm x 5.4mm FOV.
Image 4: Parylene coating on a stent. 120µm x 90µm FOV.

## AFM Systems

This chart provides a brief summary of the key features afforded by Veeco's AFM systems for the life sciences.

| | Imaging | Force Pulling | Sample Access |
|---|---|---|---|
| MultiMode V | Best resolution available | Routine force pulling | Limited to small samples |
| PicoForce | Routine imaging applications | Single molecule force pulling | Limited to small samples |
| BioScope SZ | High resolution | Routine force pulling | Petri dishes and glass slides |
| BioScope II | Combined optical/ AFM biological applications | Routine force pulling | Petri dishes and glass slides |

## Wyko NT Series Optical Profilers

The following chart provides a brief comparison between select specifications of the NT Series Profilers.

| | Form Factor | Z Range | Max. Scan Speed | Sample Stage |
|---|---|---|---|---|
| NT1100 | Bench top | 1mm standard; 2mm optional | 7.2µm m/sec | 100mm (4 in) manual; optional 100mm motorized |
| NT8000 | Integrated air table | 8mm standard | 100µm/sec | 200mm (8 in) or optional 300mm (12 in) programmable |

## Veeco Probes

Veeco Probes offers the world's largest selection of AFM probes and accessories for bioscience applications. For our full list of probes and accessories, please contact us at 1-800-715-8440.

| Sample Type | Probe Family/Model | |
|---|---|---|
| Biomolecules (nucleic acids, proteins, lipids, carbohydrates, etc.) | Silicon | OTESPA |
| | | RTESP |
| | | TESP |
| Biomolecules (nucleic acids, proteins, lipids, carbohydrates, etc.) | Silicon nitride | (D)NP-S |
| | | NP-STT |
| | | OTR4 |
| Cells | Silicon nitride | (D)NP |
| Tissues | Silicon | TESP |
| | | (D)NP |
| Tissues | Silicon nitride | (D)NP-S |
| Biomaterials | Silicon | FESP |
| | | OTESPA |
| | | TESP |
| Force measurements | Silicon nitride | (D)NP |
| Force measurements | | MSCT |

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

| Optical Integration | LED | Scanning Mechanism | Scan Sizes | Environment |
|---|---|---|---|---|
| Top-down (OMV) | Visible | Sample (XYZ) | 125µm x 125µm; 5µm (Z) | Heating cooling closed fluid cell |
| Top-down (OMV) | Visible | Sample (XYZ) | 40µm x 40µm; 20µm (Z) | Heating cooling closed fluid cell |
| Bottom-up (brightfield & fluorescence) | Visible | Tip (XYZ) | 90µm x 90µm; 8µm (Z) | Heating |
| Top-down (bright/darkfield, DIC) Bottom-up (brightfield & fluorescence) | IR | Tip (Z); Sample (XY) | 150µm x 150µm; ≥15µm (Z) | Heating and perfusion |

| Z Stage | Optics | Other Automation | Environment |
|---|---|---|---|
| Manual | Single objective or manual turret, manual field of view multipliers | Focus stitching optional | Secondary standards |
| Computer-controlled | Single objective, manual or motorized turret automated field of view multipliers | Focus intensity; high-speed autofocus tip/tilt, stiching optional | Self-calibrating to internal primary standard |

| Experiment | | AFM Mode | |
|---|---|---|---|
| Liquid | Air | Tapping | Contact |
| — | x | x | — |
| — | x | x | — |
| — | x | x | — |
| x | — | x | x |
| x | — | x | x |
| x | — | x | x |
| x | — | x | x |
| — | x | x | — |
| x | — | x | — |
| x | — | x | — |
| — | x | x | — |
| — | x | x | — |
| — | x | x | — |
| x | — | — | x |
| x | — | — | — |

# Technology Enabled By Veeco Instrumentation

Here is a partial bibliography of the more than 2300 scientific papers that have been published detailing the many biological AFM imaging and material interaction studies enabled by Veeco instrumentation.

■ Films of self-assembled purely helical type I collagen molecules
Author(s): Giuseppe Falini, Simona Fermani, Elisabetta Foresti, Bruna Parma, Katia Rubini, Maria Chiara Sidoti, Norberto Roveri
Source: Journal of Materials Chemistry, 14 (2004), 14 (July 14), 2297-2302

■ Measurement of interactions between protein layers adsorbed on silica by atomic force microscopy
Author(s): J.J. Valle-Delgado, J.A. Molina-Bolívar, F. Galisteo-González, M.J. Gálvez-Ruiz, A. Feiler, M.W. Rutland
Source: Journal of Physics: Condensed Matter, 16 (2004), 26 (July 07), S2383-S2392

■ Reversible Hydrophobic Barriers Introduced by Microcontact Printing: Application to Protein Microarrays
Author(s): Ye Zhou, Olof Andersson, Peter Lindberg, Bo Liedberg
Source: Mikrochimica Acta, 146 (2004), 3-4 (June), 193-205

■ Precipitation of lignin and extractives on kraft pulp: effect on surface chemistry, surface morphology and paper strength
Author(s): Krista Koljonen, Monika Osterberg, Marjatta Kleen, Agneta Fuhrmann, Per Stenius
Source: Cellulose, 11 (2004), 2 (June), 209-224

■ Preparation and characterization of cationic PLGA nanospheres as DNA carriers
Author(s): M.N.V. Ravi Kumar, U. Bakowsky, C.M. Lehr
Source: Biomaterials, 25 (2004), 10 (May), 1771-1777

■ Fractal aggregation of DNA after thermal denaturation
Author(s): L. Yan, H. Iwasaki
Source: Chaos, Solitons & Fractals, 20 (2004), 4 (May), 877-881

■ Exploring the consequences of attractive and repulsive interaction regimes in tapping mode atomic force microscopy of DNA
Author(s): Andrew N. Round, Mervyn J. Miles
Source: Nanotechnology, 15 (2004), 4 (April 01), S176-S183

■ Helical rosette nanotubes: a more effective orthopaedic implant material
Author(s): Ai Lin Chun, Jesus G. Moralez, Hicham Fenniri, Thomas J. Webster
Source: Nanotechnology, 15 (2004), 4 (April 01), S234-S239

■ In-vitro assessment of the biological response to nano-sized hydroxyapatite
Author(s): J. Huang, S.M. Best, W. Bonfield, R.A. Brooks, N. Rushton, S.N. Jayasinghe, M.J. Edirisinghe
Source: Journal of Materials Science: Materials in Medicine, 15 (2004), 4 (April), 441-445

■ Bioimprinted QCM sensors for virus detection-screening of plant sap
Author(s): Franz L. Dickert, Oliver Hayden, Roland Bindeus, Karl-J. Mann, Dieter Blaas, Elisabeth Waigmann
Source: Analytical and Bioanalytical Chemistry, 378 (2004), 8 (April), 1929-1934

■ High-throughput investigation of osteoblast response to polymer crystallinity: influence of nanometer-scale roughness on proliferation
Author(s): N.R. Washburn, K.M. Yamada, C.G. Simon, S.B. Kennedy, E.J. Amis
Source: Biomaterials, 25 (2004), 7-8 (March), 1215-1224

■ Self-assembled extracellular matrix protein networks by microcontact printing
Author(s): N. Sgarbi, D. Pisignano, F. Di Benedetto, G. Gigli, R. Cingolani, R. Rinaldi
Source: Biomaterials, 25 (2004), 7-8 (March), 1349-1353

■ Lactose Surface Modification by Decantation: Are Drug-Fine Lactose Ratios the Key to Better Dispersion of Salmeterol Xinafoate from Lactose-Interactive Mixtures?
Author(s): Nazrul Islam, Peter Stewart, Ian Larson, Patrick Hartley
Source: Pharmaceutical Research, 21 (2004), 3 (March), 492-499

■ Ultrastructure of Dental Enamel afflicted with Hypoplasia: An Atomic Force Microscopic Study
Author(s): N. Batina, V. Renugopalakrishnan, P.N. Casillas Lavin, J.C.H. Guerrero, M. Morales, R. Garduno-Juarez, S.L. Lakka
Source: Calcified Tissue International, 74 (2004), 3 (March), 294-301

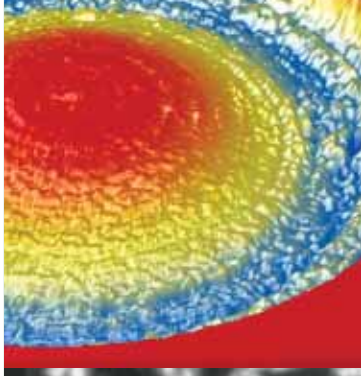
■ Intracellular structural changes under the stress of applied force at a nanometre range investigated by atomic force microscopy
Author(s): Dong Han, Wanyun Ma, Fulong Liao, Dieyan Chen
Source: Nanotechnology, 15 (2004), 1 (January 01), 120-126

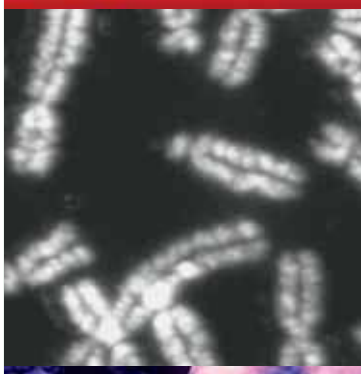
■ Endothelial and vascular smooth muscle cell function on poly(lactic-co-glycolic acid) with nano-structured surface features
Author(s): D.C. Miller, A. Thapa, K.M. Haberstroh, T.J. Webster
Source: Biomaterials, 25 (2004), 1 (January), 53-61

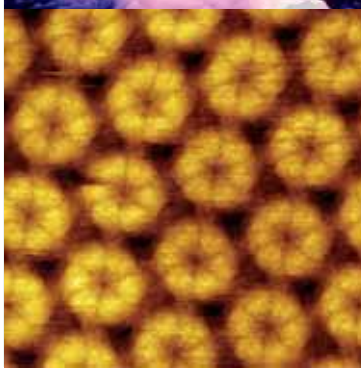
■ Detection of heavy metal ions using protein-functionalized microcantilever sensors
Author(s): S. Cherian, R.K. Gupta, B.C. Mullin, T. Thundat
Source: Biosensors and Bioelectronics, 19 (2003), 5 (December 30), 411 - 416

■ Time-series observation of the spreading out of microvessel endothelial cells with atomic force microscopy
Author(s): Han Dong, Ma Wanyun, Liao Fulong, Yeh Meiling, Ouyang Zhigang, Sun Yunxu
Source: Physics in Medicine and Biology, 48 (2003), 23 (December 07), 3897-3909

■ Passive Transport of Macromolecules through Xenopus laevis Nuclear Envelope
Author(s): K. Enss, T. Danker, A. Schlune, I. Buchholz, H. Oberleithner
Source: Journal of Membrane Biology, 196 (2003), 3 (December), 147-155







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