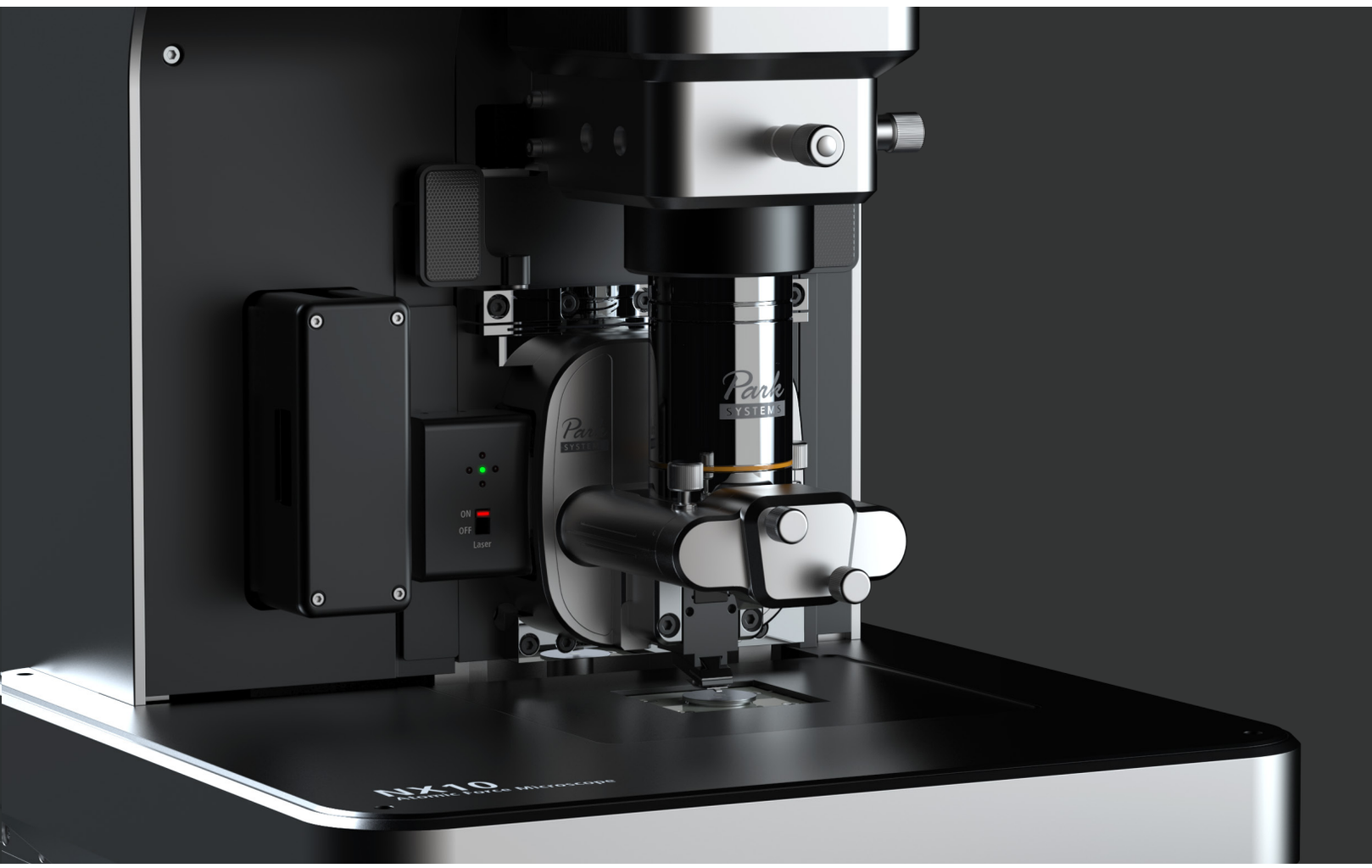
Park NX10

Proven Performance in Nanoscale Metrology



Park
SYSTEMS

Park NX10 is a flagship atomic force microscope (AFM) designed for small-sample research, delivering unmatched accuracy, reliability, and ease of use. As Park Systems' original small-sample AFM, it has earned global recognition in both academic and industrial laboratories for producing precise, repeatable nanoscale measurements.

At the core of the NX10 are Park's proprietary orthogonal scan system and True Non-contact™ mode, innovations that virtually eliminate lateral motion artifacts while protecting both tip and sample. Together, these technologies ensure artifact-free, high-resolution imaging even for the most delicate or challenging samples.

From materials science to polymers and bioengineering, NX10 delivers robust performance and dependable results, making it a trusted platform for advanced nanoscale metrology.

NX10 – Key Features

Outstanding AFM Performance

- True Non-Contact™ Mode
- Orthogonal Scan System
- Fast Z-Servo Speed

User Convenience

- Easy Probe Exchange
- Intuitive Laser Beam Alignment
- Recipe-Based Sequential Measurement

Additional Features

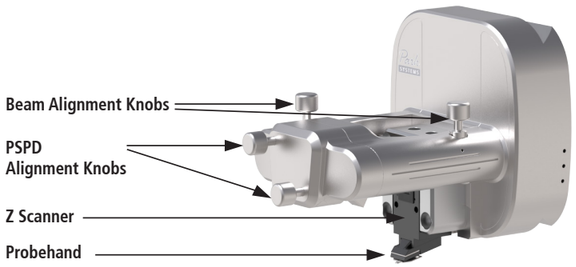
- Comprehensive Selection of AFM Modes
- Various Sample Chuck Options
- Pipette-Based Applications

Park NX10

The Most Advanced AFM for Small Samples

Fast Z Servo and High Resolution

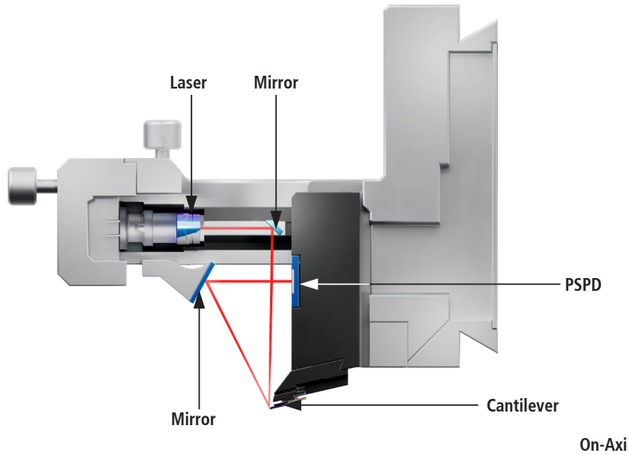
The resolution of the images in Park NX series has been further enhanced. The NX Z scanner, built with a stacked piezo actuator and a strain gauge sensor, delivers fast and precise measurements across a wide range of surfaces. From extremely flat to rough samples, it maintains consistent roughness linearity regardless of scan size, ensuring reliable results in any measurement.



NX Laser Beam Path

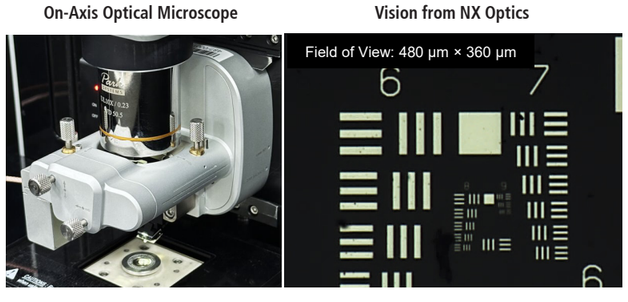
The NX head integrates a superluminescent diode that provides low coherence illumination, minimizing interference for stable signal detection. The laser beam is guided through precision mirrors to the cantilever and position-sensitive photodetector (PSPD), ensuring accurate signal alignment.

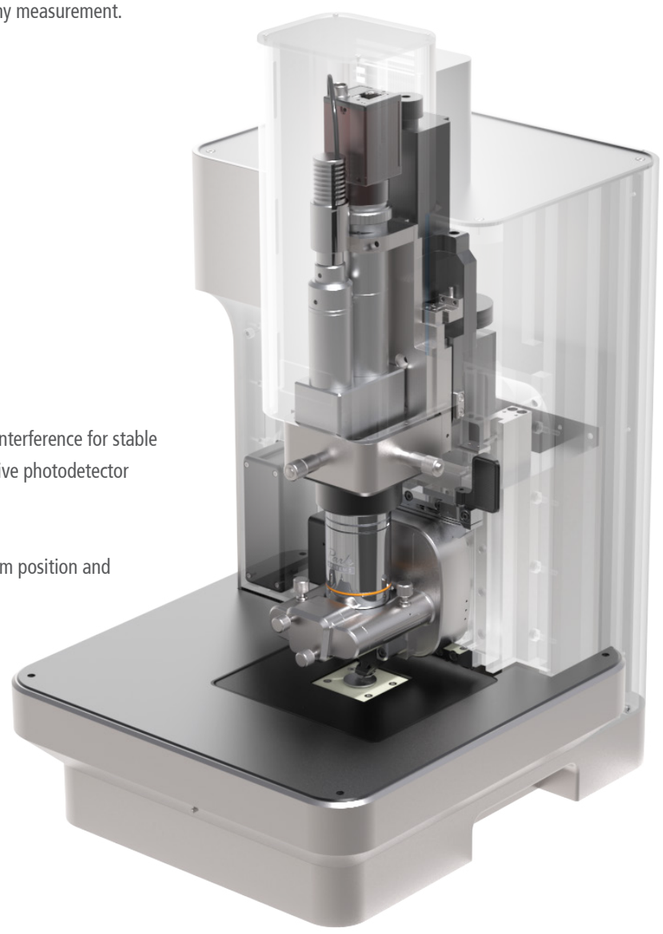
The knobs move the laser beam directly along the X and Y axes, allowing intuitive adjustment of the beam position and effortless realignment during probe replacement.



On-Axis Optical Microscope

The high-power on-axis optical microscope provides a clear view of the sample surface. A software-controlled LED light source illuminates the sample surface for better observation.

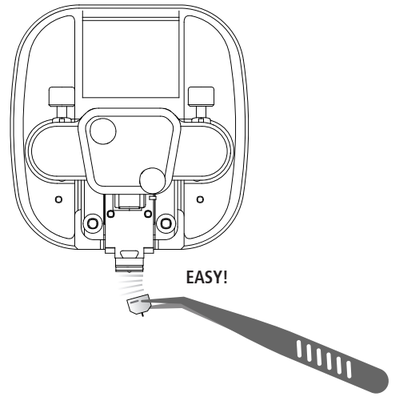




Pre-Mounted Probe

AFM probe exchange can be challenging, even for experienced users, often resulting in cantilever breakage. Park AFM addresses this by using pre-aligned probe chip carriers with kinematic mounting points, ensuring reliable and consistent tip positioning.

The NX head's Z scanner features three precision balls for kinematic mounting, complemented by magnets at the base to ensure a secure, reliable, and repeatable mounting position.



Simple Expansion Slot for Modes and Options

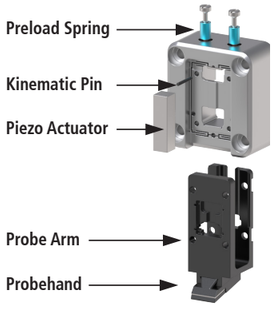
Simply plug an option module into the expansion slot to enable advanced AFM modes.

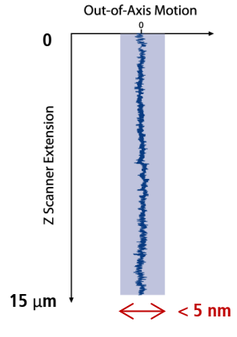
Park NX series AFM features a modular design, ensuring compatibility with options across its product line.

Improved Z Scan Straightness

Park NX series Z scanner maintains straightness within 0.1% across the usable range, with out-of-axis motion under 5 nm even at a full 15 µm extension.

Its compact assembly, combining a preload spring, kinematic pin, and piezo actuator, minimizes drift and ensures accurate vertical motion for reliable, distortion-free nanoscale measurements.

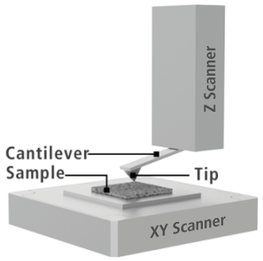




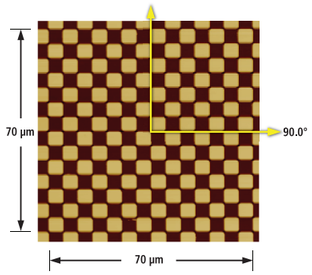
Park AFM Technology

Orthogonal Scan

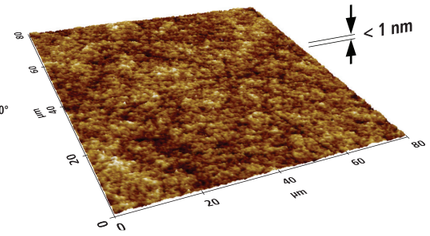
Conventional AFMs with tube scanners suffer from out-of-plane motion and axes crosstalk, resulting in image distortion, especially over large scan areas. NX10, like all Park AFMs, employs an advanced orthogonal scan system featuring a flexure-guided architecture: a 2D flexure scanner moves the sample in the XY plane, while a separate 1D flexure scanner independently controls the probe's Z-axis motion.
Equipped with low-noise optical sensors for XY feedback and an ultra-low-noise strain gauge sensor for Z control, this separated scanner system ensures highly orthogonal, linear scans with minimal out-of-plane motion and fast dynamic performance.



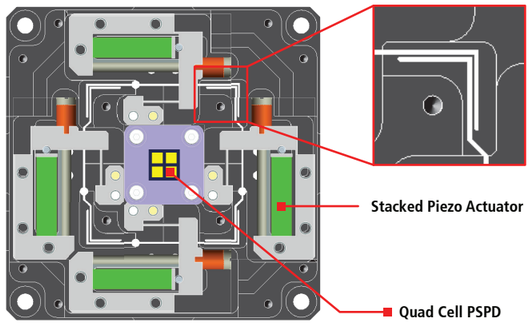
10 μm Pitch Calibration Grating



Optical Flat (80 × 80 μm)



Inside View of XY Scanner



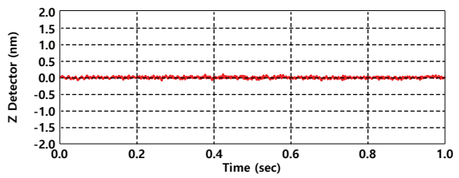
Flexure Hinge

The XY scanner is designed to achieve flat, purely horizontal motion without vertical interference by using stacked piezo actuators and flexure hinge structures. A position sensor is located at the center of the scanner to provide direct feedback for servo control, minimizing positioning errors across the scan area. This design ensures consistent accuracy and stability, even when scanning large samples.

Low Z Detector Noise

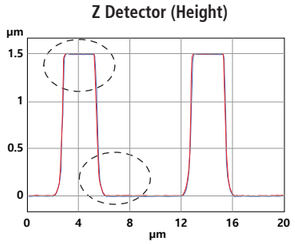
The Z detector has a noise level of less than 0.02 nm, enabling height measurements with sub-nanometer accuracy, down to 0.1 nm.
Unlike conventional Z voltage mapping, which often overshoots at stiff walls, the Z detector provides precise, conformal surface tracing.

Z Detector Noise

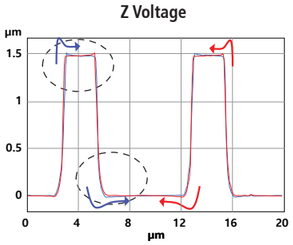


0.02 nm (rms), 1 kHz BW

Z Detector (Height)



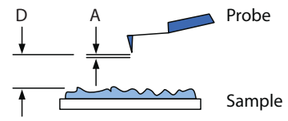
Z Voltage

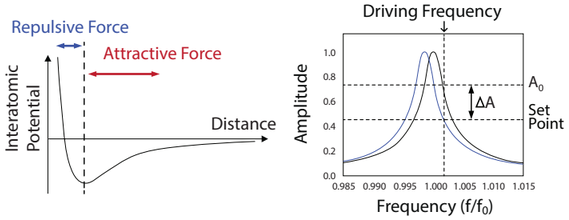


Forward scanning (→)
Backward scanning (←)

True Non-Contact™ Mode

NX10 features True Non-contact™ mode, a proprietary technology exclusively offered by Park Systems. True Non-contact mode obtains topography by detecting the attractive van der Waals force between the AFM tip and the sample surface.



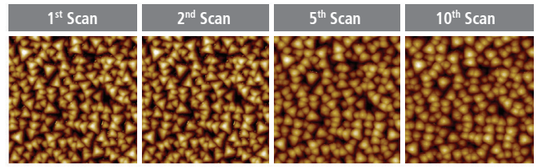


In True Non-contact mode, the tip oscillates at a frequency slightly higher than its resonance frequency, where the amplitude-frequency curve has its steepest slope.

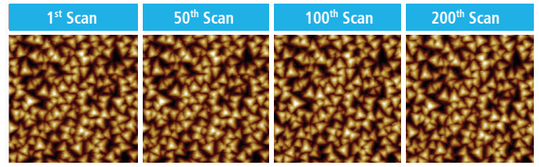
As the tip approaches the sample, the attractive force causes a downshift in the effective resonance frequency, leading to a decrease in oscillation amplitude at the driving frequency. The Z-servo maintains this new amplitude as the set point, keeping a constant tip-sample interaction while the tip scans in the XY direction.

An important advantage of True Non-contact mode, compared to tapping mode, is the prevention of tip wear and sample damage.
The results of repetitive scans on a chromium nitride (CrN) tip-checking sample show that while the tapping mode image became blurry after just a few scans due to tip wear, the True Non-contact mode image remained sharp even after 200 scans.

Tapping Mode



True Non-Contact Mode

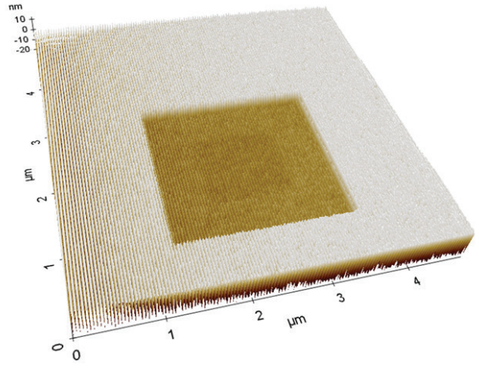


CrN Tip-checking Sample

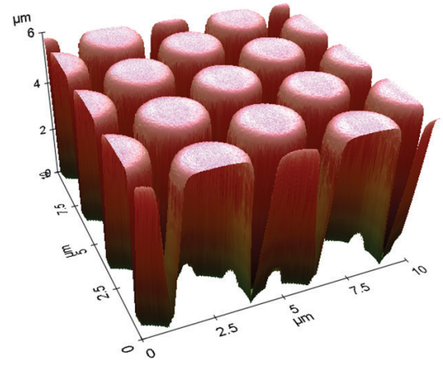
True Non-contact mode can measure soft and sticky samples as well as the most delicate and brittle samples, which cannot be imaged with tapping mode AFM. The image below is the topography of an unbaked photoresist acquired with True Non-contact mode, showing damages induced by electron beam irradiation during SEM scanning.

True Non-contact mode can also scan tall features. By sensing attractive forces not only at the apex of the tip but also along its sides, the Z-servo quickly retracts the tip as it approaches vertical features. With True Non-contact mode, deep holes and tall pillars like molds for nanoimprint can be measured, as in the image below.

Unbaked Photoresist



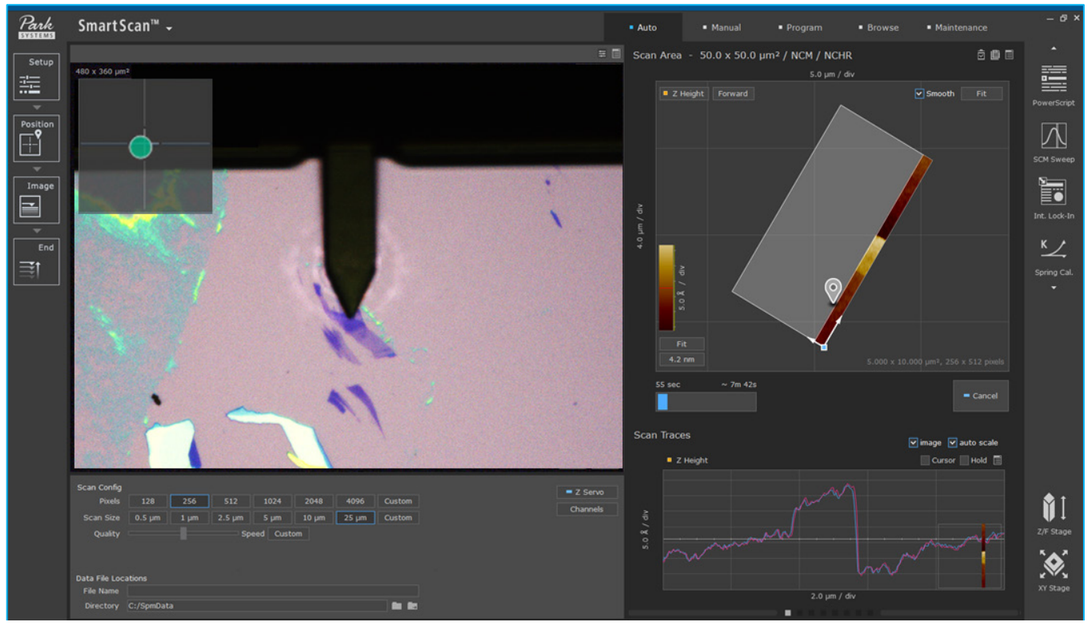
Mold for Nanoimprint



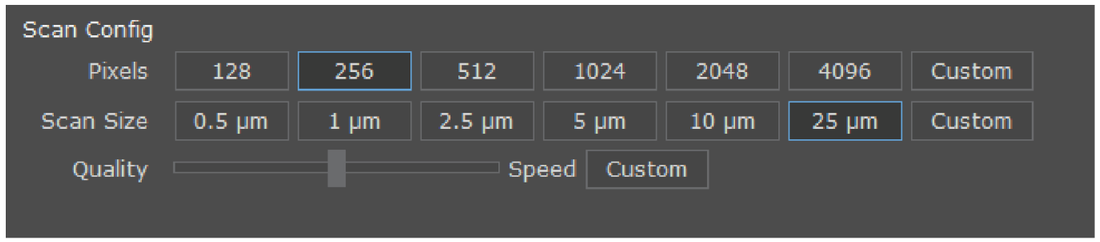
Park SmartScan™

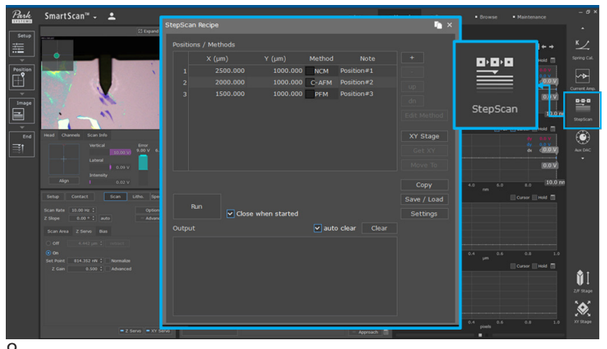
Bringing the Power and Versatility of AFM Technology to Everyone

NX10 comes with Park SmartScan™, an advanced AFM operating software that simplifies image acquisition and enhances usability with its intuitive interface and powerful automation features.



In conventional AFM systems, users must manually adjust numerous parameters, such as Z servo gains, force set point, and XY scan speed, often through trial and error. SmartScan eliminates this complexity by allowing users to choose only three parameters: pixel density, scan size, and quality vs. speed preference. Then, all other settings are automatically optimized in real time by analyzing sample geometry and obtaining the best possible AFM images. SmartScan reduces the operational burden and makes high-quality imaging accessible to users of all experience levels.





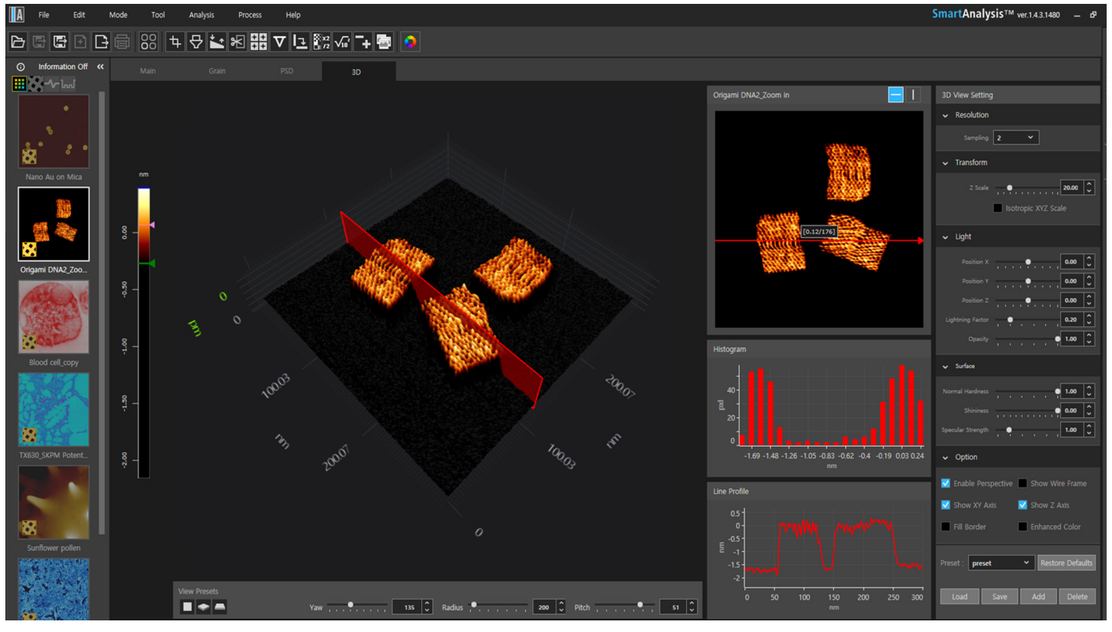
StepScan™

StepScan™ is an advanced Park SmartScan™ feature to pre-define measurement locations and recipes for efficient and consistent data acquisition.

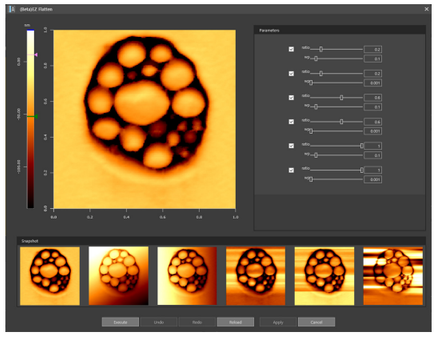
Park SmartAnalysis™

Streamlining AFM Data Workflow

Scan data from the NX10 can be analyzed with Park SmartAnalysis™, a powerful AFM image analysis software that enables fast image processing, comprehensive data analysis, and efficient result publication.



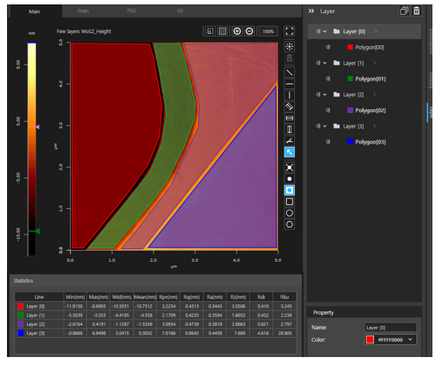
Styrenic Block Copolymer Topography
Postprocessed with EZ Flatten



EZ Flatten

Postprocessing AFM data to correct artifacts such as noise, sample tilt, and surface irregularities is a manual, tedious, and time-consuming task. SmartAnalysis simplifies this process through the EZ Flatten function. With six automatically flattened results using different flattening parameter sets, users can choose the version that most accurately represents the data.

Few Layers of MoS_2 Topography
Multiple Areas of Interest Assigned



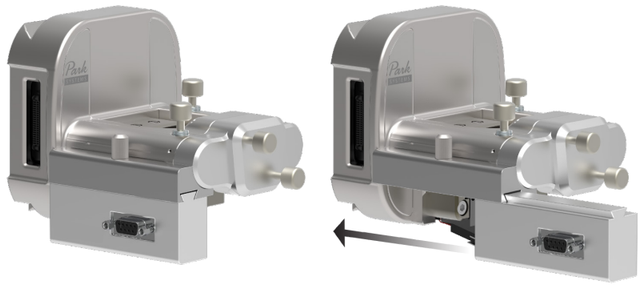
Multilayer Analysis

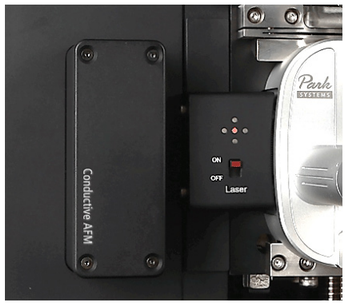
Users can analyze and compare multiple areas of interest at once using a polygonal freeform area drawing tool. Unlike conventional AFM data analysis software that allows inspection of one region at a time, SmartAnalysis provides various metrics for all selected areas simultaneously.

Park NX10
Additional Features

Easy Hardware Setup for Option Modes

NX10 features a modular design that enables a wide range of expansion options for advanced AFM capabilities. Head Extension Modules (HEMs) can be easily integrated with the NX AFM head to enhance functionality, while option modules plug directly into the expansion slot, simplifying setup for advanced modes. These modules are cross-compatible within the NX series, allowing for easy sharing and flexibility across different systems.

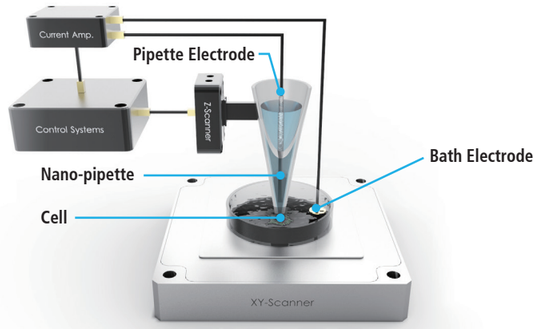




Pipette-Based Applications

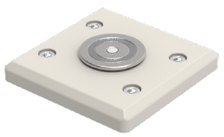
NX10 enables high-resolution, non-invasive morphology imaging of live biological samples using Scanning Ion Conductance Microscopy (SICM). It also supports advanced pipette-based electrochemical techniques, including SICM-SECM and SECCM, for nanoscale studies of electrochemical activity, and surface reactivity.

SICM Head



Sample Chuck and Holder Options

The magnetic sample holder allows quick and easy sample loading using metal disks, ensuring stable attachment across various sample types. NX10 supports multiple sample holder options, including a wedge-type sample holder for sidewall analysis, a cross-sectional holder, and a vacuum sample chuck.



Magnetic Sample Holder

Vacuum Sample Chuck

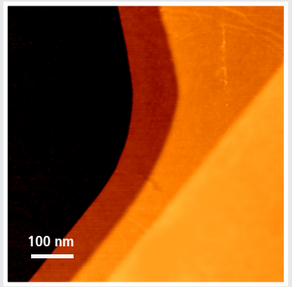
Wedge-Type Sample Holder

Cross-Sectional Holder

Park NX10
Designed for Your Applications

NX10 offers precise measurements for a wide range of research and industrial applications.

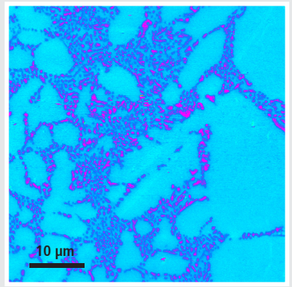
2D Materials



Few Layers of MoS_2

Few-layer MoS_2 was imaged in True Non-contact mode to obtain topographic information. The scan data revealed step structures formed by multiple layers, with a peak-to-valley height of 18.9 nm.

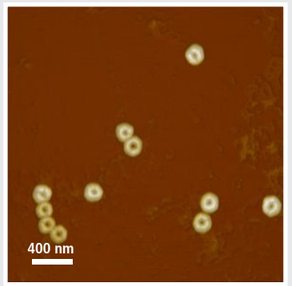
Materials Science



Aluminium TX630 Alloy

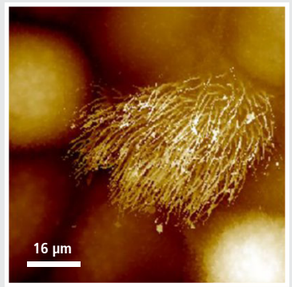
An aluminium TX630 alloy was characterized using Sideband KPFM to obtain surface potential information. The scan image reveals nanoscale potential variations up to 1201 mV, appearing as tiny dots on the substrate that form an irregular pattern.

Biological & Organic Materials



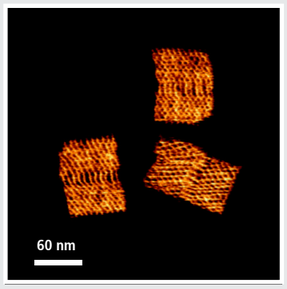
Nano Au on Epithelial Cells

Nano Au on epithelial cells was imaged using True Non-contact mode to obtain surface topography. The scan image shows ring-shaped Au nanoparticles on the substrate, with height variations up to 56.3 nm.



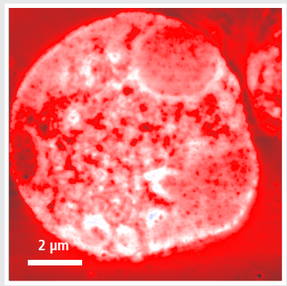
Rat Trachea Cell

A rat trachea cell was observed by Scanning Ion Conductance Microscopy (SICM) which uses micro glass pipette to obtain very delicate samples such as cells, bacteria and etc. The scan image shows numerous beard-like structures of the rat trachea cell in liquid condition.



Origami DNA

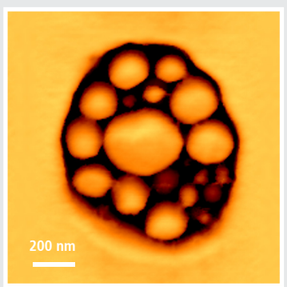
Origami DNA was imaged in liquid using Tapping mode to obtain surface topography. The scan image shows rectangular DNA origami structures with internal patterns, with height variations up to 2.6 nm.

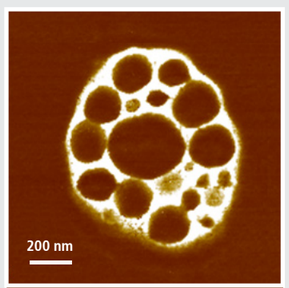


Blood Cell

A blood cell was imaged using True Non-contact mode to obtain surface topography. The scan image shows a circular cell with internal structural features, with height variations up to 211.6 nm.

Polymers





Styrenic Block Copolymer Embedded in Rubber

The styrenic block copolymer was scanned using PinPoint nanomechanical mode to simultaneously acquire both the surface mechanical properties and the topography. The scan image shows the height (left) and adhesion energy (right), highlighting the differences between the block copolymer and the rubber.

Park NX10
Technical Specifications

AFM Modes

- Topographic Imaging
  - Contact Mode
    - Constant Height Mode
    - Constant Force Mode
  - True Non-Contact™ Mode
  - Tapping Mode
  - PinPoint™ Mode
  - Fast PinPoint™ Mode
- Mechanical Properties
  - PinPoint™ Nanomechanical Mode
  - Fast PinPoint™ Nanomechanical Mode *
  - Force-Distance (F-D) Spectroscopy
  - Nanoindentation
  - Force Modulation Microscopy (FMM)
  - Dynamic Mechanical Analysis (DMA) *
  - Torsional Force Microscopy (TFM) *
  - Lateral Force Microscopy (LFM)
- Electrical Properties
  - Conductive AFM (C-AFM) *
    - Current-Voltage (I-V) Spectroscopy
    - Photocurrent Mapping (PCM) *
  - Scanning Spreading Resistance Microscopy (SSRM) *
  - Scanning Tunneling Microscopy (STM) *
  - Scanning Capacitance Microscopy (SCM) *
  - Piezoresponse Force Microscopy (PFM)
    - Piezoreseponse Spectroscopy
    - Off-resonance PFM
    - Contact Resonance PFM (CR-PFM) *
    - Dual Frequency Resonance Tracking PFM (DFRT-PFM) *
  - PinPoint™ Nanoelectrical Modes *
  - Electrostatic Force Microscopy (EFM)
  - Kelvin Probe Force Microscopy (KPFM)
    - Heterodyne KPFM *
    - Sideband KPFM
    - Amplitude Modulation KPFM (AM-KPFM)
  - Microwave Impedance Microscopy (MIM) **
- Magnetic Properties
  - Magnetic Force Microscopy (MFM)
    - Frequency Modulation MFM (FM-MFM)
    - Amplitude Modulation MFM (AM-MFM)
- Thermal Properties
  - Scanning Thermal Microscopy (SThM) *
    - Temperature Mapping
    - Thermal Conductivity Mapping
- Nanolithography & Manipulation
  - Nanolithography *
  - Nanomachining *
- In-liquid Operation
  - In-liquid Topography *
  - Scanning Ion Conductance Microscopy (SICM) *
- Electrochemical Properties
  - Electrochemical AFM (EC-AFM) *
  - Scanning Ion Conductance Microscopy-Scanning Electrochemical Microscopy (SICM-SECM) *
  - Scanning Electrochemical Cell Microscopy (SECCM) *

Scanner

- XY scanner (50 μm × 50 μm, 100 μm × 100 μm or 10 μm × 10 μm)
- Flexure-guided high-force Z scanner (15 μm or 30 μm)

Sample Mount

- 100 mm × 100 mm (w × d), up to 20 mm thickness

On-axis Optical Microscope

- Direct on-axis vision of sample surface and cantilever
- Field of view: 480 μm × 360 μm (w/ 10× objective lens)
- CCD: 1.2 M Pixel
  5 M Pixel (optional)

Stage

- XY stage : 20 mm × 20 mm
- Z stage: 25 mm
- Focus stage: 15 mm

Dimension and Weight

- AE (Outer): 700 mm × 830 mm × 1303 mm
- Desk: 1410 mm × 810 mm × 740 mm
- Total weight: 325 kg (AFM Body + AE)

Required Environment

- Required acoustic noise level: Below 65 dB
- Required floor vibration level: VC-D (6.25 μm/sec)
- Power: 1 kW (Maximum)

** Requires additional options*

*** Consult with Park Systems*

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