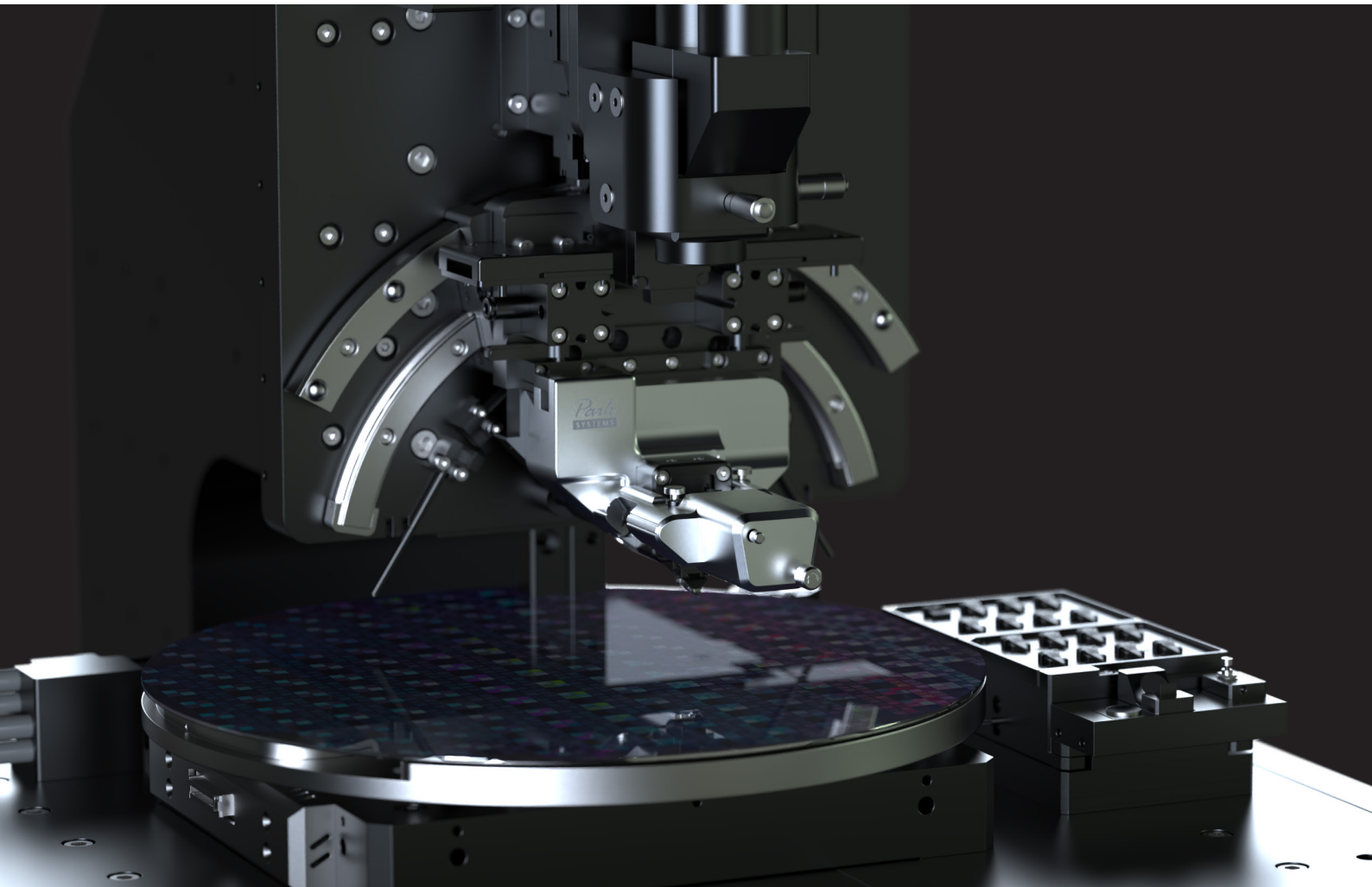


Park NX-3DM

Industry's Leading Automated AFM
for High-Resolution 3D Metrology



Park
SYSTEMS

Park NX-3DM is a leading-edge atomic force microscope (AFM) designed for seamless integration into semiconductor fabrication environments. Built on Park Systems' proven AFM technology, it delivers high-resolution 3D metrology for semiconductor manufacturing while ensuring full compliance with SEMI standards and complete automation. With a strong track record in the semiconductor industry, NX-3DM offers proven reliability and effectiveness for advanced metrology applications.

Park NX-3DM

Key Features

Semiconductor Fab Integrability

- Innovative Z-scan system for 3D measurement
- Fully automated operation through XEA software with an intuitive UI
- SECS/GEM communication for fab host integration
- Automated wafer handling and probe exchange
- Full compatibility according to SEMI standards

High-Precision AFM Technology

- Reduced out-of-plane motion through a decoupled XY and Z scanner architecture
- High orthogonality and precise positioning via dual-servo XY control
- Extended probe lifetime through True Non-contact™ operation

Versatile Applications

- Undercut and overhang profiling
- Sidewall roughness measurement
- Photoresist sidewall angle and undercut measurement

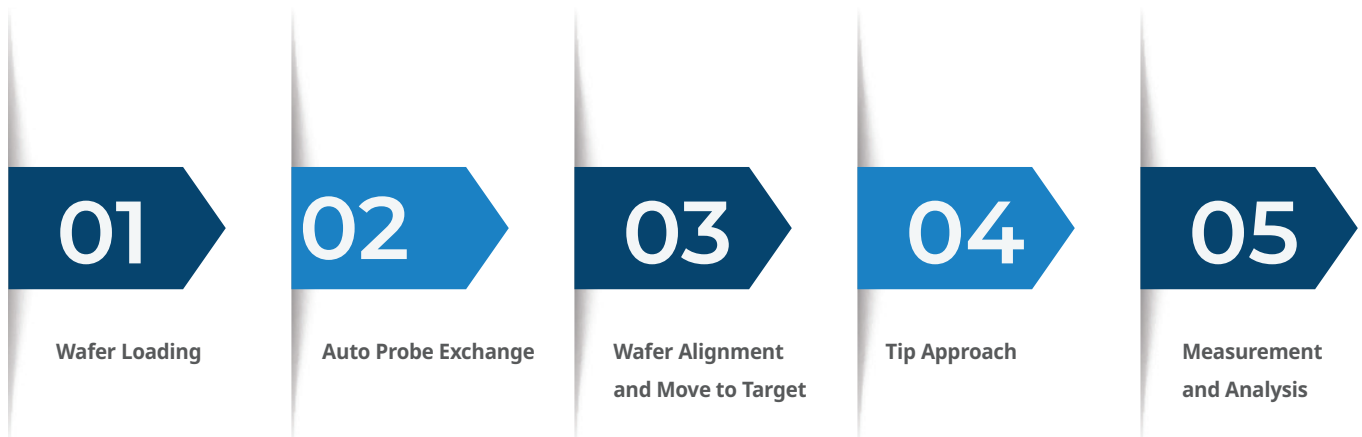


Park NX-3DM

Semiconductor Fab Integrability

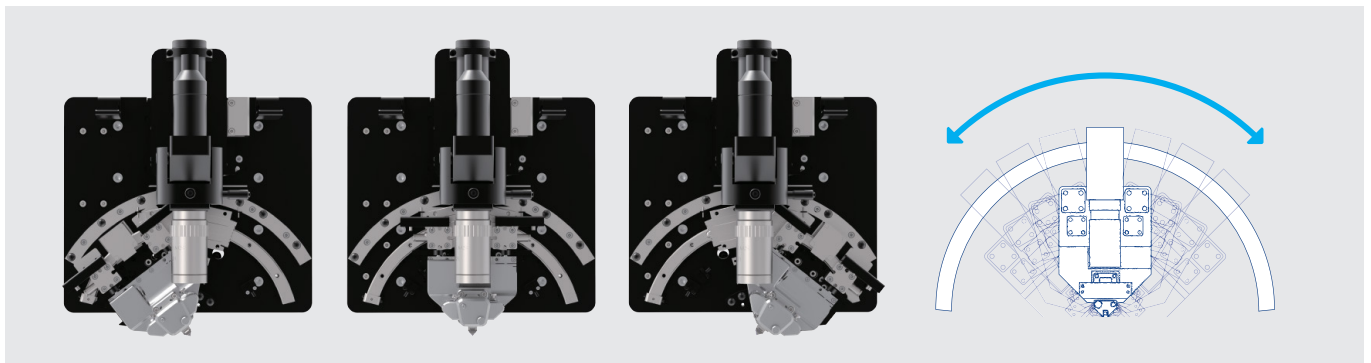
Fully Automated Operation

NX-3DM enables fully automated operation from wafer handling to measurement and analysis. It automatically receives a recipe from a host, performs end-to-end automation by selecting the appropriate tip, scanning multiple target areas, analyzing data, and generating reports.



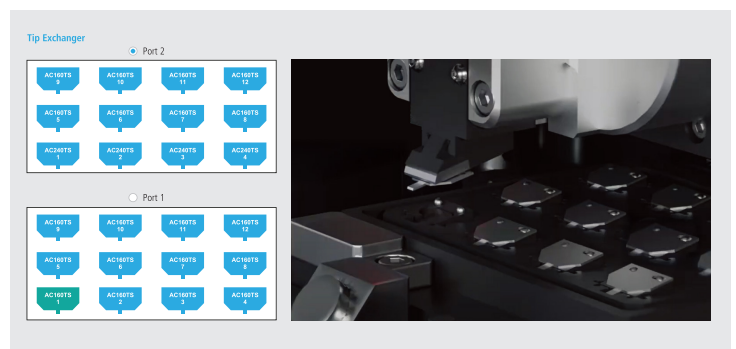
Innovative Z-Scan System for 3D Measurement

The many unique features of the NX-3DM are made possible by independently tilting the Z-scanner on its patented crosstalk-eliminated platform, where XY and Z scanners are completely decoupled. This design allows users to access vertical sidewalls as well as undercut structures at various angles. Unlike systems with flared tips, this system enables the use of high resolution and high aspect ratio probes.



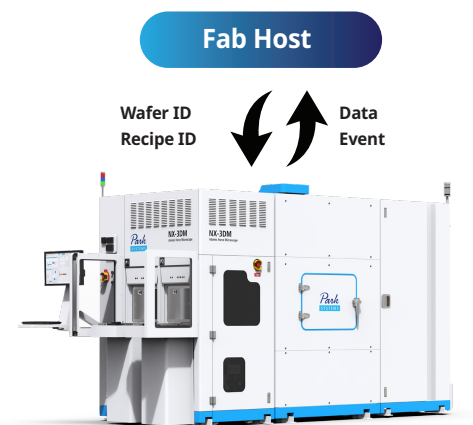
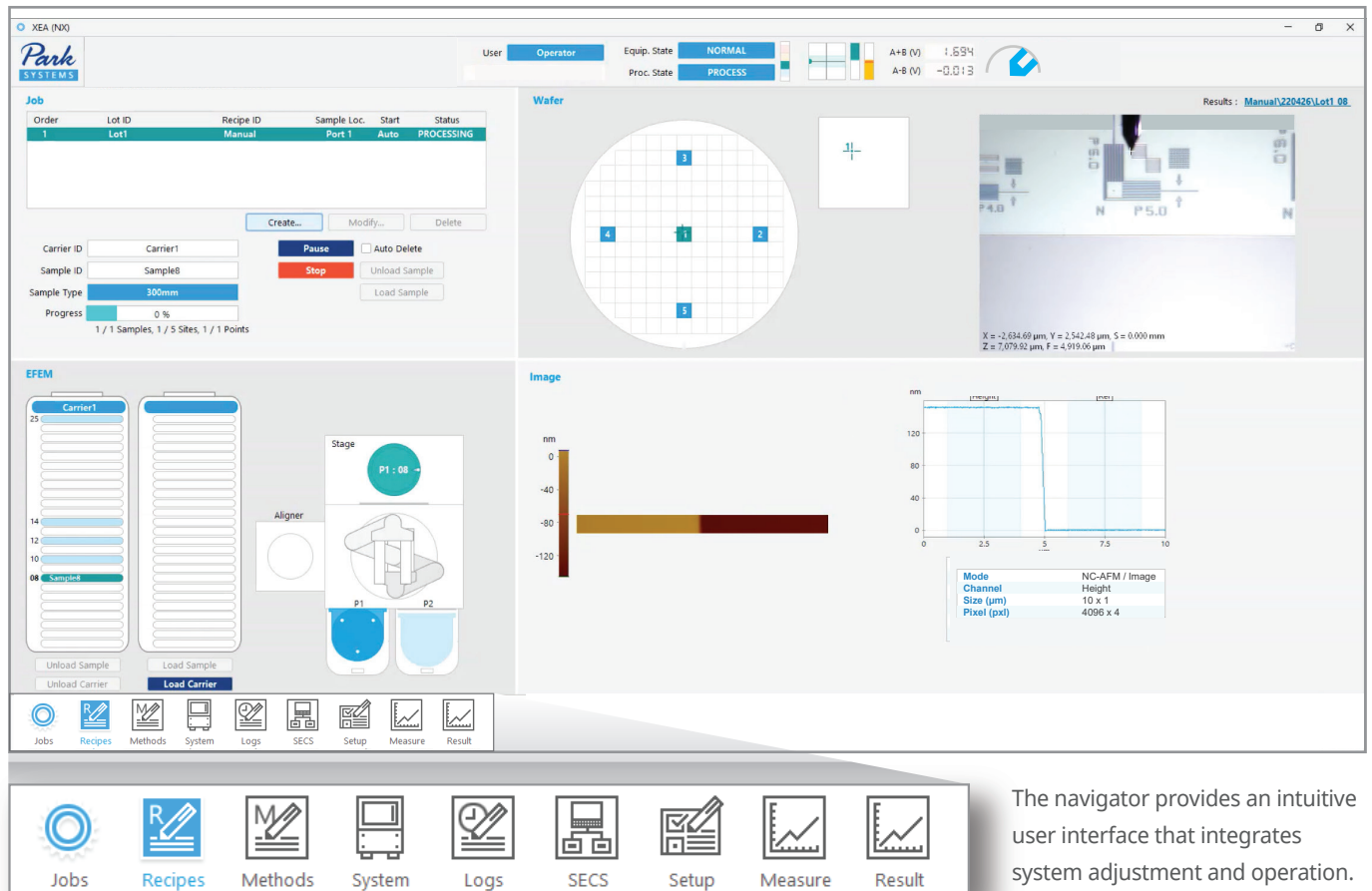
Automatic Probe Exchange

The automatic tip exchanger seamlessly replaces the probe when a threshold is exceeded. It can store up to 24 pre-mounted probes (12 probes per cassette).



Easy-to-Use Operation Software XEA

XEA offers practical features such as easy copy/paste of recipes, specialized editing modes, and real-time recipe updates. With built-in functions providing comprehensive system operation—including parameter adjustment, database management, and maintenance—the interface remains straightforward and user-friendly.



Fab Host Communication via SECS/GEM Protocol

NX-3DM enables Fab host communication via the SECS/GEM protocol, ensuring full compliance with SEMI standards, including E30, E40, E87, E90, E94, and E84 PI/O for AMHS integration.

Fab Compatibility According to SEMI Standards

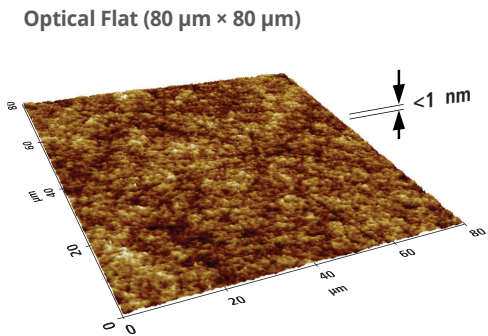
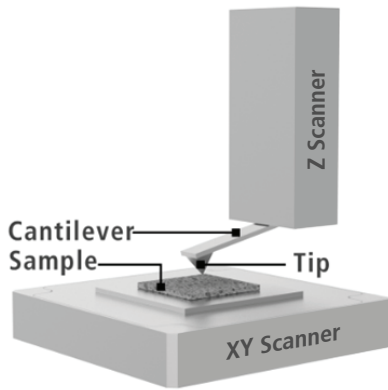
NX-3DM ensures optimal compatibility with cleanroom environments in semiconductor fabs. The system achieves ISO Cleanliness Class 1 (≤ 10 particles/ $m^3 \geq 0.1 \mu m$ and ≤ 2 particles/ $m^3 \geq 0.2 \mu m$) and minimizes particle contamination along the wafer movement path through its engineered fan filter unit and ventilation system, while maintaining efficient noise shielding. Additional chemical filters are available as options to effectively block airborne molecular contamination (AMC), which can adversely affect sensitive samples. Furthermore, the system is equipped with advanced monitoring capabilities that can detect and alert users to potential fire hazards or voltage sags.

Park NX-3DM

Park High-Precision AFM Technology

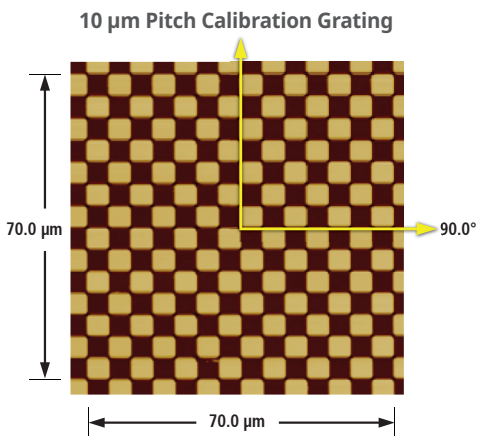
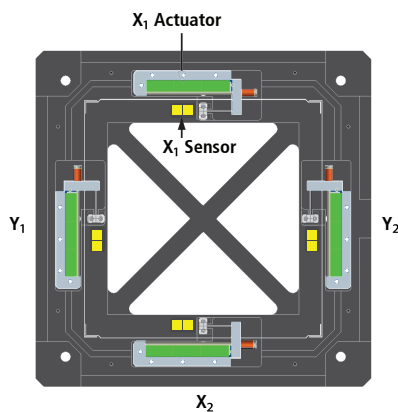
Decoupled XY and Z Scanner System

The separated flexure-guided 2D XY scanner and 1D Z scanner system minimizes out-of-plane motion by eliminating crosstalk between horizontal and vertical motion. The independent Z scanner enables precise, linear, and fast dynamic performance.



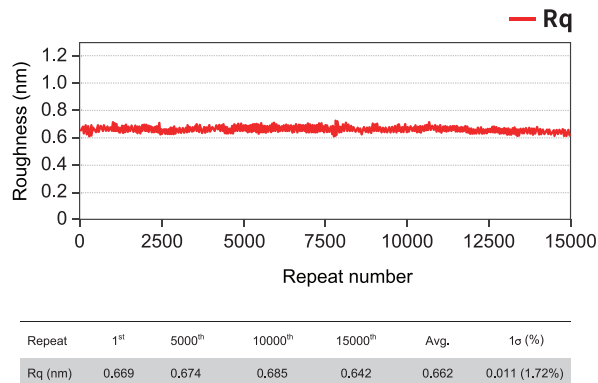
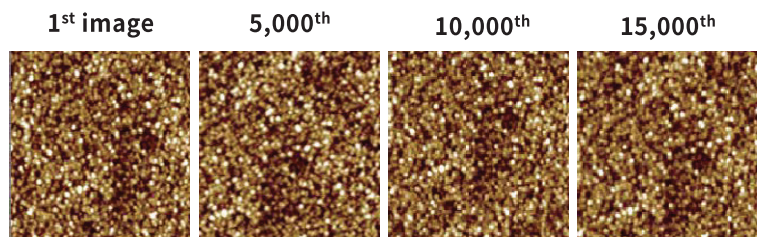
Orthogonal Scan for XY Scanner

The XY scanner features a dual-servo architecture with two pairs of actuators and position sensors mounted on opposite sides of each axis, providing precise orthogonality and accurate positioning across the entire scan area.



True Non-Contact™ Mode

True Non-contact™ mode, a proprietary technology offered by Park Systems, obtains topography by detecting the attractive van der Waals force between the tip and sample surface. The key advantage of True Non-contact mode is the prevention of tip wear and sample damage, ensuring consistent results with superior data reliability. This also reduces the total cost of ownership by extending tip life. The system also supports contact mode and tapping mode when required.



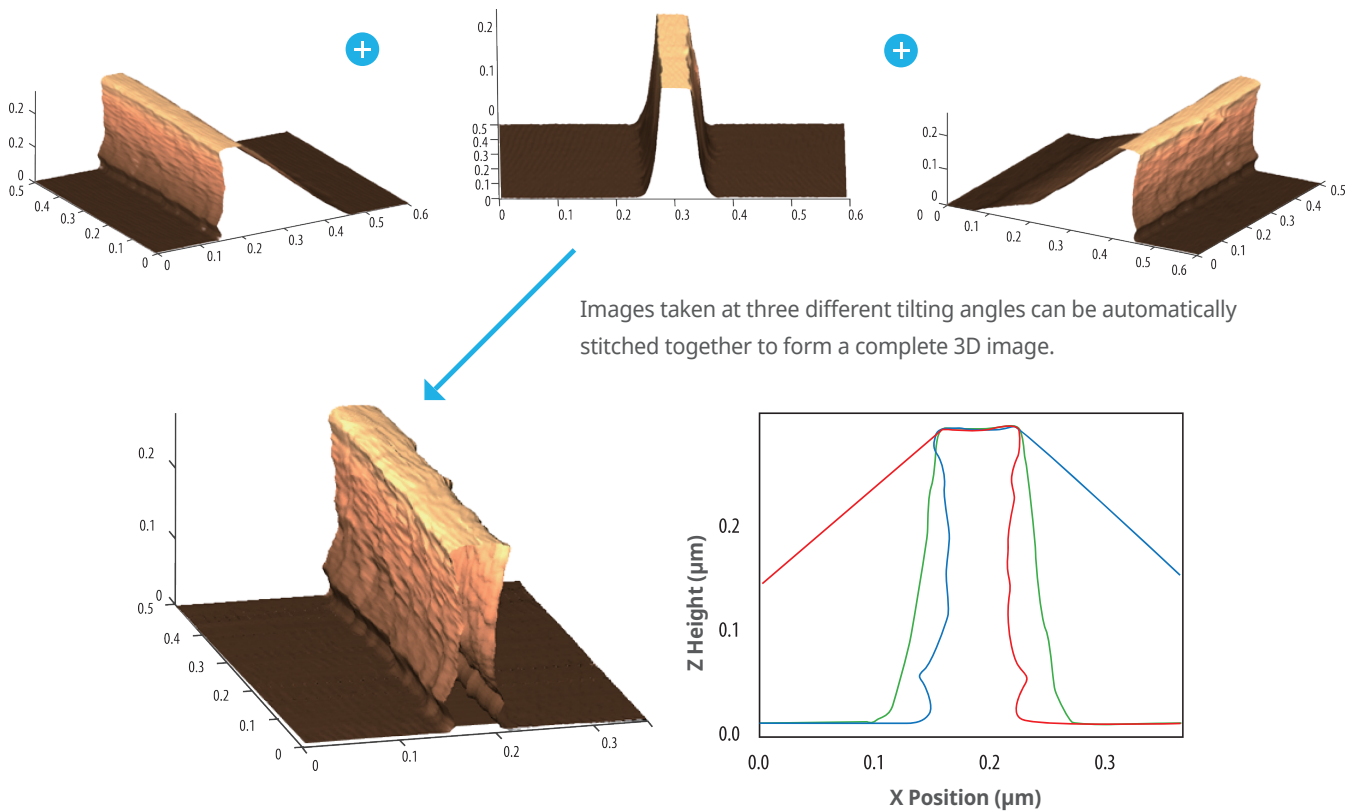
(500 nm × 500 nm)

Park NX-3DM

Versatile Applications

Undercut and Overhang Profiling

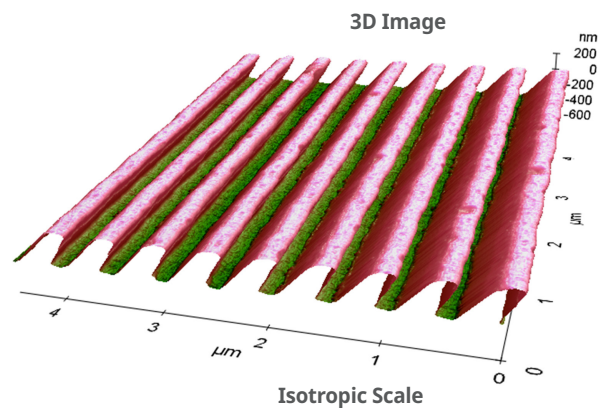
NX-3DM provides unique access to undercut and overhang structures in photoresist and other industrial materials, ensuring users receive accurate topographical data across the entire sample.



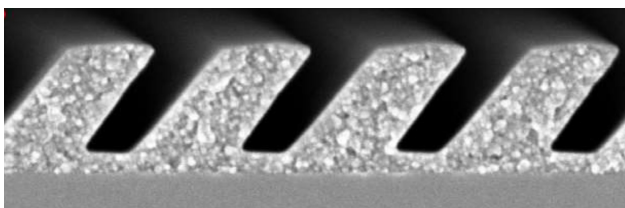
AR/VR Optics Display Structure

NX-3DM tilts the AFM head to capture true 3D sidewall topography, enabling non-destructive, precise measurement of steep and even highly undercut angles.

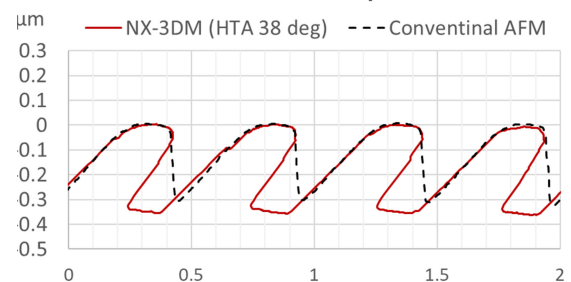
Conventional SEM/TEM cross-sectioning is destructive, while conventional AFM is limited by tip geometry, making it difficult to accurately measure steep or highly undercut sidewalls.



SEM
Slanted pattern in AR/VR Optics Display

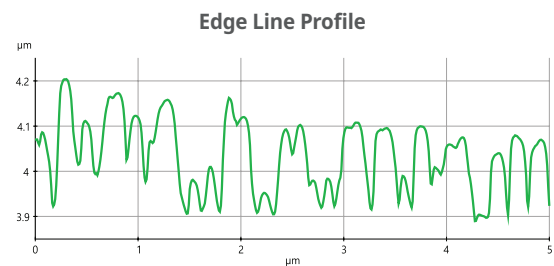
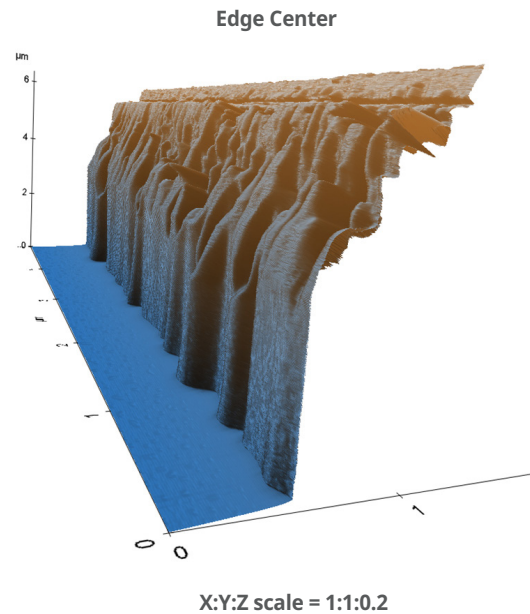
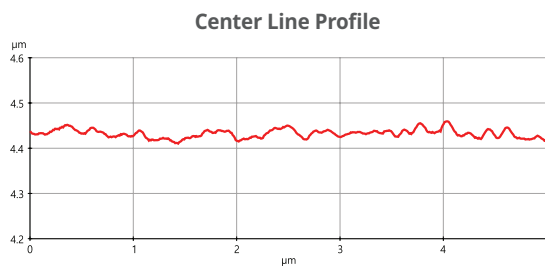
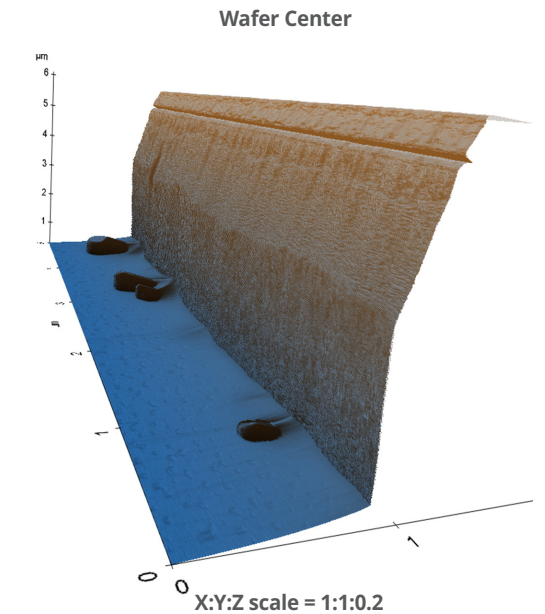


AFM Profile Comparison



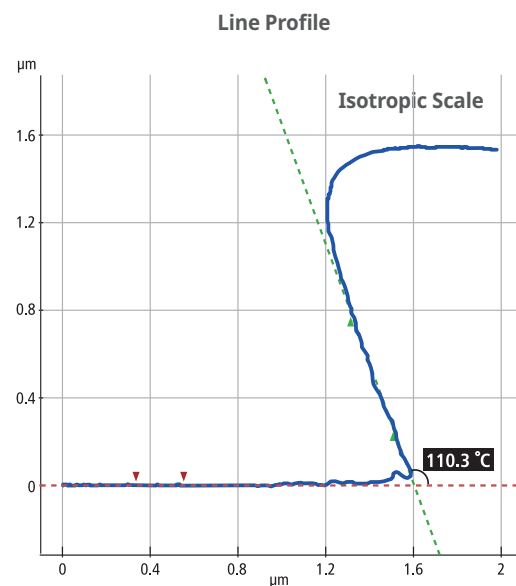
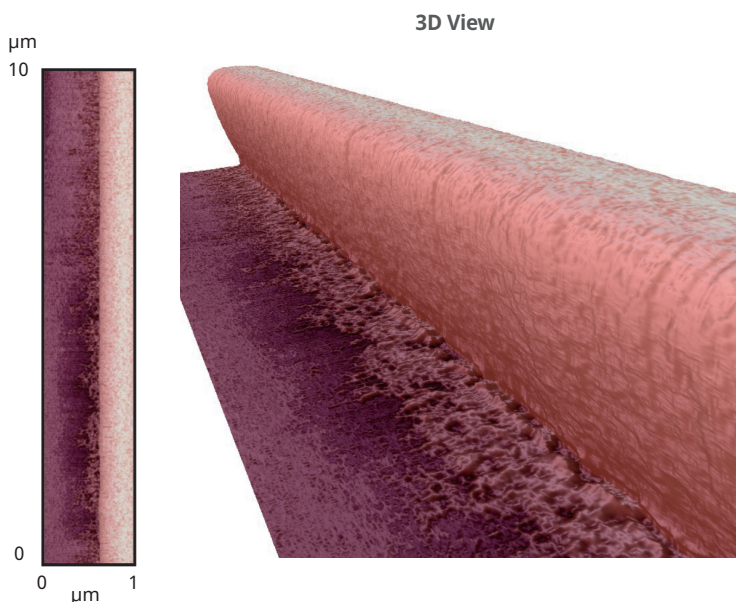
Sidewall Roughness Measurement

NX-3DM's innovative head-tilting design provides access to sidewalls with an ultra-sharp tip, enabling high-resolution, well-defined measurement of sidewall roughness. This allows precise characterization of sidewall topography, including fine surface variations and irregularities critical to process control and device performance in semiconductor manufacturing.



Photoresist Sidewall Angle and Undercut Measurement

NX-3DM's True Non-contact™ mode enables precise measurement of sidewall angle in photoresist patterns without causing sample deformation, and accurately resolving undercut profiles critical to lithography process control. As demonstrated in the line profile, NX-3DM captures the full sidewall geometry at an isotropic scale, revealing a sidewall angle of 110.3°



Park NX-3DM

Technical Specifications

AFM Modes

- True Non-contact™ Mode
- Tapping Mode
- Contact Mode

Scanner

- Dual-servo XY scanner (100 μm $\times$ 100 μm)
- Flexure-guided Z scanner (15 μm)

Motorized Head Angle Range

- -19 degrees and +19 degrees
- -38 degrees and +38 degrees

On-Axis Optics

- Direct on-axis vision of sample surface and cantilever
- Field of view: 840 μm $\times$ 630 μm (w/ 10 $\times$ objective lens)
- CCD: 5 M pixels

Automatic Tip Exchanger

- 16 pre-mounted probes (8 probes per cassette)

Sample Handling Capability

- 200 mm system: 150 mm, 200 mm wafer
- 300 mm system: 200 mm, 300 mm wafer

Dimension and Weight (Approx.)

- 200 mm system: 2,763 mm $\times$ 1,245 mm $\times$ 2,242 mm (2,510 kg)
- 300 mm system: 3,854 mm $\times$ 1,582 mm $\times$ 2,228 mm (3,995 kg)

Required Environment

- Room Temperature (Standby): 10 °C ~ 40 °C
- Room Temperature (Operating): 18 °C ~ 24 °C
- Humidity: 30% to 60% (not condensing)
- Floor Vibration Level: VC-D (6.25 $\mu\text{m}/\text{sec}$)
- Acoustic Noise: Below 65 dB
- Pneumatics: CDA 0.7 MPa, Vacuum -80 kPa
- Power Supply Rating: 208 ~ 240 V, 1 Phase, 50/60 Hz
- Ground Resistance: Below 1 Ω

