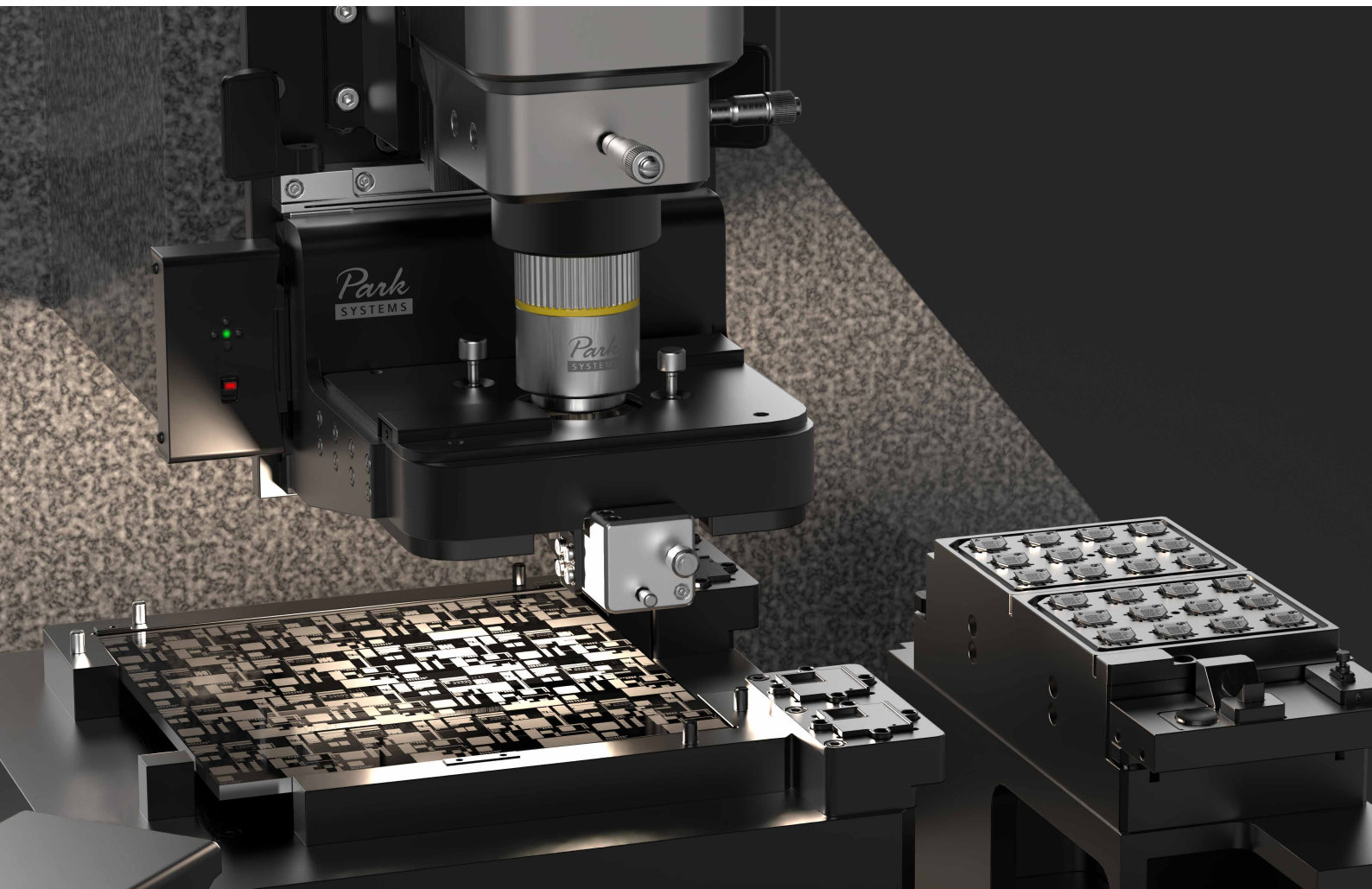


Park NX-Mask

Industry's Leading Automated AFM
for In-Line Photomask Repair Solutions



Park
SYSTEMS

Park NX-Mask is a state-of-the-art photomask repair and metrology system designed for next-generation semiconductor nodes. By integrating Park Systems' proprietary True Non-contact™ mode with innovative nanomachining technology, it removes soft and hard defects on both advanced and conventional photomasks without damaging the substrate. Notably, our unique Sweep Mode eliminates the debris issues common in conventional methods, maximizing yield and reliability.

Park NX-Mask

Key Features

Semiconductor Fab Integrability

- Automated photomask handling and probe exchange
- Full compliance with SEMI standards

Engineered for Photomask Applications

- High-precision photomask surface metrology and defect repair
- Sample chuck design minimizing backside contact to prevent damage

High-Precision AFM Technology

- Minimized out-of-plane motion through a decoupled XY and Z scanner architecture
- True Non-contact™ mode preserves tip shape and extends tip lifetime

Versatile Applications

- Repair of various defect types
- Chrome delayer repair on MoSi masks



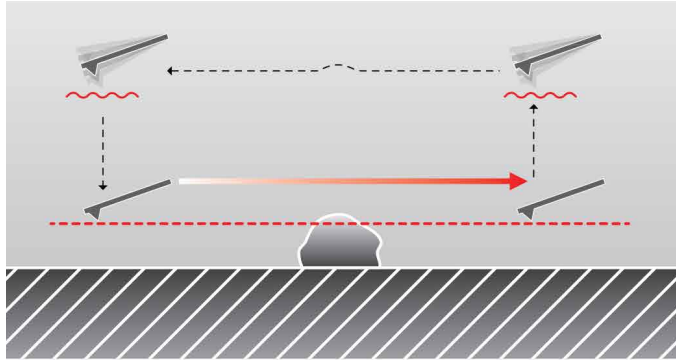
Park NX-Mask

Defect Repair Capability

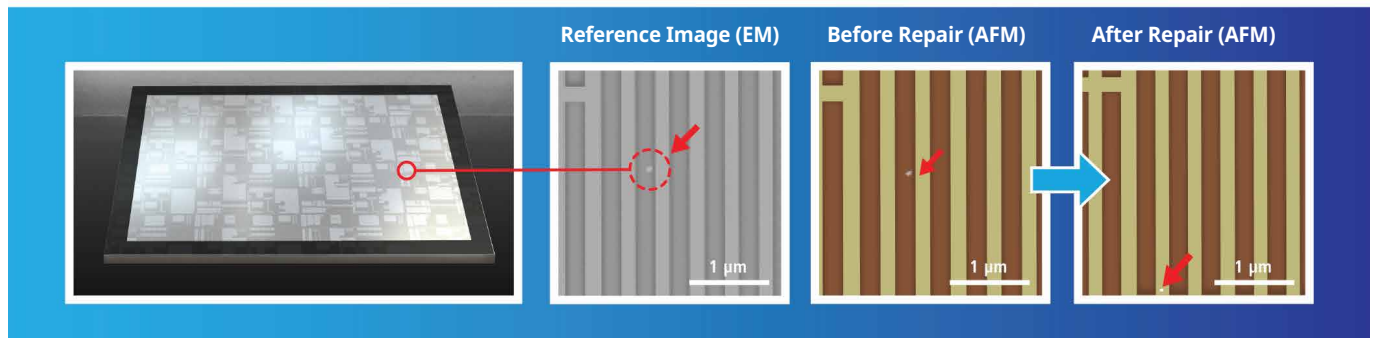
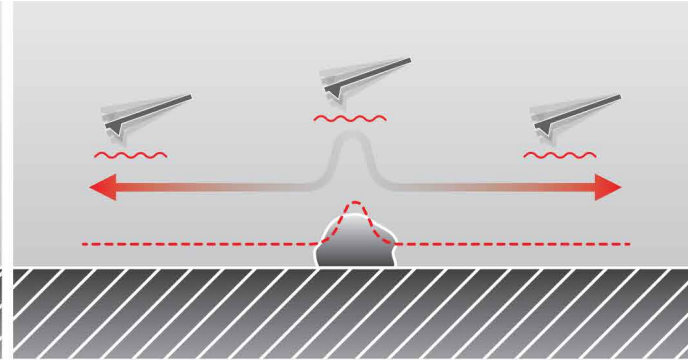
AFM-Based Photomask Defect Repair

Park NX-Mask performs precise photomask defect repair using an AFM-based nanomechanical method with two operating modes, Repair Mode and Sweep Mode, depending on the defect type.

Repair Mode

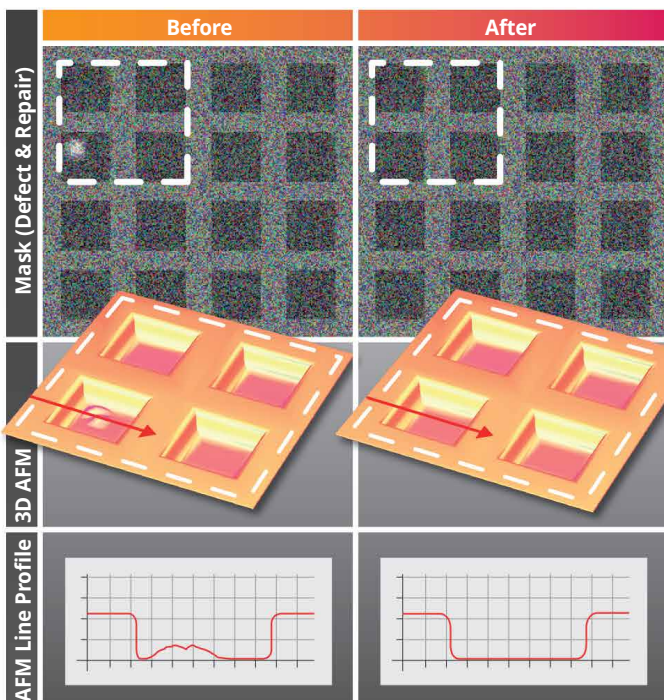


Sweep Mode

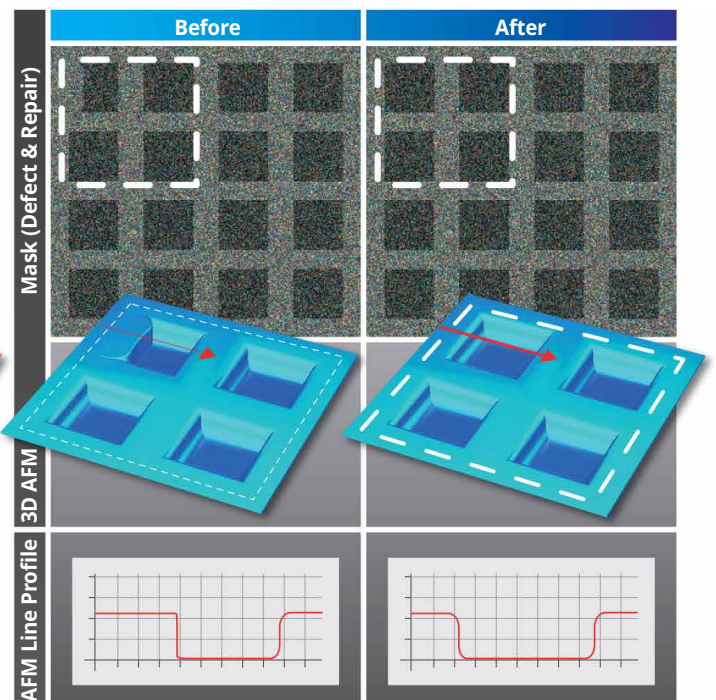


Photomask defects can be caused by foreign particles in the environment or by errors during pattern processing. The most commonly observed defects on high-end photomasks are tin particles generated during the lithography process. The AFM-based nanomechanical repair method implemented in the Park NX-Mask system provides a safe and precise solution for photomask defect repair.

Soft Defect Repair



Hard Defect Repair

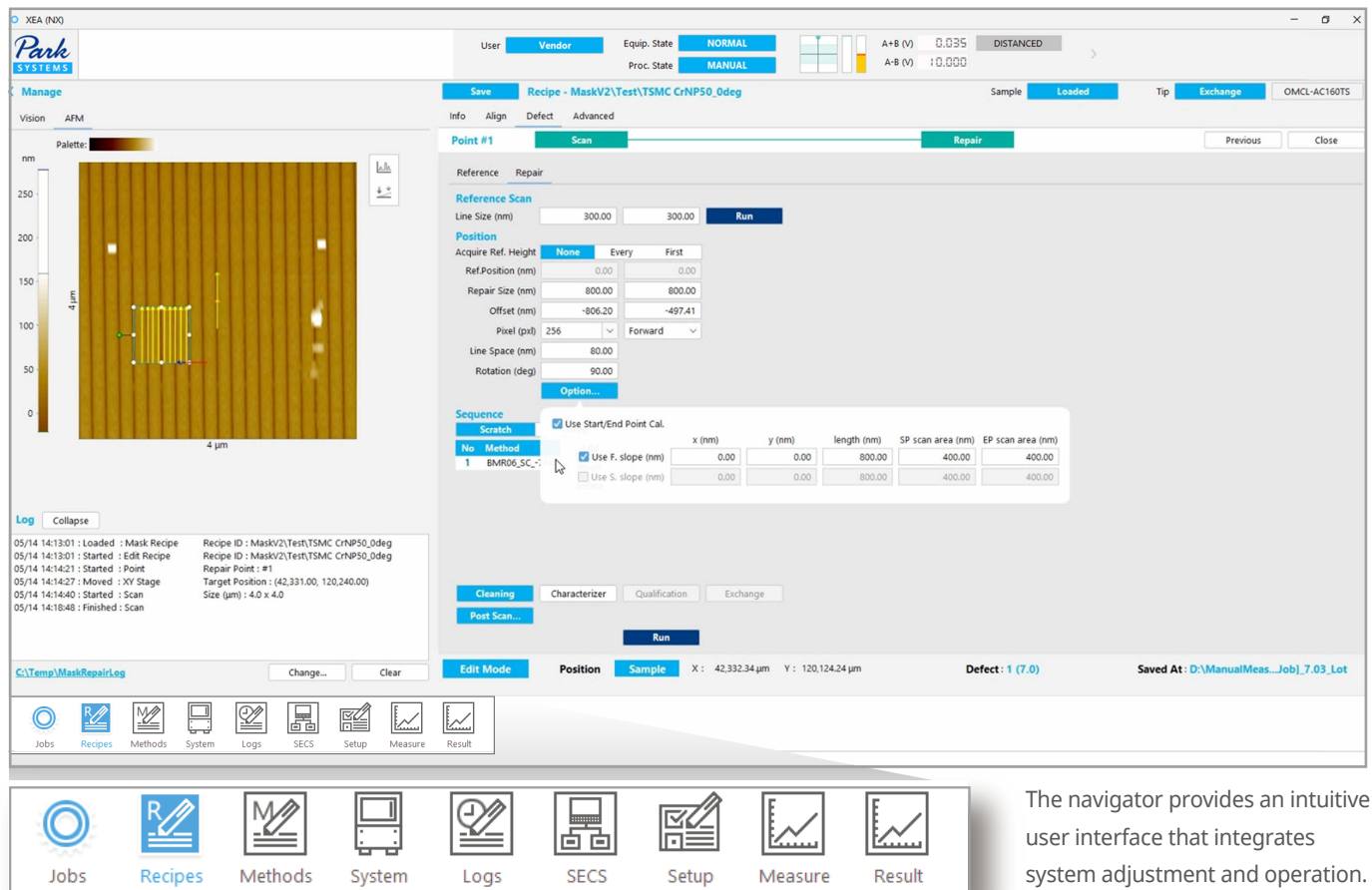


Park NX-Mask

Compatible with Semiconductor Fab Automation

Engineered for Performance and Mask Protection

Powered by Park Systems' process expertise, XEA software optimizes repair performance while ensuring comprehensive protection for high-value masks—leveraging intelligent z-servo control, scan-data-based slope calculation, and a pre-repair safety interlock.



The navigator provides an intuitive user interface that integrates system adjustment and operation.

Fab Host

Mask ID
Recipe ID

Data
Event

Fab Host Communication via SECS/GEM Protocol

The system 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

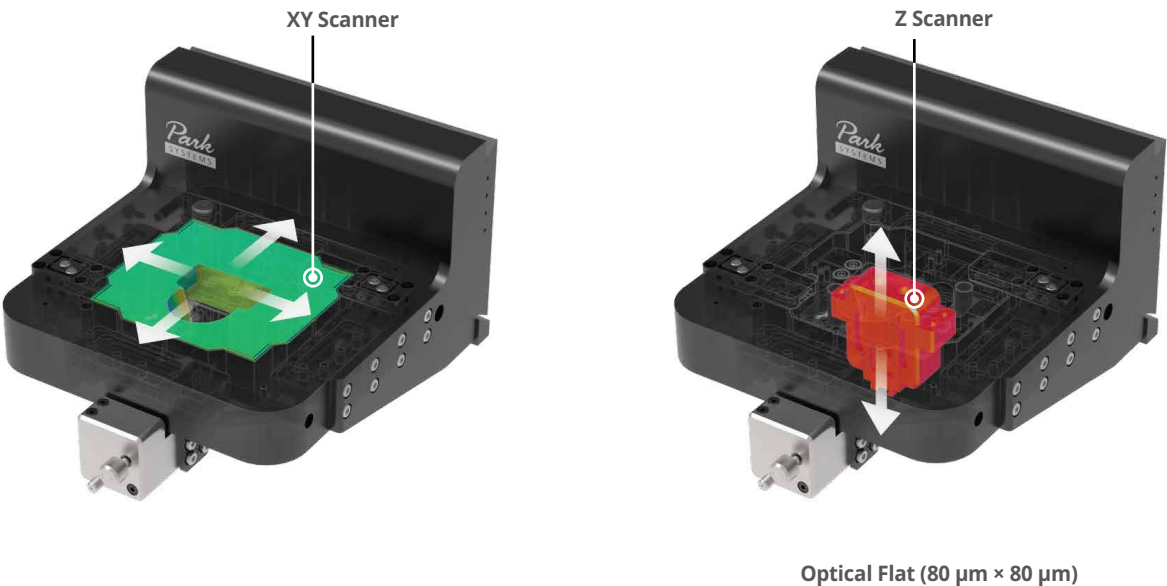
The NX-Mask ensures optimal compatibility with cleanroom environments in semiconductor fabs. The system achieves ISO Cleanliness Class 1 (≤ 10 particles/ $m^3 \geq 0.1 \mu m$ and ≤ 2 particles/ $m^3 \geq 0.2 \mu m$) and minimizes particle contamination along the wafer movement path through its engineered 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-Mask

Park High-Precision AFM Technology

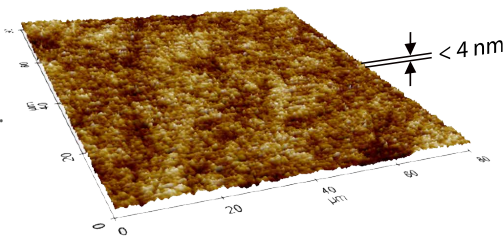
Tip Scanning Head (TSH) System

The sample is secured on the chuck while the gantry-mounted tip scanning head moves to desired measurement positions on the sample surface. This tip scanning approach eliminates sample size and weight limitations. The tip scanning head features a fully decoupled XY scanner and Z scanner, enabling precise control in each direction



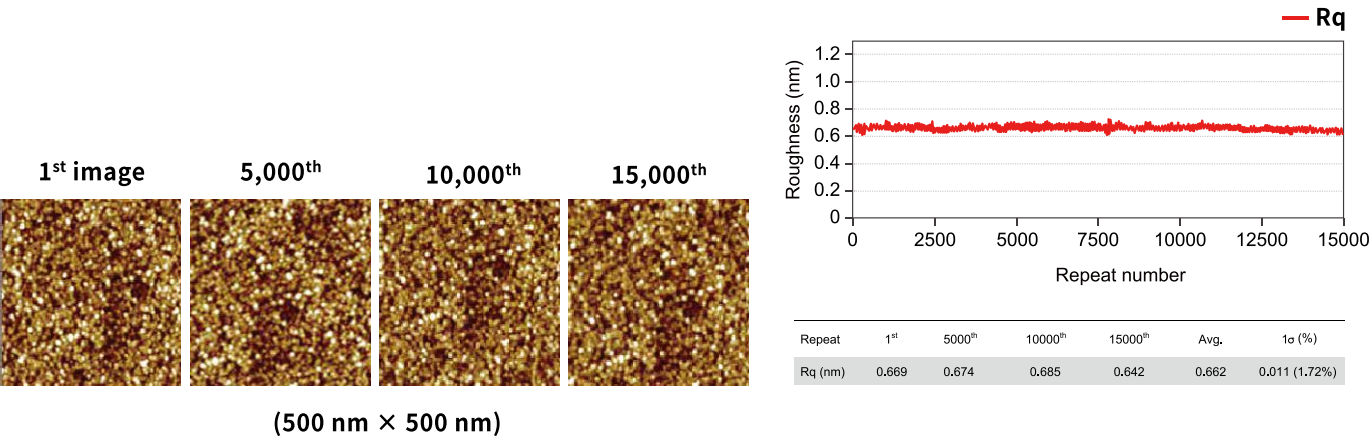
Decoupled XY and Z Scanner System

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



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)

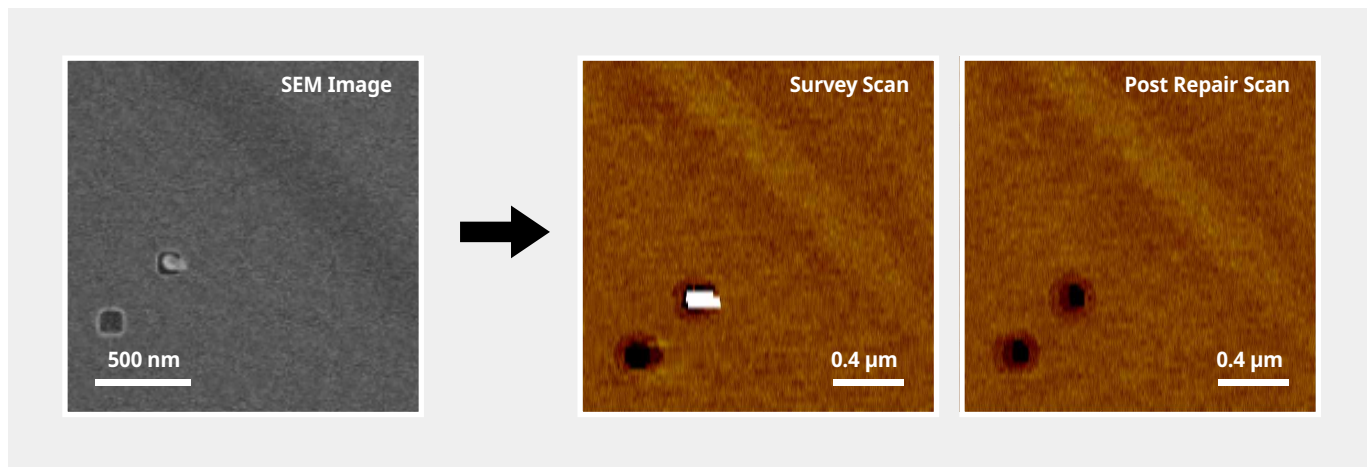
Park NX-Mask

Versatile Application

High Matching Rate Between SEM and AFM

The AFM survey scan before repair and the post-repair scan are in close agreement with the SEM results, confirming successful repair performance.

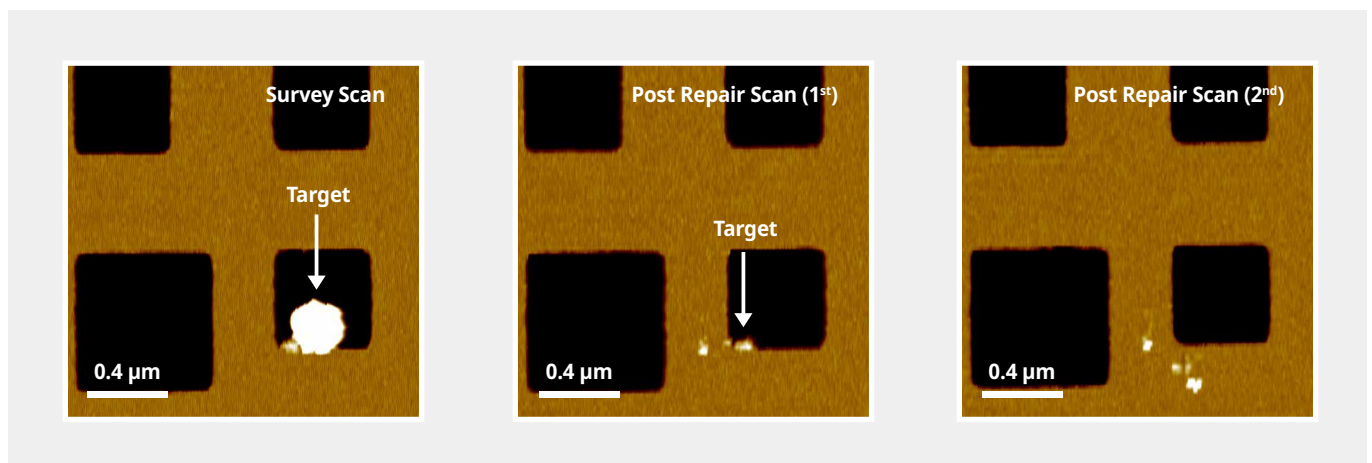
- Scan size: $2\text{ }\mu\text{m} \times 2\text{ }\mu\text{m}$ (512 pixels $\times$ 64 lines)
- Mode: True Non-contact™ mode
- Repair mode: Sweep



Repair Performance

With flexible debris management, any material remaining after repair can be moved to a designated location of your choice.

- Scan size: $1.8\text{ }\mu\text{m} \times 1.8\text{ }\mu\text{m}$ (1024 pixels $\times$ 300 lines)
- Mode: True Non-contact™ mode
- Repair modes: Scratch (1st), Sweep (2nd)



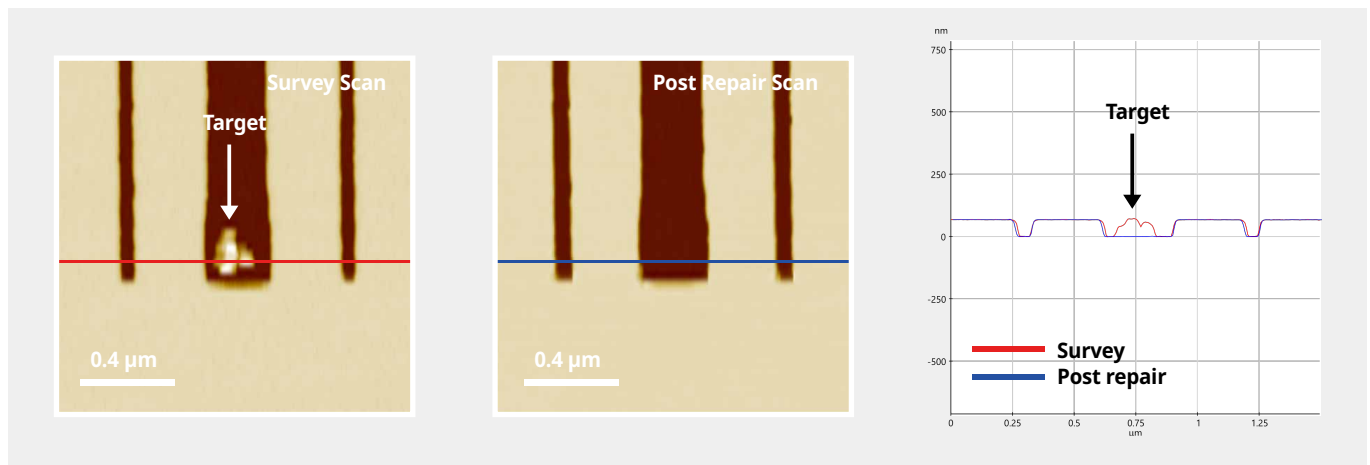
Park NX-Mask

Versatile Application

1D Profile Analysis and 2D Imaging

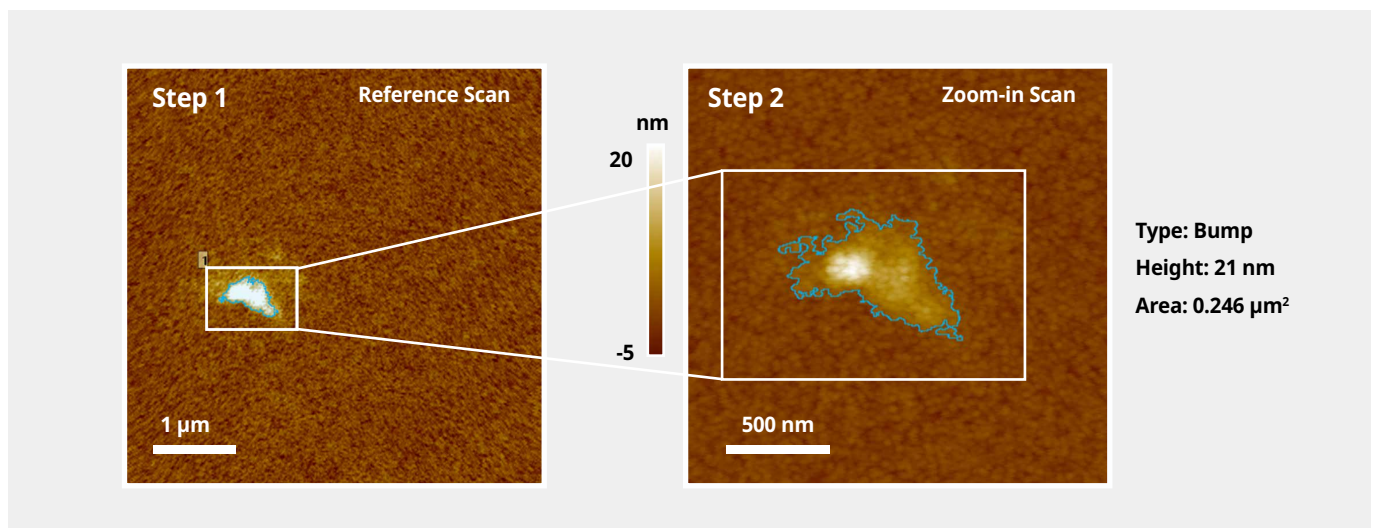
Park NX-Mask enables both 2D AFM imaging and 1D profile analysis, allowing clear verification of repair results.

- Scan size: $1.5\ \mu\text{m} \times 1.5\ \mu\text{m}$ (256 pixels $\times$ 50 lines)
- Mode: True Non-contact™ mode
- Repair mode: Scratch



Automatic Defect Review (ADR) for Blank Mask

The ADR function provides further analysis of defects detected by conventional defect inspection tools. The defects are automatically scanned by AFM once inspection tool data with defect coordinates is uploaded. Defect types and profiles are automatically analyzed in detail using zoom-in scan data.



Park NX-Mask

Technical Specifications

AFM Modes

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

Tip Scanning Head

- XY scan range (90 µm × 90 µm)
- Z scan range (15 µm)

On-Axis Optics

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

Automatic Tip Exchanger

- 24 pre-mounted probes (12 probes per cassette)

Sample Handling Capability *

- 6 inch Photomask (6,025 Mask)

Dimension and Weight (Approx.)

- 3,879 mm × 1,582 mm × 2,231 mm (4,345 kg)

Required Environment

- Room temperature (stand by): 10 °C–40 °C
- Room temperature (operating): 18 °C–24 °C
- Humidity: 30%–60% (not condensing)
- Floor vibration level: VC-D (6.25 µm/sec)
- Acoustic noise: Below 65 dB
- Pneumatics
 - CDA 0.7 MPa
 - Vacuum -80 kPa
- Power supply rating
 - 208-240 V, 3-phase, 50/60 Hz
- Ground resistance: Below 1 Ω

