ATOMIC FORCE MICROSCOPE

Park FX40

A New Class of Atomic Force Microscope
The Automatic AFM
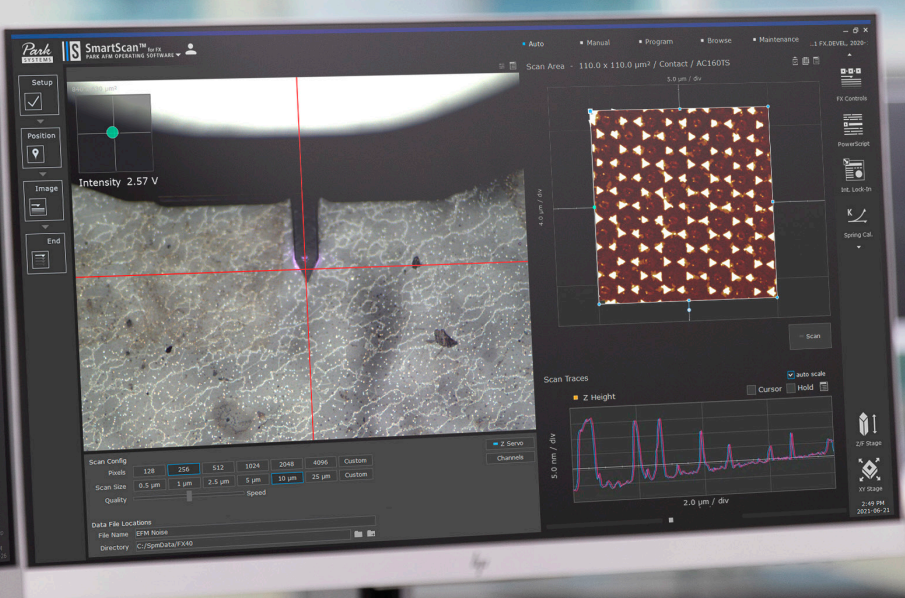
Park FX40
The Automatic AFM
Accelerate Your Research

Get the highest resolution images and most accurate data autonomously, thereby accelerating your research. Unlike others, Park FX40 takes care of everything automatically: from tip pick up to landing to full autonomous scanning of the sample at a click of a button. It does this by infusing robotics, AI and machine learning into its groundbreaking FX system.
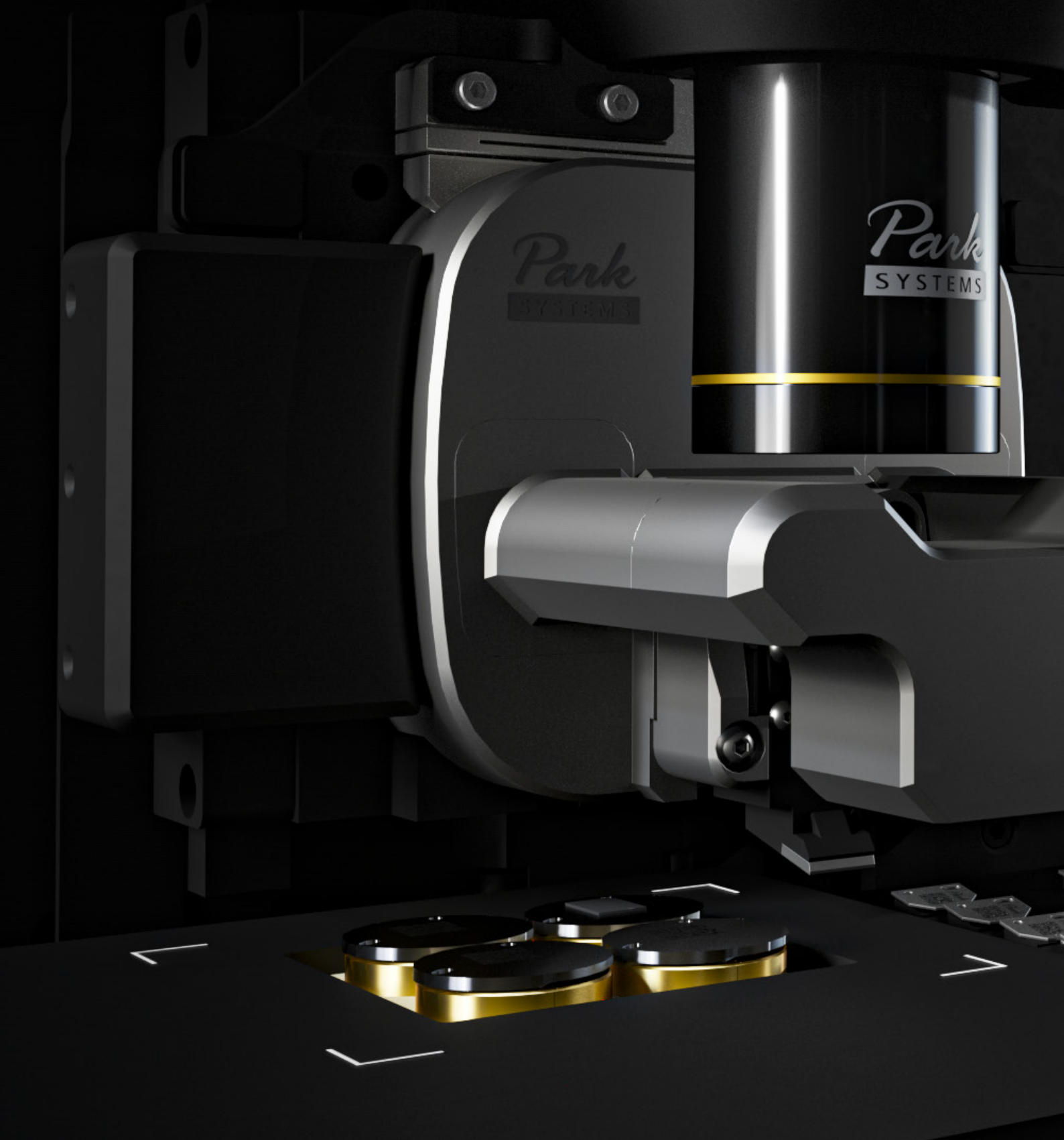
Park FX40
The Automatic AFM

Accelerate Your Research

Sail Through your Research and Development:

- The first dual-camera system ever adopted in research AFM
- Machine learning automation with updatable data

Auto Probe Identification

The Probe Recognition Camera reads the QR code imprinted on the chip carrier of a newly loaded probe and extracts and displays all pertinent information on each of the tips available, including the type, model, application, and usage. This enables you to quickly select the best probe tip for each job.

Auto Probe Exchange

With automated probe exchange, you can now replace old probes easily and safely in full automation. Harnessing the convenience of an 8-probe cassette, along with a magnetic controlled mechanism, the Park FX40 autonomously mounts the probes.
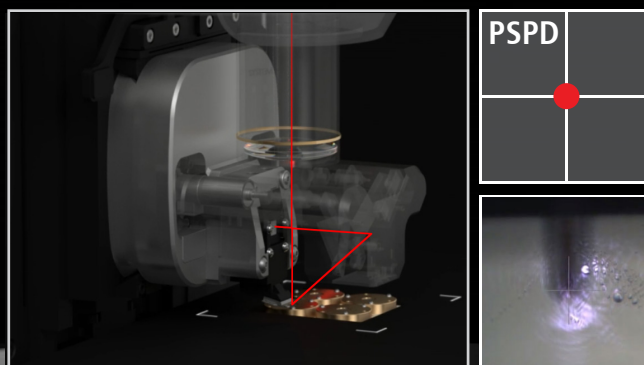

Auto Beam Alignment

Automatic Beam Alignment positions the laser beam onto the proper location of a cantilever and further optimizes the PSPD position both vertically and laterally. It shifts the X, Y and Z axis for clearer images, with no distortion, all autonomously at the click of a button.

Park FX40
The Park AFM Technology

Flat Orthogonal XY Scanning without Scanner Bow

Park's Crosstalk Elimination scanner structure removes scanner bow, allowing flat orthogonal XY scanning regardless of scan location, scan rate, and scan size. It shows no background curvature even on flattest samples, such as an optical flat, and with various scan offsets. This provides you with a very accurate height measurement and precision nanometrology for the most challenging problems in research and engineering.
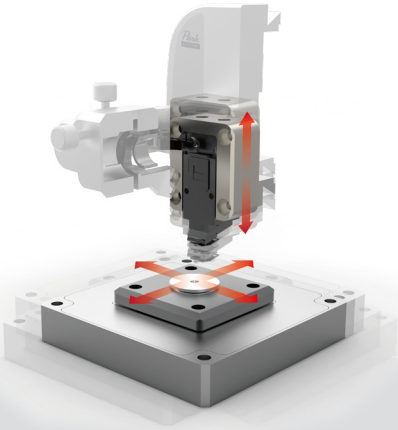
Decoupled XY and Z Scanners

The fundamental difference between Park and its closest competitor is in the scanner architecture. Park's unique flexure based independent XY scanner and Z scanner design allows unmatched data accuracy in nano resolution in the industry.

Accurate Surface Measurement
"Flat" sample surface as it is!

- Low residual bow
- No need for software processing
- Accurate results independent of scan location

Unprocessed raw data

Less than 2 nm
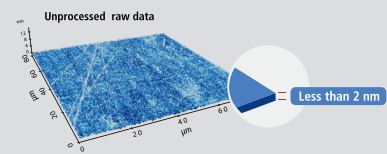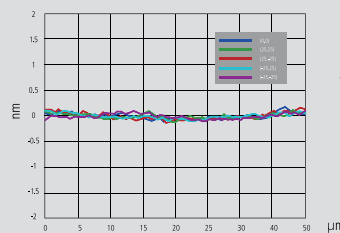
Industry Leading Low Noise Z Detector

Park AFMs are equipped with the most effective low noise Z detectors in the field, with a noise of 0.02 nm over large bandwidth. This produces highly accurate sample topography and no edge overshoot. Just one of the many ways Park NX10 saves you time and gives you better data.

ZDetector (Height)

Park NX Series
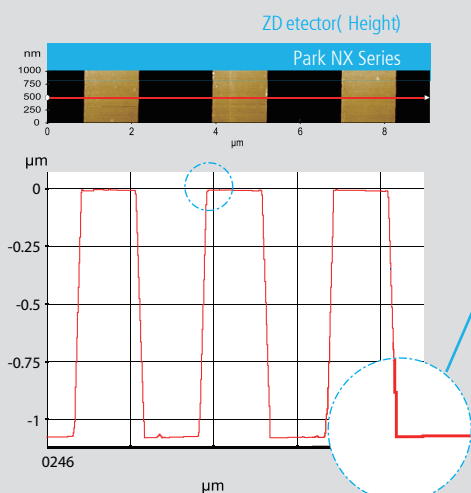
No creep effect

Accurate Sample Topography
Measured by Low Noise Z Detector

- Uses low noise Z detector signal for topography
- Has low Z detector noise of 0.02 nm over large bandwidth
- Has no edge overshoot at the leading and trailing edges
- Needs calibration done only once at the factory

  Sample: 1.2 µm Nominal Step Height
  (9 µm x 1 µm, 2048 pixels x 128 lines)
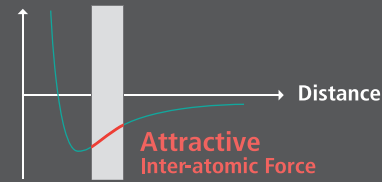
True Non-Contact™ Mode

True Non-Contact™ Mode is a scan mode unique to Park AFM systems that produces high resolution and accurate data by preventing destructive tip-sample interaction during a scan.

**Accurate Feedback by Faster Z-servo enables True Non-Contact AFM**

- Less tip wear ➝ Prolonged high-resolution scan
- Non-destructive tip-sample interaction ➝ Minimized sample modification
- Maintains non-contact scan over a wide range of samples and conditions

Potential

Distance

**Attractive Inter-atomic Force**
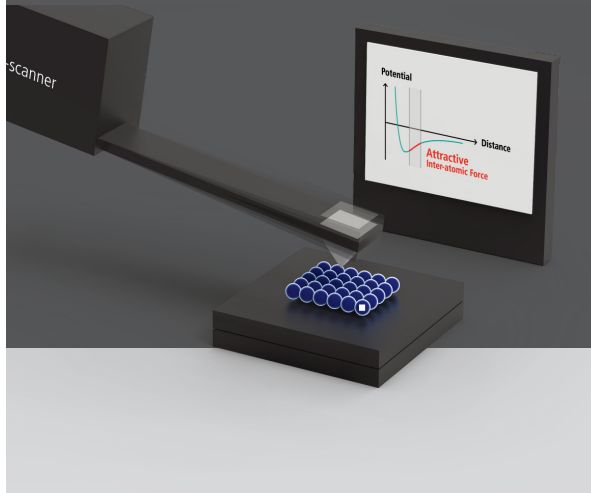
The cantilever oscillates just above the surface as it scans
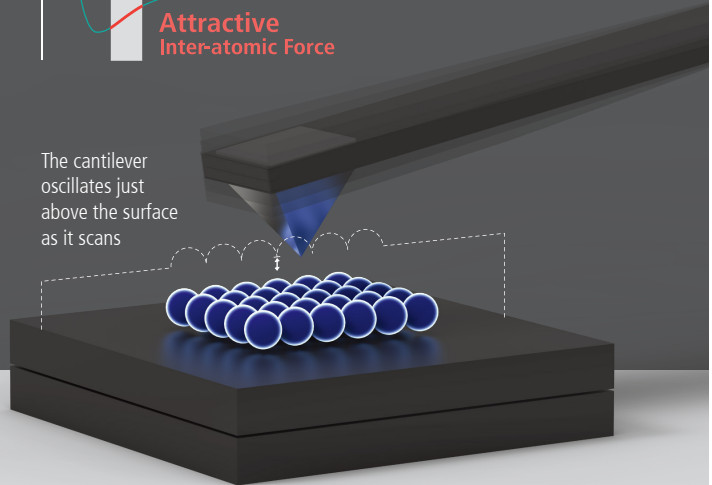
Unlike in contact mode, where the tip contacts the sample continuously during a scan, or in tapping mode, where the tip touches the sample periodically, a tip used in non-contact mode does not touch the sample. Because of this, use of non-contact mode has several key advantages. Scanning at the highest resolution throughout imaging is now possible as the tip's sharpness is maintained. Non-contact mode avoids damaging soft samples as the tip and sample surface avoid direct contact.
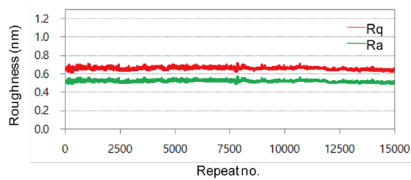
Repeat	1st	…5 000th	…1 0000th	…1 5000th	Total Avg.	1σ (%)
Rq(nm)	0.669	0.6740	.665	0.642	0.662	0.011 (1.720%)
Ra(nm)	0.527	0.5350	.525	0.5080	.524	0.010 (1.835%)

| 1st image	5,000th	10,000th	15,000th
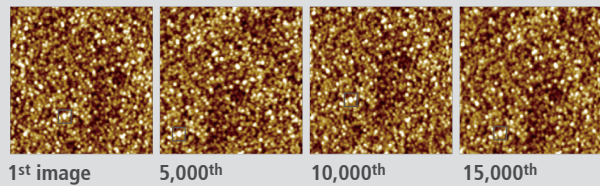
Furthermore, non-contact mode senses tip-sample interactions occurring all around the tip. Forces occurring laterally to tip approach to the sample are detected. Therefore, tips used in non-contact mode can avoid crashing into tall structures that may suddenly appear on a sample surface. Contact and tapping modes only detect the force coming from below the tip and are vulnerable to such crashes.
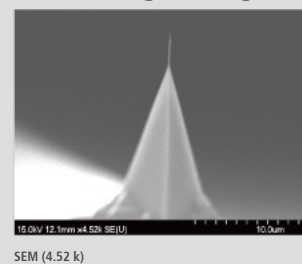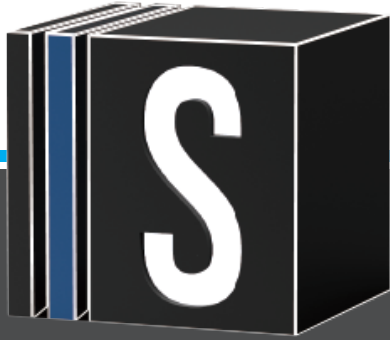
Deep trench image

1:1 aspect ratio

3.7 µm
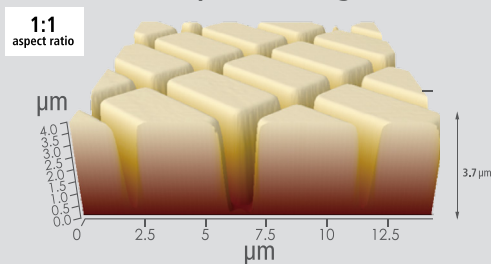
Before taking image

SEM (5.00 k)
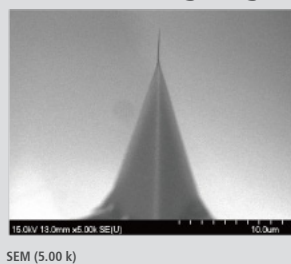
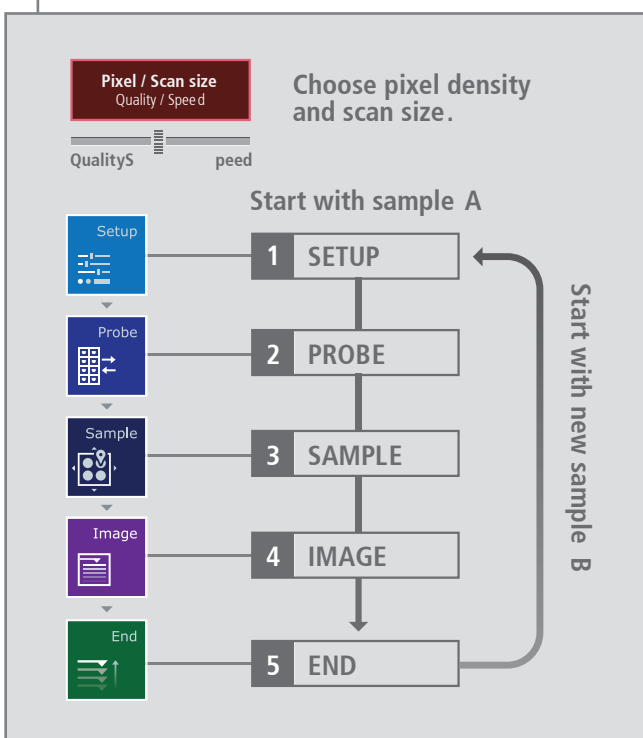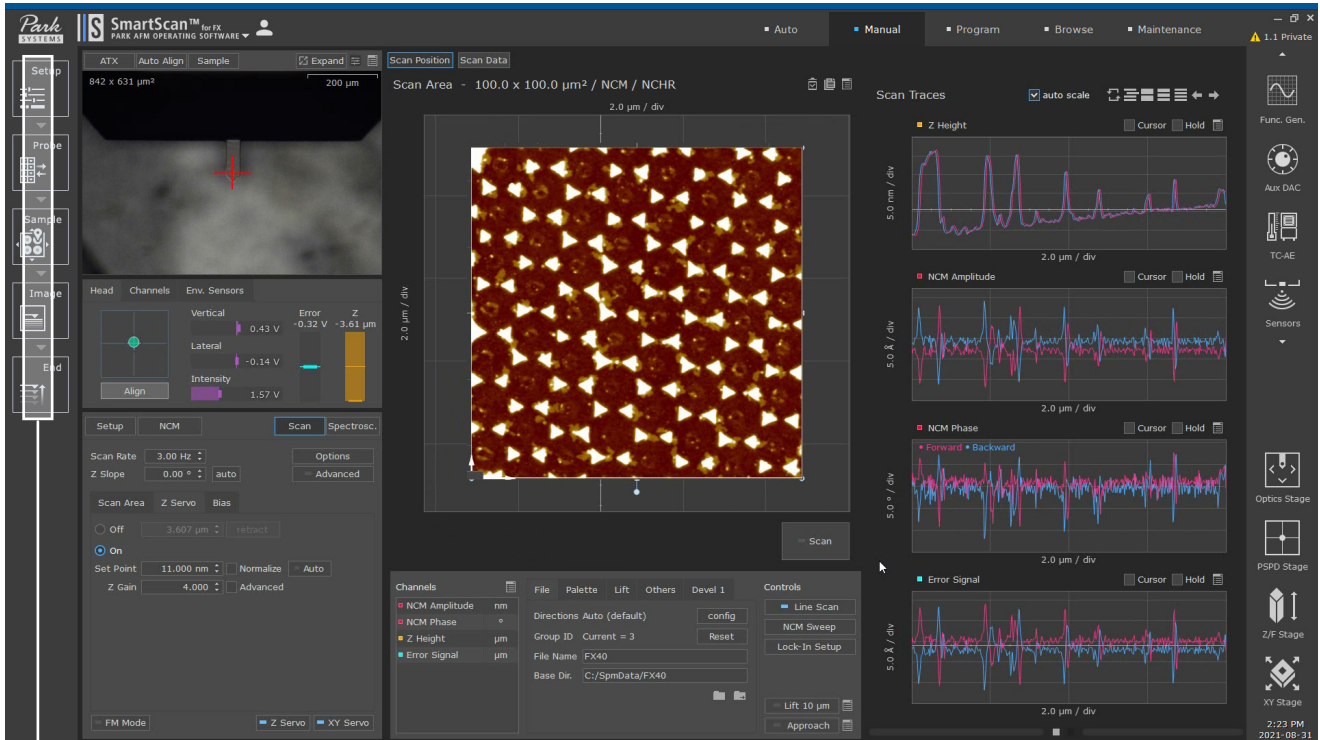**After taking 20 images**

SEM (4.52 k)

SmartScan™ for FX
PARK AFM OPERATING SOFTWARE

The Most Intelligent Operating Software
Park SmartScan for FX

Start to finish with 3 steps of Park SmartScan™

Choose pixel density and scan size.

Pixel / Scan size
Quality / Speed

QualityS ——————— peed

Start with sample A

1 SETUP
2 PROBE
3 SAMPLE
4 IMAGE
5 END

Start with new sample B

SETUP

Park SmartScan does all your setup including the probe exchange and laser alignment, ready for imaging.

POSITION

Autonomously, it performs the frequency sweep for the cantilever and brings down the Z-stage to the sample. The added sample camera of Park FX40 enables you to navigate effortlessly to the area of your interest for scanning.

IMAGE

The system sets all the necessary parameters for optimum imaging, and starts scanning the sample. It continues to scan until the image is acquired and completed with best result.
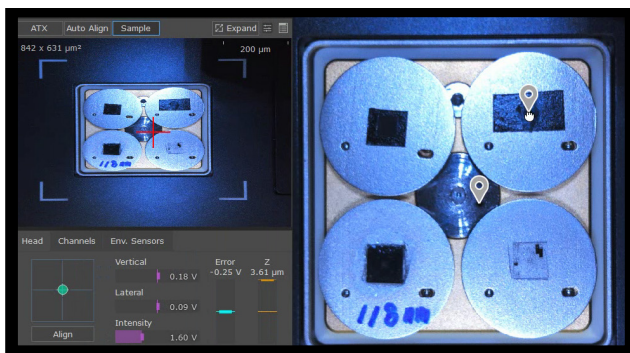
Easy Sample Navigation

With the newly added sample camera, you can automatically pair probes to sample locations. The sample camera effortlessly locates the most relevant spot for scanning. Park SmartScan allows you to surf the sample intuitively by controlling the motorized stages through its sample navigation window.
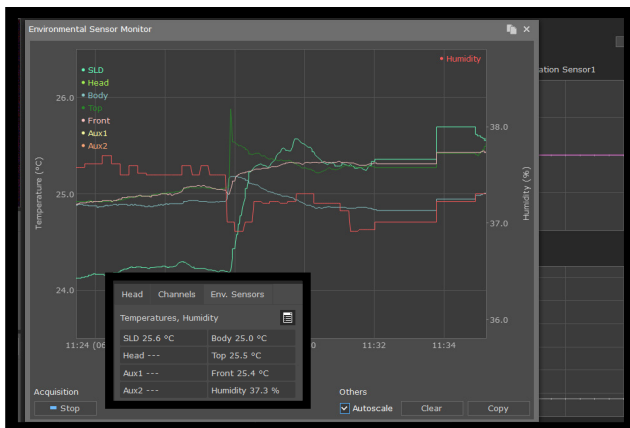
Environmental Sensors for Self-diagnostics

SmartScan displays and stores data from sensors, which measures essential environmental conditions such as temperature, humidity, leveling and vibration. This allows you to compare your scanned images with different environmental channels, providing further environmental indicators for system diagnosis.
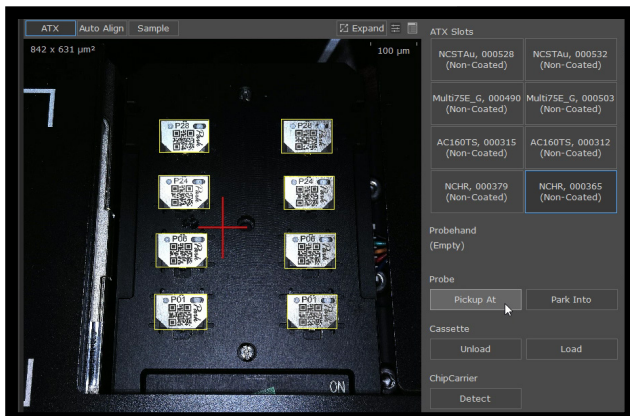
Auto Set-up for Imaging

Park FX does all your set up with the simple click of a button, automatically changing and replacing its own tips, to avoid any contamination or user-related errors. Operators are offered tip choices including the type, model, application, and usage.

Park **FX40**

The Automatic AFM

Accelerate Your Research

Park **FX40**

Conventional AFM

	Park FX40		START	START		Conventional AFM
	Place the sample	■	1	1	■	Place the sample
	Select the region of interest	■	2	2	■	Select the right probe
	Auto scan	■	3	3	■	Pick and mount the probe
	End	■	4	4	■	Find cantilever on the optical vision
				5	■	Align laser beam to probe then to PSPD
				6	■	Very slowly bring down the tip to sample. "Be careful!"
				7	■	Perform a frequency sweep
				8	■	Select the optimal frequency
				9	■	Set servo gain: adjust p-gain, l-gain, overall gain
				10	■	Bring down the tip near the sample
				11	■	Select region of interest
				12	■	Make the "approach"
				13	■	Slowly lift up the Z-stage
				14	■	Set scan parameters, scan rate, monitor line trace
				15	■	Scan the sample
				16	■	Carefully bring back the cantilever and stage at the end
				17		End!

↩ **Go to back to step 1 for a new sample**

Save Time

- ■ **Let FX40 do automatically and fast all time-consuming tasks of AFM**

Save Energy

- ■ **Free stress from probe and scanning operation**

Accomplish More

- ■ **Focus on your research**
- ■ **Publish your work faster**
- ■ **Win recognition**

Save time. Save energy.
Accomplish more!

Ask for a demo, and experience the FX difference.

C36H74 on HOPG
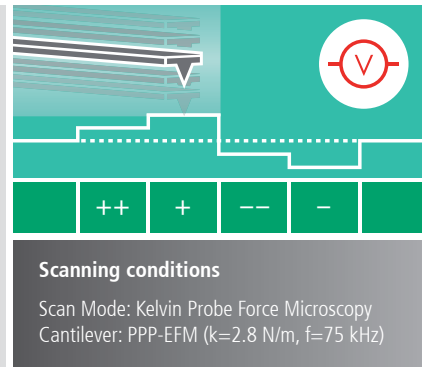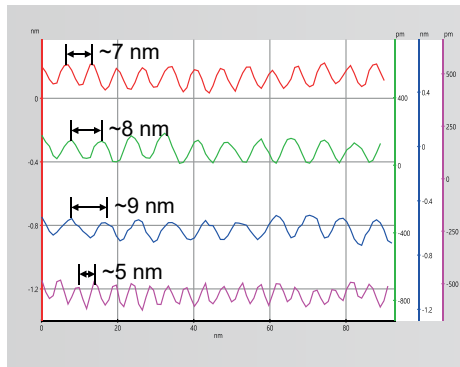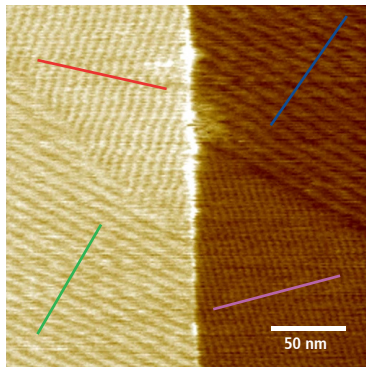
~7 nm
~8 nm
~9 nm
~5 nm

++ | + | -- | -

Cobalt doped iron oxide

1 µm

1 µm
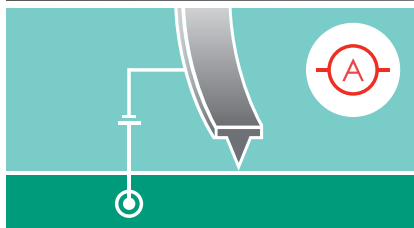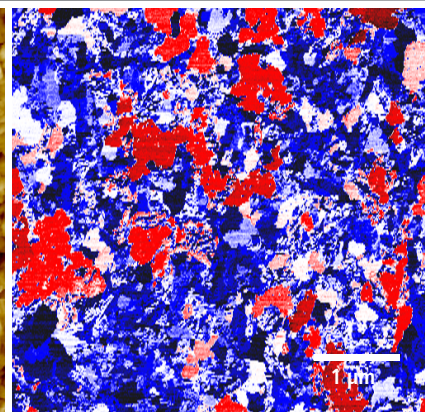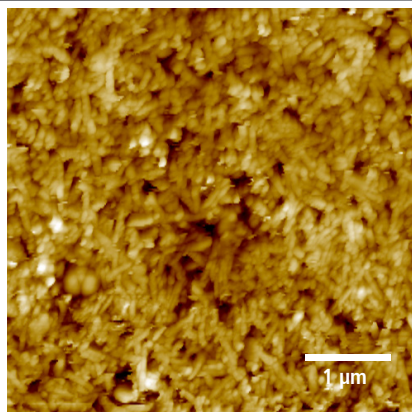
Lithography, PFM, KPFM : PZT thin film

++ | + | -- | -
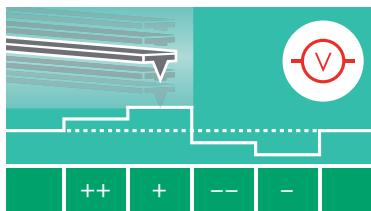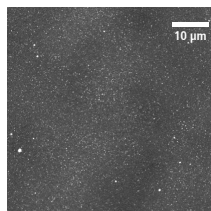
KPFM | **Design** | **Height** | **PFM amplitude** | **PFM phase**
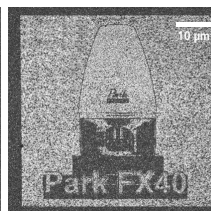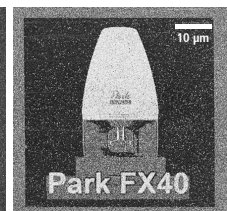
Park FX40

10 µm · 10 µm · 10 µm

MFM: Cr-Co-Mo alloy

↑ | → | ↓ | ← | ↑

2.5 µm
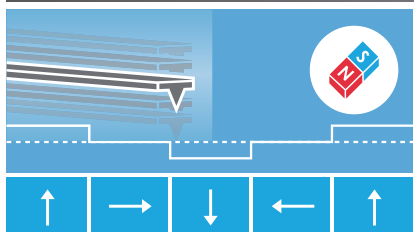
2.5 µm
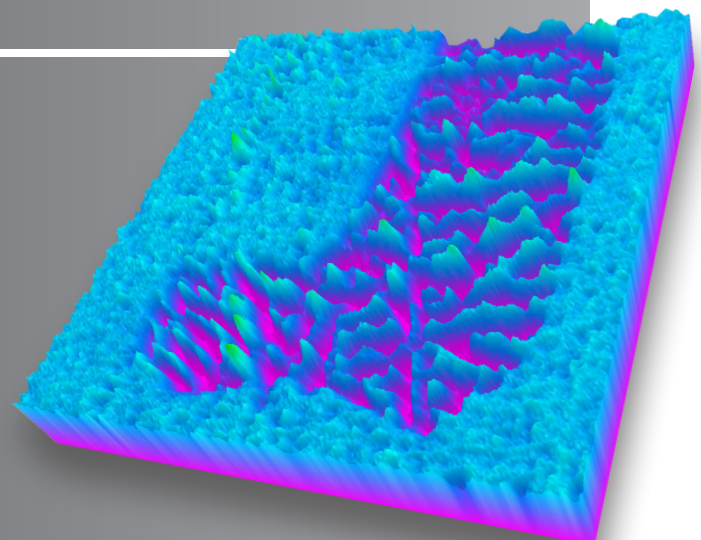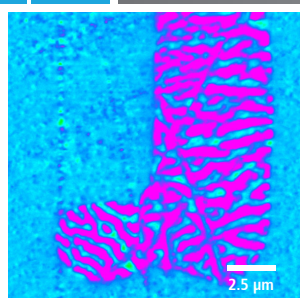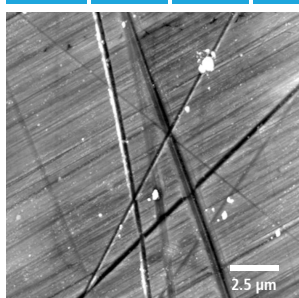
Park FX40 Specifications

■ XY-scanner

Structure	Position detector noise level
- Single-module, parallel-kinematic 2D flexure scanner - Better symmetry than serial-kinematic flexure scanner	- < 0.4 nm (@ 1 kHz bandwidth, rms) - Resolution: 0.1 nm
XY scan range	
- 100 µm x 100 µm	

■ Z-scanner

Structure	Height noise
- Flexure-guided high-force scanner	- < 0.03 nm (@ 0.5 kHz bandwidth, rms) - Resolution: 0.015 nm
Z scan range	
- 15 µm	

■ Sample mount

Sample size	Mounting
- 20 mm x 20 mm (w x d) recommended, thickness up to 20 mm	- Magnetic holder (Max. 4 sample disc) - FX Snap-in Sample Disk for Multi Snap-in Sample Chuck

■ Stage

XY stage travel range	Z stage travel range
- 105 mm x 40 mm (Motorized)	- 22 mm (Motorized)

■ Visions and optics

Vision path	Objective lens	CCD	Field-of-view
- On-axis sample view from top - The same view as an optical microscope	- 10x (N.A. 0.21) - Resolution: 1 µm	- 5.1 M Pixel - Pixel size: 3.45 µm x 3.45 µm	- 840 µm x 630 µm View with 10x lens

■ AFM controller

Lock-in amp
- 4 channel integrated 16 Hz ~ 5 MHz

■ Dimensions

AFM body dimension
- 450 mm x 350 mm x 300 mm (W x D x H) Max. dimension of system use inside the acoustic enclosure

■ Accessories

Probe exchange	Probe mount
- Probe exchanges in less than 1 minutes using Automated Probe Exchange (ATX) (No need to remove head to exchange cantilevers)	- Pre-aligned mount using chip carrier

■ Modes and options

Topography imaging	Magnetic properties	Mechanical properties		
- True Non-Contact™ Mode - Contact Mode - Tapping Mode	- Magnetic Force Microscopy (MFM)	- PinPoint™ Nanomechanical Mode - Force Modulation Microscopy (FMM) - Nanoindentation	- Nanolithography - Nanolithography with High Voltage* - Nanomanipulation	- Lateral Force Microscopy (LFM) - Force Distance (F/d) Spectroscopy - Force Volume Imaging

Electrical properties		Dielectric/piezoelectric properties	Thermal properties
- Conductive AFM (C-AFM) - I/V Spectroscopy - Kelvin Probe Force Microscopy (KPFM) - KPFM with High Voltage*	- Scanning Capacitance Microscopy (SCM)* - Scanning Spreading-Resistance Microscopy (SSRM) - Photo Current Mapping (PCM)* - Electrostatic Force Microscopy (EFM)	- Piezoresponse Force Microscopy (PFM) - PFM with High voltage* - Piezoresponse Spectroscopy	- Scanning Thermal Microscopy (SThM)* * Soon to be available

Committed to Contribute to Impactful Science and Technological Development

Park Systems continues to advance the scope of its products to enhance nanometrology in line with their mission to **enable nanoscale advances** for scientists and engineers solving the world's most pressing problems. The advanced AFM architecture, the True Non-Contact™ mode and SmartScan technology embedded in Park Systems's full line of products provides the highest degree of accuracy and advanced automation for today's most demanding nanoscale applications. Research driven product innovations, accelerated at the rapid pace of nanotechnology, are the hallmark of Park's longstanding success with leading academic and industrial customers worldwide. Park Systems is a publicly traded corporation on the Korea Stock Exchange (KOSDAQ) with corporate headquarters in Suwon, South Korea, and regional offices in New York & California USA, Germany, France, UK, China, Japan, Singapore, India, Taiwan and Mexico. To learn more about Park Systems, please visit www.parksystems.com.

Park Systems
Enabling Nanoscale Advances