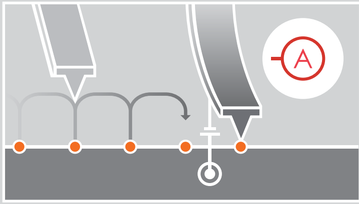
ATOMIC FORCE MICROSCOPE

Park PinPoint™ mode

PinPoint your sample via AFM

Accurate nanomechanical imaging via PinPoint™ mode

What is PinPoint™ mode



PinPoint is a proprietary operation mode of Park Systems AFMs that provides accurate and quantitative nanomechanical images via fast force spectroscopy mapping. Besides the acquisition of nanomechanical properties, including adhesion force and elastic modulus, the controlled contact force and time in PinPoint allows more accurate and less invasive electrical and electromechanical imaging. In Park AFMs, PinPoint combines several traditional modes of second generation AFMs into one potent and customizable package.

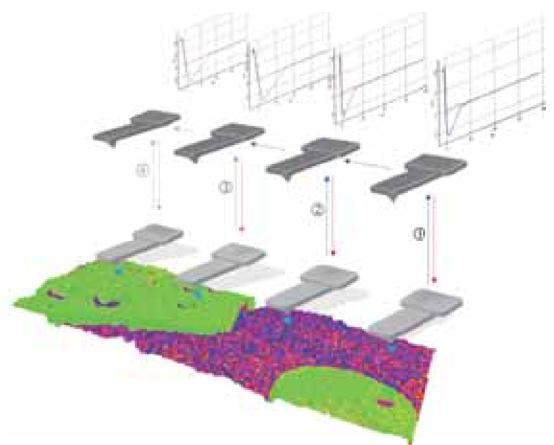
How does PinPoint work?

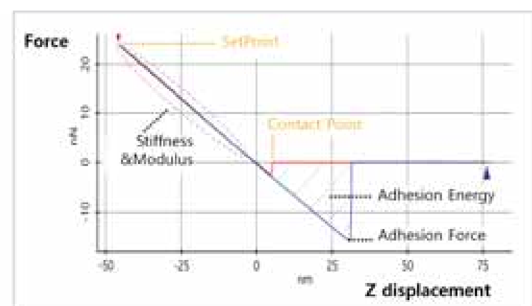
In PinPoint mode, the cantilever approaches and retracts at each pixel of the entire scan area to simultaneously acquire 3D topography and nanomechanical information of the sample surface (for example
256 x 256 pixel = 65536 measurement points).
At each pixel, the XY scanner stops and high-speed force-distance curves are taken with well-defined control of contact force and contact time between the tip and the sample.

How does PinPoint work?

PinPoint mode has the capability to simultaneously collect topography, stiffness, elastic modulus, and adhesion force in real-time. By moving the tip in an approach-retract technique with forces down to a few nano Newton, PinPoint ensures a frictionless operation that eliminates the shear force and therefore preserves tip and sample condition.

- PinPoint can be combined with electrical and electromechanical measurement modes.
- PinPoint allows a non-invasive characterization of soft samples, that are sensitive to shear forces.
- It offers simultaneous acquisition of up to eight unique information channels.
- The user has full customization control of acquisition channels, allowing to configure each experiment according to varying requirements.





Working principle of PinPoint nanomechanical mode by Park Systems. The probe is moved from point 1 to 5, and at each point force-distance curves are taken to calculate the nanomechanical properties.

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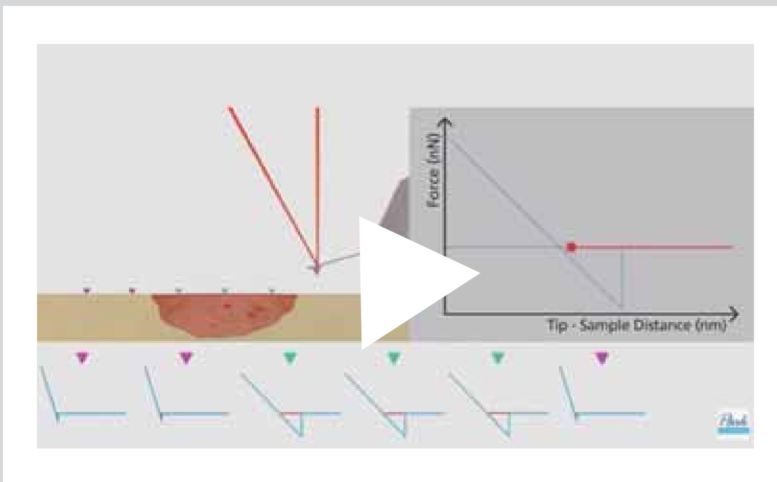


Scan QR code to watch an instructive video on Park PinPoint™ mode.

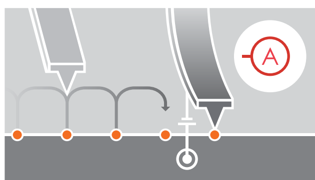
PinPoint C-AFM

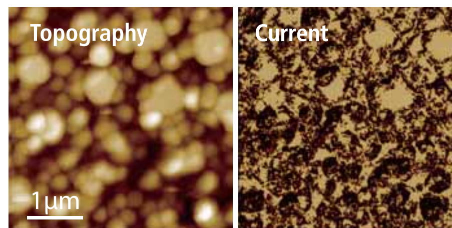
PinPoint C-AFM for highly reproducible, non-invasive current imaging

PinPoint C-AFM performs conductive measurements with higher accuracy for both topography and current measurements compared to traditional C-AFM, due to:

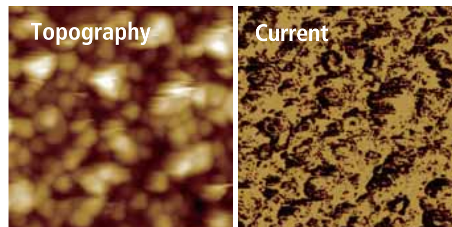
- a reduction of shear force,therfore perserving the tip quality and lifetime, which increases the repeatability,
- higher spatial resolution as result of lower tip wear,
- controlled contact force and time for highly accurate current detection,
- defined contact force that preserves the sample integrity, particularly on soft, polymeric surfaces,
- simultaneous acquisition of conductive, topographical and nanomechanical sample properties.

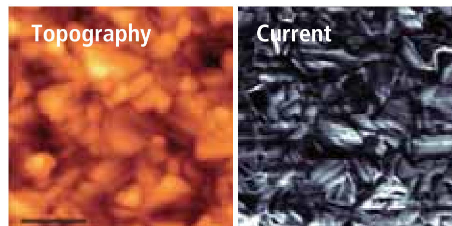
- PinPoint C-AFM





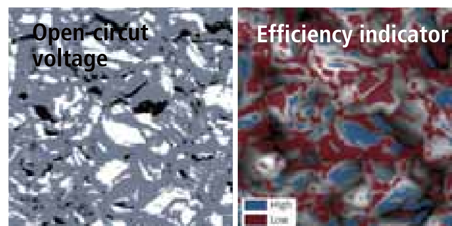
- Conventional C-AFM





- PinPoint Photoconductive AFM
  on Hybrid Halide Perovskite Solar Cell

Sibel Y. Leblebici et al. (2016). Facet-dependent photovoltaic efficiency variations in single grains of hybrid halide perovskite. Nature Energy 16093.

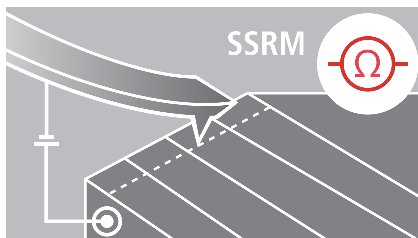


PinPoint SSRM

PinPoint SSRM for optimal results in semiconductor applications

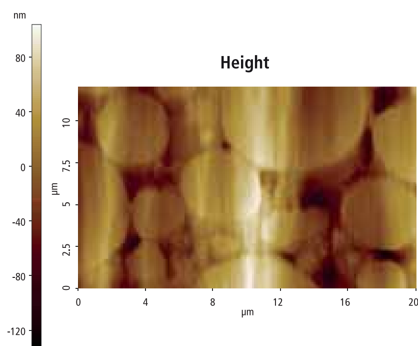
In comparison to traditional SSRM operation, PinPoint SSRM improves the data acquisition by:

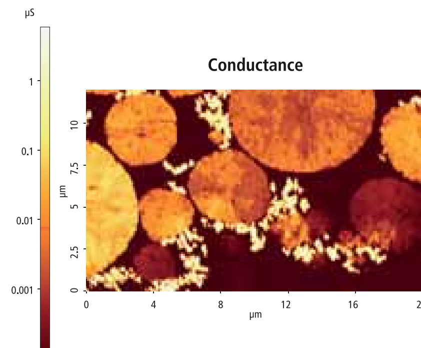
- reducing shear forces for longer tip lifetime and reduced sample damage,
- offering a more accurate detection of the electrical signals due to controlled contact force and time,
- simultaneous acquisition of current, conductance, resistance, topography and nanomechanical properties.

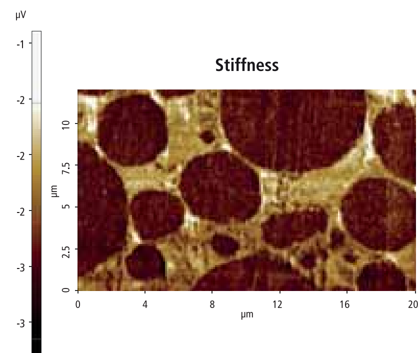


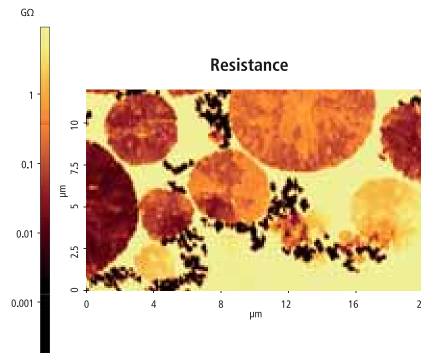
PinPoint SSRM on Li ion battery electrode

Topography, conductance, resistance, adhesion and stiffness of the sample were simultaneously measured on the NX-Hivac, High Vacuum AFM from Park Systems.







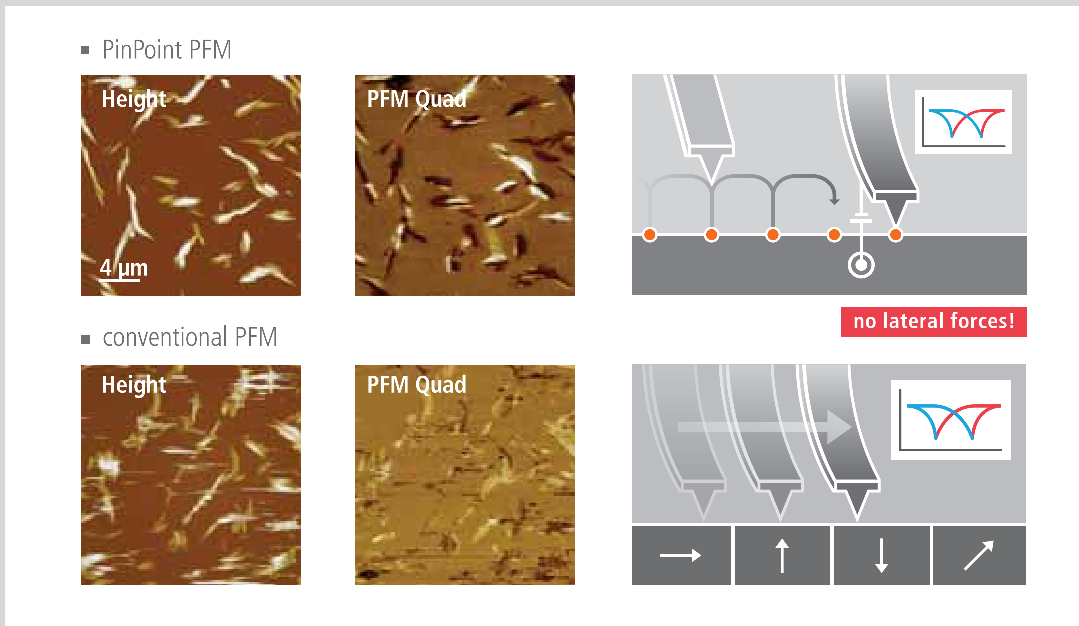


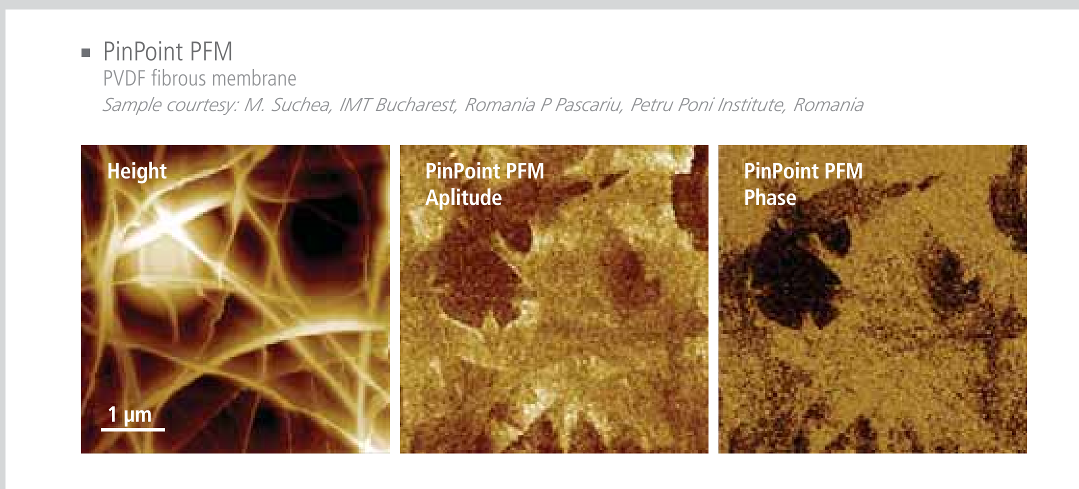
PinPoint PFM

PinPoint PFM for enhanced electrical investigation at the nanoscale

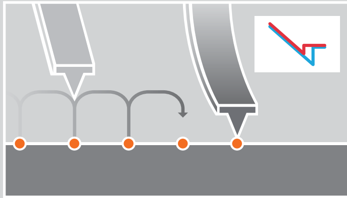
In comparison to conventional contact PFM, PinPoint PFM non-invasively acquires topography and piezoelectric data on soft, polymeric samples. PinPoint PFM provides:

- controlled contact force and time for repeatable and accurate piezoresponse measurements,
- high spatial resolution due to reduced tip wear,
- non-invasive imaging particularly for soft samples by reduction of shear forces,
- simultaneous acquisition of piezoresponse, topography and nanomechanical properties.





Application Examples

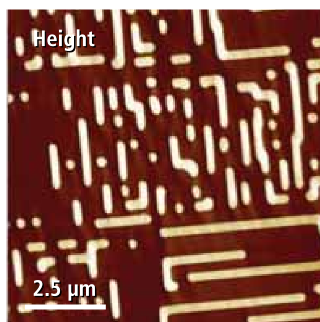


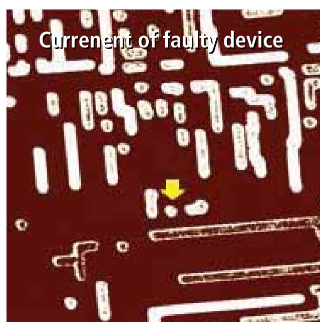
PinPoint nanomechanical mode

PinPoint nanomechanical mode for Failure Analysis and Defect Recognition

PinPoint C-AFM allows the characterization of electrical designs of semiconductor devices like SRAMs with the high accuracy, precision and repeatability required for failure analysis, due to:

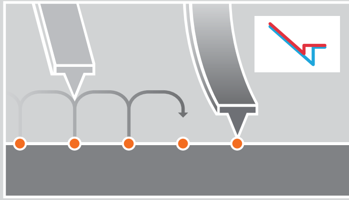
- the controllable data acquisition time allowing a very high signal-to-noise ratio,
- frictionless conductivity scanning,
- reproducible data from repeated measurements,
- cost savings from longer lasting AFM probe tips.





- Failure analysis of semiconductor device via PinPoint C-AFM
  - *A leakage current was observed on a component of the faulty device (leaking component marked by yellow arrow). (component marked by yellow arrow).*
  - *Leakage current originates from a contact of the n-doped area below the faulty device component.*

Application Examples

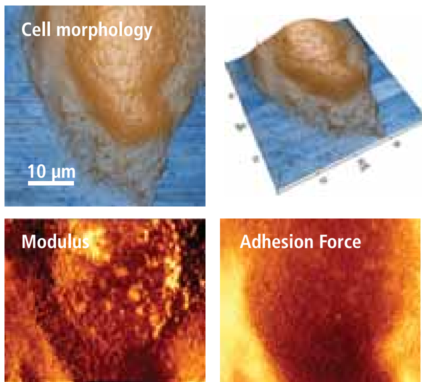


PinPoint nanomechanical mode

PinPoint nanomechanical mode for cell biology and life science applications

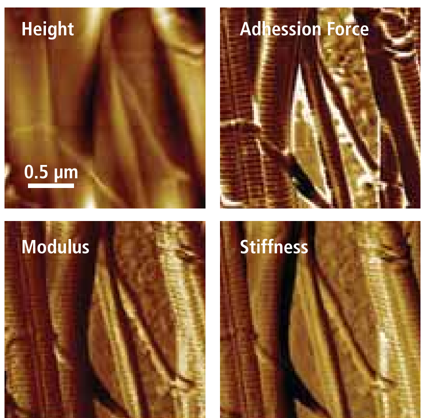
PinPoint mode offers accurate nanomechanical imaging of biological samples via:

- mapping of nanomechanical properties including adhesion force, elastic modulus, stiffness and deformation plus topography with nanometer resolution,
- fast, quantitative imaging of elasticity distribution with a correlated topography map, which reveals the position and orientation of sample,
- simultaneous acquisition of topography and force-distance data avoids positional errors,
- sample damage such as scratches or streak marks, frequently observed in traditional AFM imaging of cells or biological samples in liquid.



- PinPoint nanomechanical

images on an MRC-5 cell (human lung fibroplast), giving an averagev elastic modulus of 90 kPa



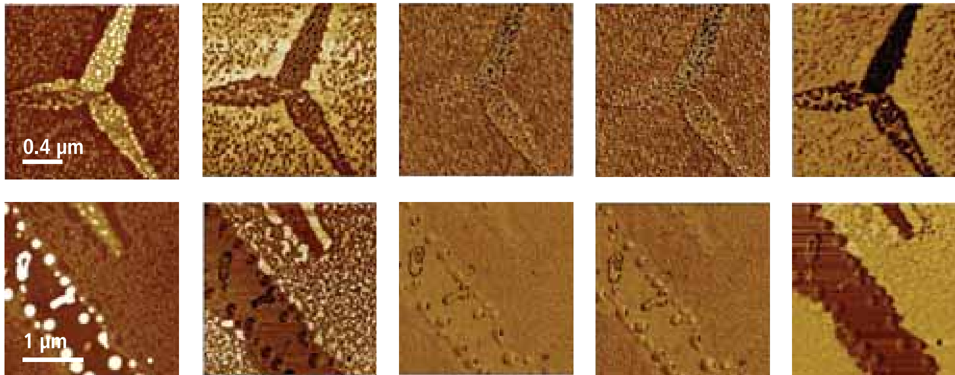
- PinPoint nanomechanical

images on collagen fibrils in air, giving on collagen fibrils in air, giving an average elastic modulus of 1.94 GPa

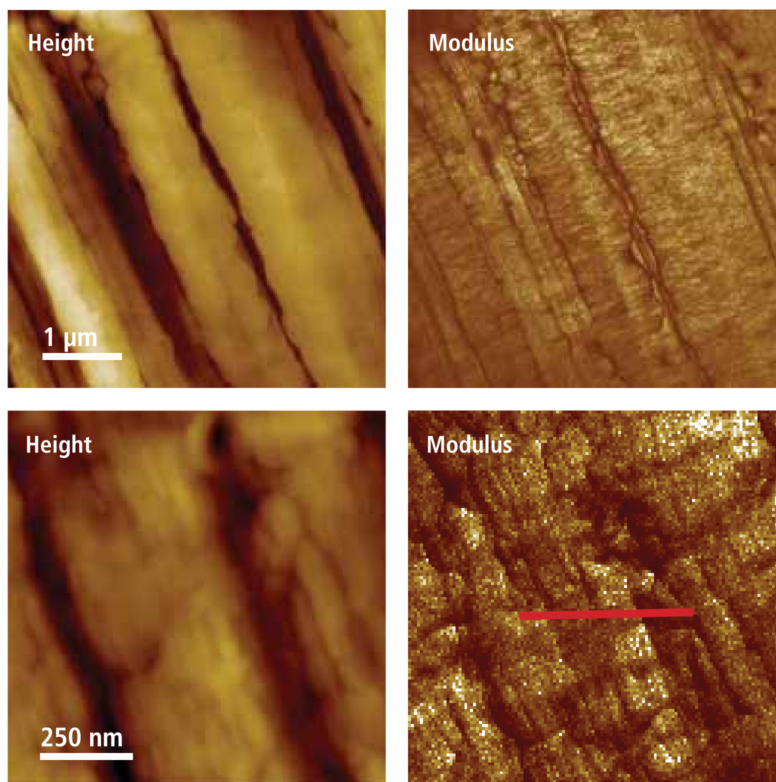
Additional Application Examples

PinPoint nanomechanical mode on 2D materials

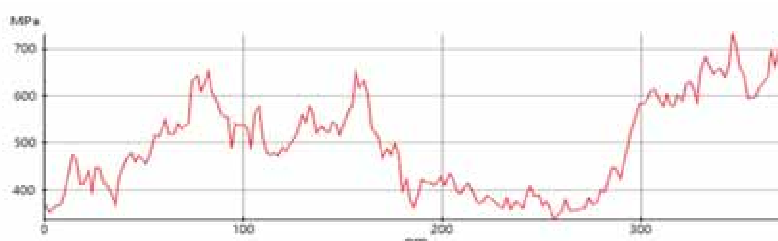
Lateral Force Microscopy via PinPoint nanomechanial mode on MoS_2 on SiO_2



PinPoint Nanomechanical imaging on commercial Teflon polymer



High resolution nanomechanical map of DMT Modulus on a sample of commercial Teflon tape. The average modulus is ~400 MPa. On crystalline areas it reaches 500-600 MPa.



The graph shows a cross-sectional profile from modulus image, depicting varying modulus on the teflon domains.

Park Atomic Force Microscopy Modes

Get the data you need with Park's selection of scanning modes

TOPOGRAPHY IMAGING

- Contact
- Non-Contact
- Tapping

ELECTRICAL / MAGNETIC PROPERTIES

- Conductive AFM
- PinPoint Conductive AFM
- IV Spectroscopy
- Photocurrent Mapping
- Scanning Tunneling Microscopy
- Scanning Spreading Resistance Microscopy
- Scanning Capacitance Microscopy
- Electrostatic Force Microscopy
- Kelvin Probe Force Microscopy
- Piezoresponse Force Microscopy
- Magnetic Force Microscopy
- Tunable Magnetic Field MFM

NANOMECHANICAL PROPERTIES

- Force Distance Spectroscopy
- PinPoint Nanomechanical
- Force Modulation Microscopy
- Lateral Force Microscopy
- Nanoindentation
- Nanolithography
- Nanomanipulation

OTHER PROPERTIES

- Scanning Thermal Microscopy
- Scanning Ion Conductance Microscopy

PinPoint mode available on NX product line:

General AFM

Park NX10

The world's most accurate easy-to-use research AFM

Park NX20

Power, versatility, ease of use, brilliantly combined for large sample AFM

Park NX20 300mm

The leading automated nanometrology tool for 300 mm wafer measurement and analysis

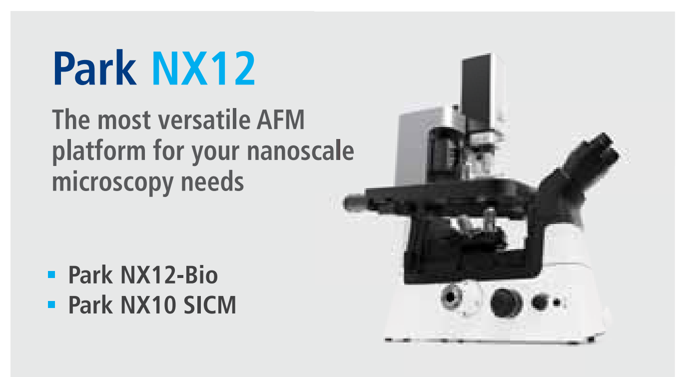
Park XE7

True research-grade AFM for the practical budget

Park NX-Hivac

The most advanced high vacuum AFM for failure analysis and sensitive materials research

Life sciences and chemical



Park NX12

The most versatile AFM platform for your nanoscale microscopy needs

- Park NX12-Bio
- Park NX10 SICM

Industrial AFM

Park PTR

Fully automated AFM for accurate inline metrology of hard disk head sliders

Park HDM

Simply the best AFM for media & substrate manufacturing

Park 3DM

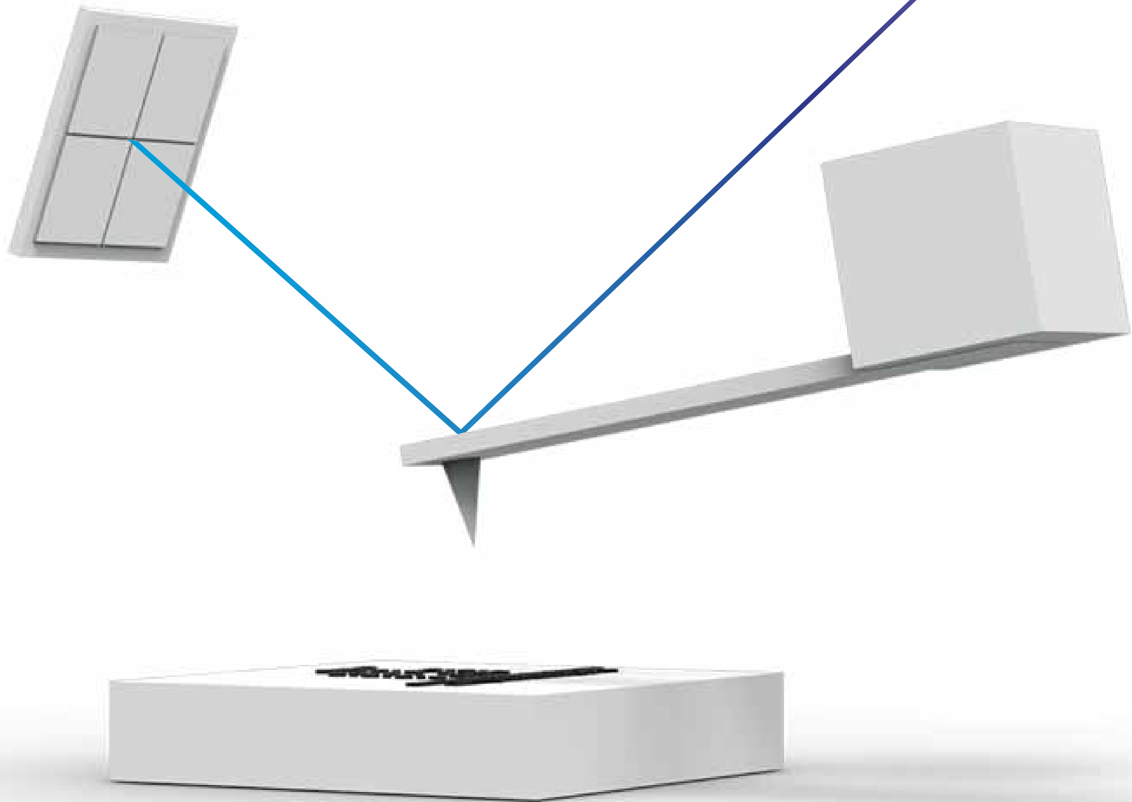
Automated industrial AFM for high-resolution 3D metrology

Park NX-Wafer

Low noise, high throughput Atomic Force Microscope

Park NX-TSH

The automated AFM system for ultra large and heavy flat panel displays at nanoscale



Committed to Contribute to Impactful Science and Technological Development

More than 25 years ago, the foundations of Park Systems were laid at Stanford University, where Park Systems' founder, Dr. Sang-il Park, worked in Prof. Calvin Quate's group; the group that invented the world's first AFM. After years of development, Dr. Park introduced the first commercial AFM to the world, thus starting the successful path of Park Systems. With good foresight, a superior product and keen business acumen.

Park Systems continuously strives to live up to the innovative spirit of its origin. Throughout its long journey, the company has been committed to provide advanced, accurate, and reliable AFM instrumentation, with revolutionary features such as True Non-Contact™ mode and PinPoint™ Nanomechanical AFM. Cutting-edge AFM automation features, like SmartScan™, make Park Systems AFMs not only extremely easy to use, but they also enable users to obtain outstanding results faster, more efficiently, and more accurately.

Park Systems

Enabling Nanoscale Advances

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