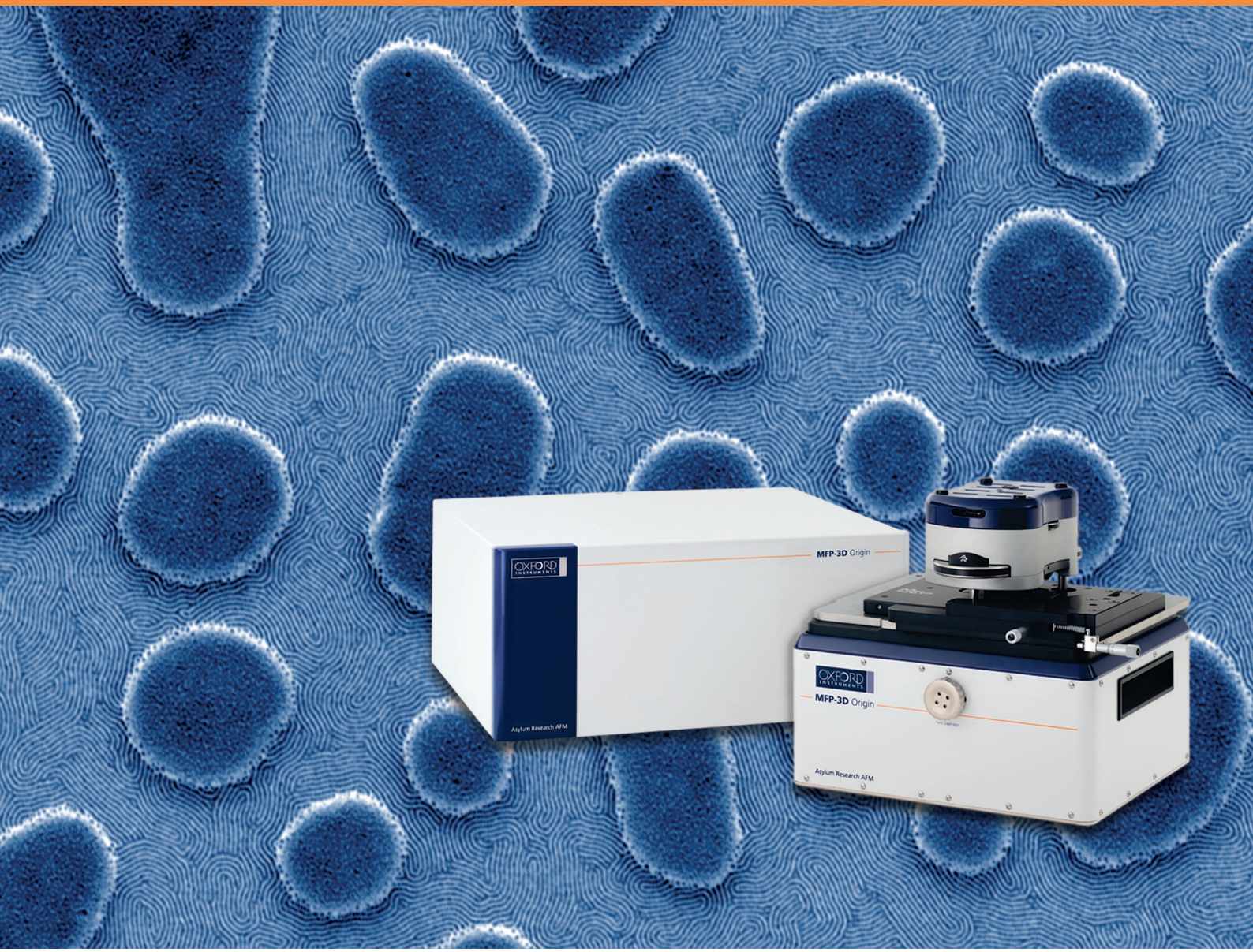
Asylum Research

MFP-3D **Origin** and **Origin+** AFMs

Asylum Research performance and quality within reach of your budget

High Performance – Full Range of Modes and Accessories – Easily Upgradable



Performance / Versatility / Support

OXFORD INSTRUMENTS

The Business of Science®

AFFORDABLE

The Asylum AFM Advantage is Within Reach

Get a much better AFM at a price competitive with most low-cost AFMs

The **MFP-3D Origin**™ AFMs mark the intersection of performance and affordability. They feature the high resolution and experimental versatility that you would expect from Asylum Research, the AFM technology leader. Their ease of use and budget-friendly prices make them ideal for researchers new to AFM or anyone seeking a powerful yet affordable AFM.

The best place to start with AFM

- Easily the best AFMs at this low price point
- Big samples—up to 80 mm diameter
- High performance—a single scanner scales from atomic resolution to huge 120 µm scans
- Unmatched range of modes and accessories
- Tough, robust design is great for busy labs
- Unmatched customer support worldwide
- Confidence backed by the Asylum reputation

MFP-3D Origin

Asylum's most affordable AFM model supports large samples, most imaging modes, and many accessories.

MFP-3D Origin+

The Origin+ features the same core performance as the Origin but adds support for the complete range of MFP-3D modes and accessories.

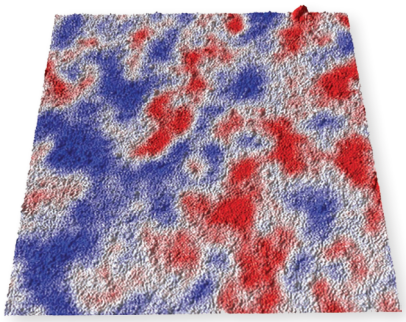
Think you can't afford an Asylum Research AFM? Think again.

You can get a research-grade AFM from Asylum Research for the same price as many low-cost AFMs without compromising capability, quality, or customer support. Just ask for pricing: *AFM.info@oxinst.com*

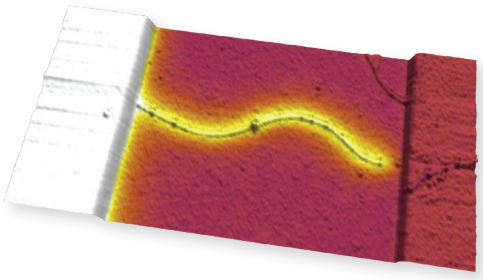
RESEARCH-GRADE

Origin AFMs are Ready for Your Research

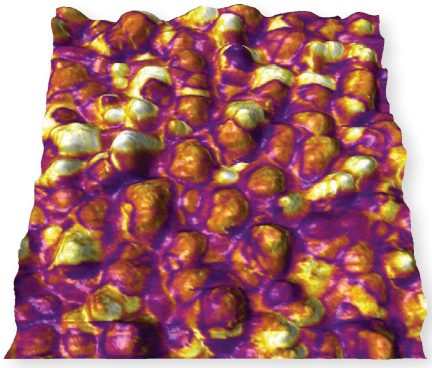
High performance and broad capabilities for every research field



Microgel thin film, surface potential image, 15 µm scan. Courtesy of C. Sorrell and L. Lyon, Georgia Institute of Technology.



Carbon nanotube attached to an electrode, electric force microscopy (EFM) phase is overlaid on topography, 5 × 2.5 µm scan. Courtesy of Minot Lab, Oregon State University.



$GaFeO_3$ thin film, piezoresponse force microscopy (PFM) amplitude overlaid on topography, 1.25 µm scan. Sample courtesy of S. Mukherjee, R. Gupta and A. Garg, Indian Institute of Technology, Kanpur.

DNA origami triangles, imaged in fluid, 600 nm scan. Sample courtesy of P. Rothemund, California Institute of Technology.

"The MFP-3D Origin has proven itself as a top quality research AFM in our lab. Our main project now involves molecular recognition on soft biological samples,which requires low-noise, high-resolution force mapping. We especially appreciate the flexibility that it provides in terms of both the measurements supported and the ease with which we can create custom analysis routines."

Franziska Wild and Felix Hilpert,
lab of Prof. Thorsten Röder
Mannheim University of Applied Sciences

Polymers

- Morphology
- Nanomechanical properties
- Blends, copolymers, and composites
- Interface / interphase properties
- Investigation of thermal transitions

Thin Films

- Roughness and uniformity
- Hardness and wear
- Electrical conductivity
- Nanomechanical properties

Electronic Devices

- Nanoscale failure analysis
- Dopant profiling

Advanced Materials

- Graphene and 2D materials
- Piezo- and ferro-electrics
- Ceramics and glasses

Energy Materials

- Batteries / electrochemistry
- Photovoltaics

Bioscience and Biophysics

- Mechanical properties of cells and cell/tissue substrates
- Native membranes and supported lipid bilayers
- Proteins, nucleic acids, and other biomolecules and molecular self-assemblies
- Food science
- Biomaterials and ecology

NO COMPROMISE

The Highest Performance AFMs in Their Class

An AFM that thrives in busy research groups and multi-user facilities

Performance and features that go far beyond all competitors in its price range

High-resolution imaging in both air and fluid

- Robust mechanical design minimizes noise and drift
- Go from atomic resolution to large area scans with 120 µm XY range and 15 µm Z range (40 µm optional)

Accurate, lowest-noise force measurements

- Unique design eliminates interference to enable the lowest noise pN-scale force measurements
- Closed-loop Z scanner ensures accurate force-distance measurements and ramp velocities

Modern scanner design makes the AFM easier to use *and* improves measurement accuracy

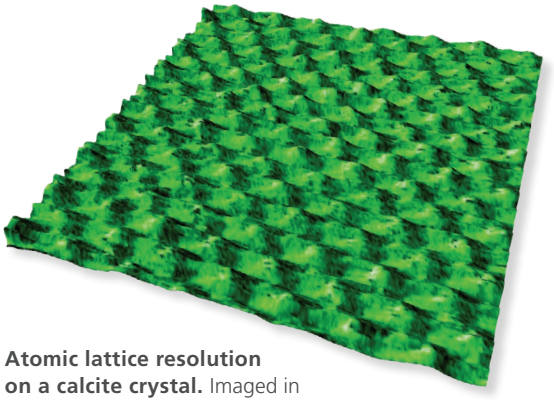
- Origin AFM scanners use low-noise sensors to measure and correct scan motion in real-time, which both improves measurement accuracy and makes it easy to precisely zoom and offset to regions of interest
- Origin AFM scanners also use mechanical flexures to keep the scan axes orthogonal and the scan plane flat
- Many similarly-priced AFMs use scanners based on piezo tubes and lack position sensors, which causes scan artifacts and unpredictable zooms and offsets

Large sample stage makes navigation easy

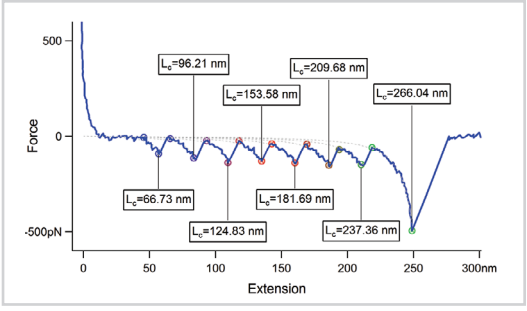
- Accommodates samples up to 80 mm diameter and up to 10 mm thick (option for up to 27 mm thick)
- Stage micrometers allow easy and precise positioning of the sample under the tip using the top-view optics

Engage and scan—quickly, easily and reliably

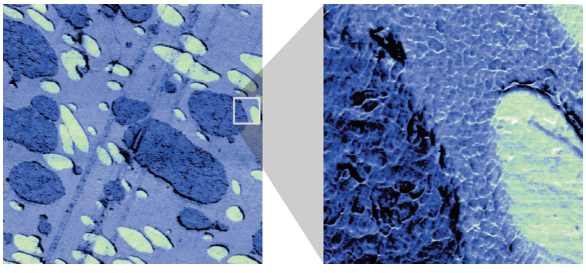
- User directly controls the approach, allowing the tip to rapidly be brought near the surface before piezo feedback gently brings it into contact, preserving delicate tips and samples



Atomic lattice resolution on a calcite crystal. Imaged in liquid in contact mode, 7.5 nm scan.



Mechanical unfolding of titin. The exquisite force sensitivity of Asylum AFMs helps unravel the mysteries of protein structure and stability.



Closed-loop scanner makes it easy to accurately zoom and offset to a region of interest in a single step
Here a three component polymer blend was imaged. A large overview scan (20 µm) was collected first (left), then a new region was chosen with a single click for a smaller 2 µm scan (right). The modulus data channel is shown, clearly indicating three components. Sample courtesy of D. Yablon, ExxonMobil Research and Engineering, Corporate Strategic Research.

Simple Yet Powerful Software

Makes AFM easy for new users while still supporting expert users

Software tools that make it easy to start getting results

- SmartStart™ automatically detects and configures system components to get results quickly
- ModeMaster™ configures the software for your choice of measurement type
- GetReal™ automatically calibrates the cantilever sensitivity and spring constant

Origin AFMs support a full range of operating modes

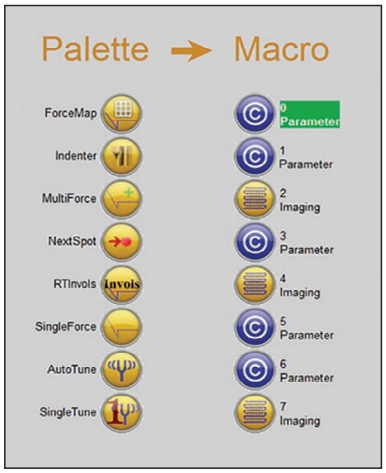
- All basic modes and many advanced modes are included at no extra charge on all Origin and Origin+ AFMs
- Some advanced modes for characterizing nanoscale mechanical and electrical properties use optional probe holders, which can be added at any time

Automation? Advanced needs? No problem.

- MacroBuilder™ allows you to easily implement custom routines by simply dragging "modules" together to form macros, no coding required
- Almost unlimited customization by users is possible within Asylum's open-source IGOR Pro-based code

ModeMaster enables one-click setup for more than thirty different modes.

Nanolithography example created by anodic oxidation on silicon, 20 µm scan.



Modes included on every Origin and Origin+ AFM

- Bimodal Dual AC™
- Contact Mode
- Dual AC Resonance Tracking (DART)
- Electrostatic Force Microscopy (EFM)
- Force Curve Mode
- Force Mapping Mode (Force Volume)
- Force Modulation
- Frequency Modulation
- Fluid Imaging
- Kelvin Probe Force Microscopy (KPFM)
- Lateral Force Mode (LFM)
- Loss Tangent Imaging
- Magnetic Force Microscopy (MFM)
- MicroAngelo™ (nanolithography and nanomanipulation)
- Phase Imaging
- Piezoresponse Force Microscopy (PFM)
- Switching Spectroscopy PFM
- Tapping Mode (AC Mode)
- Tapping Mode with Q-control
- Vector PFM

Optional modes

- AM-FM Viscoelastic Mapping Mode
- Conductive AFM (CAFM) with ORCA™ and Eclipse™ Mode
- iDrive™ (magnetically actuated tapping mode in fluid)
- Scanning Thermal Microscopy (SThM)
- Scanning Tunneling Microscopy (STM)
- High Voltage PFM*
- Scanning Microwave Impedance Microscopy (sMIM)*
- Contact Resonance Viscoelastic Mapping Mode*

**Origin+ only*

QUANTITATIVE

Go Beyond Topography—Get Material Properties

Just a few of the many techniques available on Origin family AFMs

MECHANICAL PROPERTIES

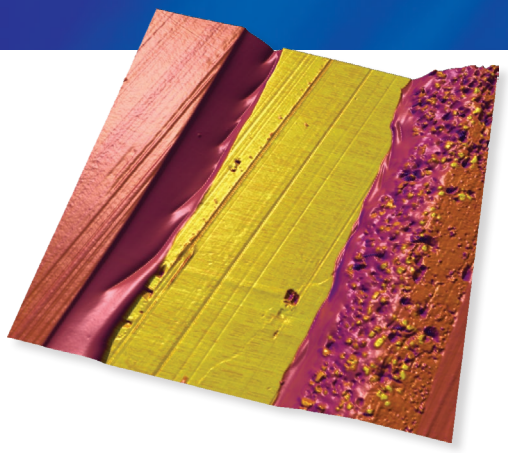
Learn more: AFM.oxinst.com/MFP-Nanomechanics

AM-FM Viscoelastic Mapping Mode

- Tapping mode technique that measures both the elastic storage modulus (E') and the viscoelastic loss tangent, $tan\ \delta = E''/E'$
- Good for samples from 50 kPa to 300 GPa
- Fast—same speed as regular tapping mode

Contact Resonance Viscoelastic Mapping Mode

- Contact mode technique that measures both storage modulus (E') and loss modulus (E'')
- Good for samples from 1 GPa to 300 GPa



Multi-layered coffee bag cross-section
imaged using AM-FM Viscoelastic Mapping Mode. Modulus data is shown in 3D topography, 30 µm scan.

ELECTRICAL PROPERTIES

Learn more: AFM.oxinst.com/MFP-Nanoelectrical

Conductive AFM (CAFM)

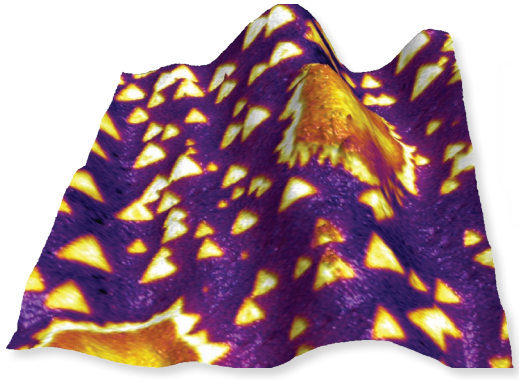
- Measures DC current from 1 pA to >10 µA

Kelvin Probe Force Microscopy (KPFM)

- Measures sample surface potential and work function

Electrostatic Force Microscopy (EFM)

- Measures electrostatic force gradient

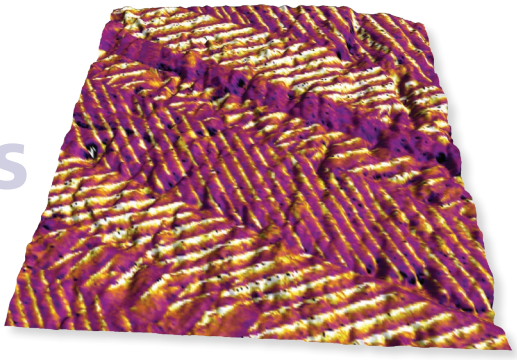


Boron nitride and graphene grown on copper film
imaged using KPFM. Surface potential data is shown on 3D topography, clearly showing triangular patches of boron nitride and irregular areas of graphene that would have otherwise been obscured by the rough topography of the copper, 50 µm scan. Sample courtesy of N. Wilson, University of Warwick.

FUNCTIONAL PROPERTIES

Piezoresponse Force Microscopy (PFM)

- High sensitivity and crosstalk-free measurements
- Higher sensitivity is enabled by operating at high voltages (up to ±220 V) and at the tip-sample contact resonance frequency (DART Mode)



Molecular ferroelectric film
PFM phase data is shown on 3D topography, 20 µm scan. Image courtesy of A. Eshghinejad and J. Li, University of Washington.

VERSATILE

Drive Your Research To the Next Level

Asylum Research offers the widest range of innovative accessories

Temperature Control

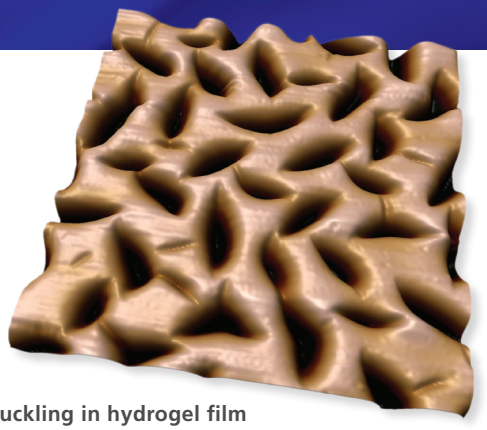
- **PolyHeater**™ heat up to 275/400°C (Origin/Origin+)
- **CoolerHeater**– cool or heat between -30 to 120°C
- **BioHeater**™ coverslip-based heater for liquids, up to 80°C
- **Petri Dish Heater**– heats petri dish up to 45°C

External Driving Forces

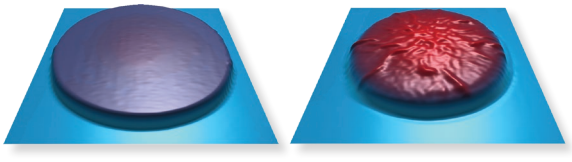
- **Variable Field Module 3**– magnetic fields up to 0.8 T
- **NanoRack**™ tensile or compressive stress up to 80 N
- **High Voltage Field**– apply up to ±220 V
- **Probe Station**– apply electric signals to samples

Controlled Gas or Liquid Environments

- **Closed Fluid Cell**– perfuse gases or liquids
- **Fluid Cell Lite**– operate in liquid without perfusion
- **Electrical Closed Cell**– controlled gas environment
- **Petri Dish Holder**– minimizes evaporation from dish
- **MicroFlow Cell**– small volume fluid exchange
- **Humidity Cell**– sealed cell with humidity sensor
- **Electrochemistry Cell**– sealed cell with electrodes

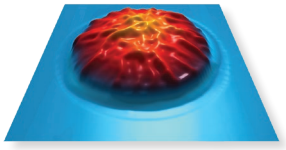


Buckling in hydrogel film immersed in water and heated using the BioHeater accessory, 90 µm scan. Courtesy of D. Chen, University of Massachusetts-Amherst.



t=0 min, T=80°C

t=78 min, T=106°C

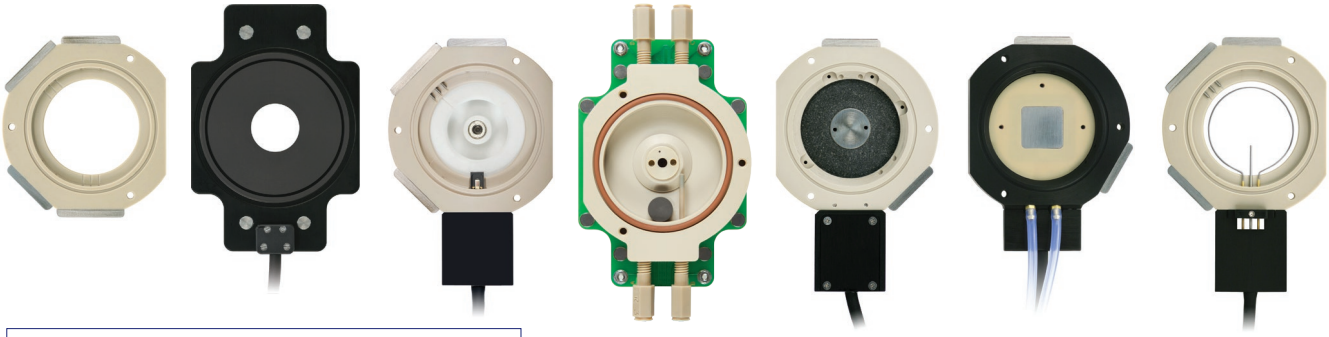


t=170 min, T=110°C

See the movie
AFM.oxinst.com/memory

Shape memory polymer microparticle imaged while annealing using the PolyHeater, 12 µm scans. The flattened particle recovers its original shape during annealing. Courtesy of J. Killgore and D. Hurley, NIST.

Closed Fluid Cell | Petri Dish Heater | Humidity Cell | Electrochemistry Cell | PolyHeater | CoolerHeater | BioHeater



- Compatible with both Origin and Origin+
- Compatible only with Origin+

Learn more: AFM.oxinst.com/MFP3D-accessories

SPECIFICATIONS

Precise, Low-Noise Closed-Loop Scanner

X&Y range 120 µm

X&Y sensors <0.6 nm noise

Z range >15 µm (>40 µm option)

Z sensor <0.25 nm noise

Low-Noise, High Bandwidth Optical Lever

Cantilever deflection sensing uses an inverted configuration (incident beam off-vertical) to dramatically reduce interference from light reflected by the sample.

Light source Low-coherence infrared (860 nm) superluminescent diode, FDA/IEC Class 1M (non-hazardous)

DC detector noise <15 pm

High Resolution System Performance

DC height noise <50 pm

AC height noise <50 pm

(All noise measurements are quoted as the average deviation measured with a 1 kHz bandwidth over a full 10 seconds at the center of the scanner range. Specifications assume required vibration and acoustic isolation in an appropriate laboratory environment.)

Top-View Optics

Probe, IR SLD spot, and sample can be viewed through top-down brightfield optics with two selectable fields of view, 720 µm and 240 µm, through a 10× objective.

Sample Stage

Sample size Up to 80 mm diameter

Sample thickness Up to 10 mm (up to 27 mm option)

Acoustic and Vibration Isolation Enclosure

A custom enclosure for acoustic and vibration isolation is included in the standard Origin and Origin+ configurations.

Vibration isolation A passive mechanical vibration isolation platform is included standard and does not require compressed air.

Acoustic isolation Rigid, highly damped design provides effective isolation of acoustic noise in typical laboratories.

Ergonomics The door of the enclosure effortlessly swings to the side to open and is reversible to accommodate different laboratory floor plans. A smaller access window allows users to reach into the enclosure to make adjustments.

Differences Between Origin and Origin+

The Origin+ model includes Asylum's ARC2 AFM controller while the Origin model uses a slightly simplified Origin AFM controller. This enables the following features on Origin+ that are not available on the Origin:

- Additional mode support *(detailed on page 5)*
- Additional accessory support *(detailed on page 7)*
- External access to various analog inputs and outputs
- 'Hamster' controller for direct parameter adjustment

All other specifications and features are identical for both.

Origin

Origin+

System Upgrade Options

- The Origin is easily upgraded to the Origin+ by upgrading to the ARC2 AFM controller
- Both models can be upgraded all the way to the latest MFP-3D Infinity model for even higher performance and additional imaging modes

Service and Support

Warranty Full one-year comprehensive warranty

Support No-charge technical support and expert applications support for the lifetime of the AFM

Seek Asylum! Find the best AFM for your research and budget

Email: AFM.info@oxinst.com, or
Call: +1-805-696-6466, or
Visit: AFM.oxinst.com/Origin, or
AFM.oxinst.com/OriginPlus

Asylum Research also sells a complete range of AFM probes

Buy online at: AFM.oxinst.com/AFM-probes

Visit **AFM.oxinst.com/Origin** or **AFM.oxinst.com/OriginPlus** to learn more and request pricing

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