

Cypher L

World-class AFM performance—even more affordable

The Cypher L atomic force microscope from Oxford Instruments Asylum Research sets new expectations for performance and ease-of-use for AFMs in its price range. New Ergo software provides the core capabilities commonly used in research fields including 2D materials, polymer science, thin film deposition and etch processing, and quantum technology. As part of the award-winning Cypher AFM family, the Cypher L is readily upgraded to the Cypher S, ES, or VRS1250, allowing you to invest in a quality AFM platform now and add new capabilities as you need them.



See more with higher resolution imaging

- The Cypher L is built on the same ultra-stable mechanical and electronic platform as all of Asylum's other ultra-high performance Cypher models. Easily obtain molecular and atomic resolution on samples including 2D materials and polymers. Routinely see details unobtainable on most other AFMs in this price range.

Get the information you need quickly and easily

- Asylum's new Ergo software platform is designed with a streamlined workflow for quick, simple setup and intuitive image acquisition. Exclusive AutoPilot algorithms automatically optimize scan parameters for high quality images. Easily analyze and export images for presentation and publication directly from Ergo.

Expand your research while saving lab space and budget

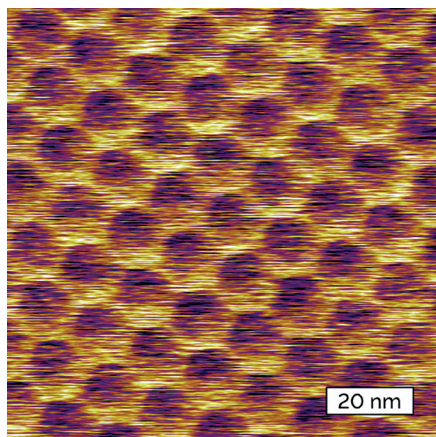
- Oxford Instruments Asylum Research recognizes that both lab space and research budgets are limited. The Cypher L easily fits in existing labs without special facility requirements. Its price is within reach of typical lab startup funds, many research grants, and most industrial R&D budgets.

Future-proof your research by investing in a fully upgradable AFM

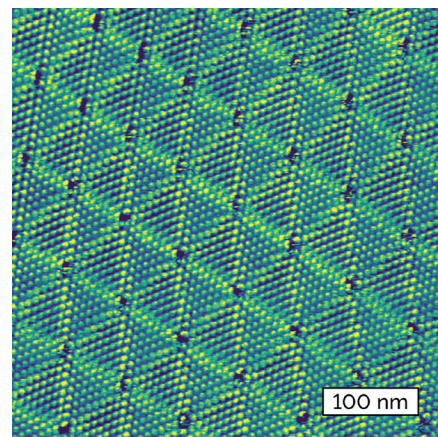
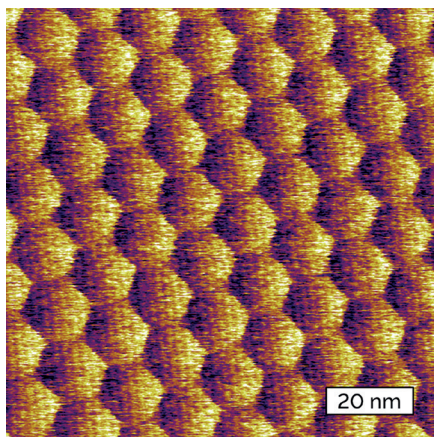
- Your research will grow and evolve over time. Make sure that your AFM can too. Unlike other AFMs, the Cypher L is fully upgradeable, allowing you to add new capabilities as you need them. Its modular design allows it to be upgraded all the way to the more powerful Cypher S, ES, and VRS1250 models to enable advanced characterization modes, environmental control accessories, and even video-rate imaging speeds.

Graphene and other 2D materials

- Cypher L supports advanced AFM measurements on twisted 2D material heterostructures.
- Moiré patterns can be imaged in commonly used modes including lateral force microscopy (LFM), Kelvin Probe Force Microscopy (KPFM), and conductive AFM (CAFM) to determine layer twist angles.
- High-resolution topography measures layer thickness and can even resolve the atomic lattice.
- Optional glovebox integration protects samples without sacrificing AFM performance.



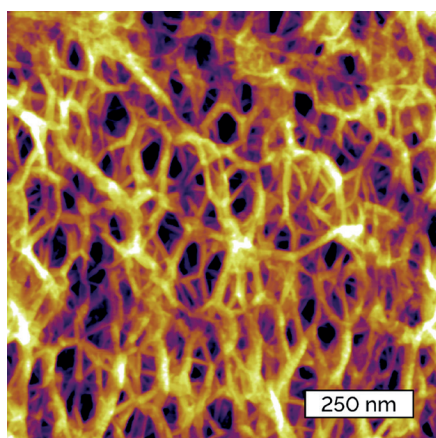
Moiré patterns in bilayer graphene on hBN are observed in contact mode topography (left) and lateral force microscopy (right). The larger scale pattern is due to the twist angle between graphene layers and the smaller pattern is due to the lattice mismatch between graphene and hBN. Color scales are ± 70 pm for the height image and ± 6 mV for LFM.



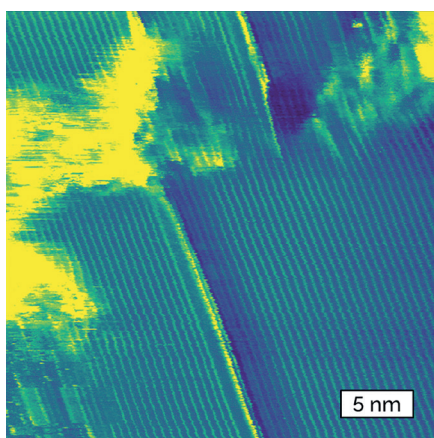
Moiré and super moiré patterns in trilayer graphene on hBN are observed with conductive AFM. Color scale is ± 15 nA. Image courtesy of the A. Young group at Univ. California, Santa Barbara.

Polymer science and self-assembled nanostructures

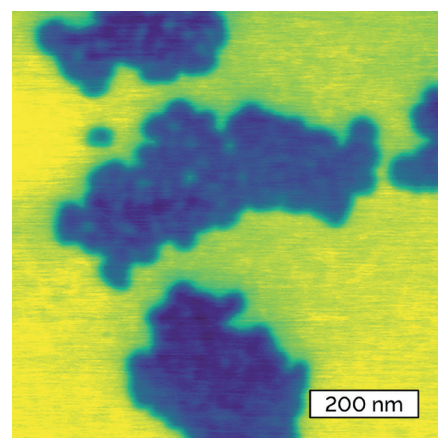
- Cypher L supports a variety of AFM measurements on polymers and self-assembled nanostructures.
- High-resolution topography measures sample morphology and roughness.
- Tapping mode phase images provide material contrast on polymer blends and composites.
- Kelvin Probe Force Microscopy (KPFM) is optionally available for additional material contrast.



Biaxially-oriented polypropylene is used for food packaging. Here, tapping mode was used to visualize its nanostructure, which varies with processing conditions. Color scale is ± 8 nm.



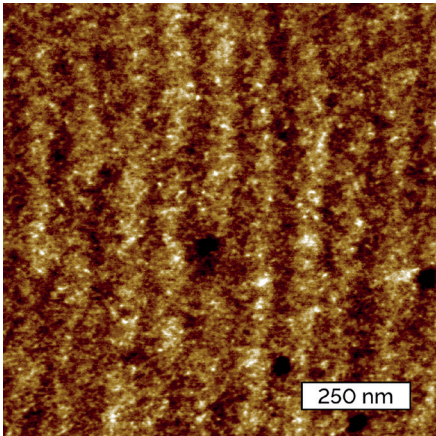
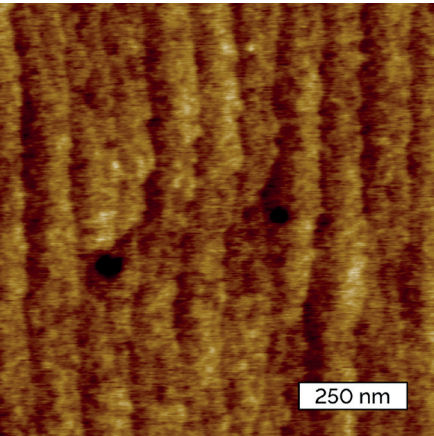
Polytetrafluoroethylene (PTFE) is a semi-crystalline polymer with both crystalline and amorphous regions. Here, tapping mode phase imaging reveals the expected ~ 0.56 nm molecular spacing. Color scale is $\pm 7^\circ$.



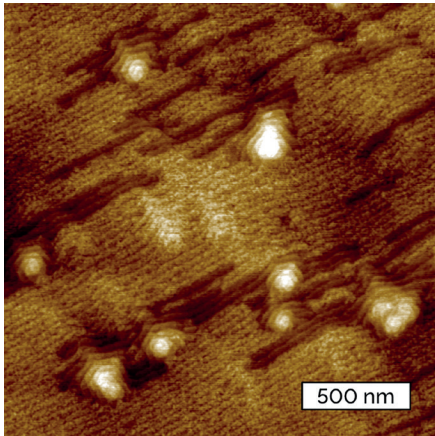
Self-assembled structures of a semi-fluorinated alkane, $\text{F}(\text{CF}_2)_{14}(\text{CH}_2)_{20}\text{H}$, on silicon. The highly polar molecules result in strong contrast in Kelvin Probe Force Microscopy (KPFM). Color scale is ± 220 mV.

Thin film roughness and morphology

- Cypher L enables quick and easy measurements like surface roughness and step heights.
- Ultra-low noise floor enables sub-Angstrom roughness measurements.
- Fast scanning at up to 10 Hz captures images 5-10× faster than most AFMs.



Gallium nitride (GaN) thin film surface roughness can affect device performance. The images here come from a study into the effect of reactive ion etch (RIE) bias power on surface roughness and sub-surface damage on GaN samples. The RIE was performed with an Oxford Instruments PlasmaPro 100D Cobra system. The image on the left is the un-etched material and the image on the right was acquired post-etch. Color scales are both ± 500 pm.



Screw dislocations on the surface of an AlN thin film grown by MBE on a SiC substrate. Sample courtesy of R. Chaudhuri in the Jena-Xing Lab, Cornell Univ. Color scale is ± 1 nm.

The only AFM in its price range that's fully upgradable to the most advanced AFM models

- Upgrading to Cypher S adds more mode support, faster scanning, and compatibility with blueDrive.
- Upgrading to Cypher ES enables support for a wide range of environmental control accessories.
- Upgrading to Cypher VRS1250 enables video-rate imaging at up to 1250 lines/s and 45 frames/s.
- Cypher L can even be upgraded to Vero, the first and only AFM with QPDI interferometric cantilever sensing.

	Cypher L	Cypher S	Cypher ES	Cypher VRS1250
Height noise	25 pm	15 pm	15 pm	15 pm
XY sensor noise	120 pm	60 pm	60 pm	60 pm
blueDrive	No	Optional	Optional	Yes
Small cantilever support	No	Optional	Optional	Required
Fast scanning	Up to 10 Hz	Up to 40 Hz (typ.)	Up to 40 Hz (typ.)	Up to 40 Hz (typ.)
Video-rate scanning	No	No	No	Up to 1250 lines/s
Software	Ergo	Ergo + Igor	Ergo + Igor	Ergo + Igor
Mode support	Core modes	Complete range	Complete range	Complete range
Accessory support	Liquid imaging	Liquid imaging	Liquid perfusion, heating, cooling, humidity control, electrochemistry	Liquid perfusion, heating, cooling, humidity control, electrochemistry
Glovebox	Optional	Optional	Optional	Optional
High voltage support	Not available	Optional	Optional	Optional

Cypher L specifications

Scanner

Cypher L uses a flexure-based sample scanning design driven by piezo stacks. Compared to commonly used piezo tube scanners, it eliminates bow/crosstalk artifacts and is much less easily damaged. Linear variable differential transformer (LVDT) sensors are used, which are inherently linear and do not require periodic recalibration.

X&Y range 30 μm (closed-loop)

X&Y sensor noise <120 pm

Z range >5 μm

Z sensor noise <50 pm

Sample size up to 15 mm diameter, 7 mm thick. Samples can be moved using software-controlled stick-slip motion.

Engage process is fully motorized.

Optical Beam Deflection Cantilever Sensing

Type modulated laser diode

Spot size 10×30 μm

Wavelength 850 nm

Probe compatibility Compatible with all common probes including high-speed Asylum Research FS-1500 probes.

Spot positioning and detector adjustment are fully motorized and software controlled.

Imaging Performance

Scan speed up to 10 Hz line rate (varies with sample, probe, scan size, and imaging mode).

Vertical noise floor <25 pm (imaging height noise)

(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 Bright-Field Optics

Resolution <1 μm (diffraction limited NA=0.45)

Field of view 690×920 μm

Illumination Intensity is software controlled.

Instrument Isolation

Vibration Passive isolation is included. No further isolation is necessary for typical laboratories.

Acoustic Included enclosure provides 20 dB of isolation.

Included Operating Modes

Tapping mode (AC mode) with phase; Contact mode with lateral force mode (LFM)

Optional Modes and Accessories

Conductive AFM (CAFM); Tapping mode in liquid droplet; Kelvin Probe Force Microscopy (KPFM); Glovebox integration for sub-ppm water and oxygen environments.

System Upgrades

Cypher: Upgradable to Cypher S, ES or VRS1250

Vero: Upgradable to Vero interferometric AFMs with QPDI

blueDrive: Available with upgrade to Cypher or Vero S, ES or VRS models

Service and Support

Warranty One-year comprehensive warranty.

Support Ask about service and support agreements that extend the original warranty and offer additional training and support services.

Regulatory Information

Cypher L is CE compliant.

Cypher L is a Class 1 laser product.



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