# Environmental Scanner
## for the Cypher™ AFM


ASYLUM RESEARCH

*Control Your Environment*

- *Temperature Control*
- *Fluid or Gas Perfusion*
- *Broad Chemical Compatibility*

cypher

*The Highest Resolution Fast Scanning AFM*

# Cypher AFM
## *Now with Environmental Control*

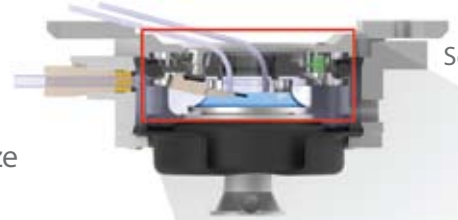
Cypher is the first commercial AFM to take advantage of the high bandwidth and low noise performance of smaller cantilevers, and is the *only* commercial AFM to routinely resolve atomic point defects and the DNA helix. Now, Asylum Research introduces the Environmental Scanner, the second in a family of scanners, which adds full environmental control to the Cypher platform - the highest resolution fast scanning AFM. The design is based around a cell constructed of inert materials, such as fused silica and FFKM, to enclose and control the sample environment. The modular design allows customization for measurements in nearly any environment.

Environmental Scanner

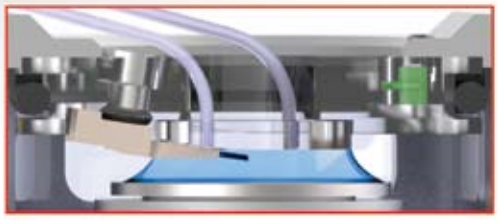
## Run Cypher in *Any* Environment

### Gas/Fluid Perfusion in a Sealed Cell

- Multiple ports for flow-through of gas and/or fluid
- Perfusion may be performed in a droplet to minimize sample volume (<20µL) and cell cleaning
- Simple gravity driven perfusion – no pumps are required



Sealed cell with fluid droplet



Cantilever-sample interface in droplet with perfusion tubes

### Integrated Temperature Control

- Modular sample stages enable precise temperature control in several temperature ranges
- No external boxes, additional electronics, or cooling pumps are required

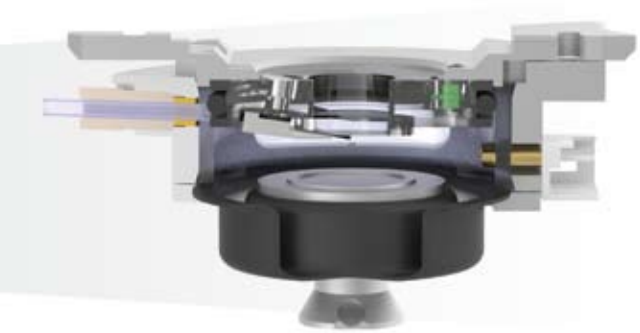
### Broad Chemical Compatibility

- Ensuring chemical compatibility even in the harshest environments, cells are constructed with inert materials:
  - Fused silica
  - Perfluoroelastomer (FFKM)
  - PEEK
- Suitable for solvents, acids, bases, buffers, inert gases

User changeable sample stage for cooling/heating

# Modular Design for Maximum Flexibility

The sealed cell is constructed from three components: cantilever holder, cell body, and sample stage. See the back page for specifications of the different versions of each component.



### Sealed Cell

- Modular and interchangeable
- Supports positive pressure (up to 5psig) for gas/fluid perfusion
- Fluid volumes as small as 20µL

## Exploded View of Cell Components

### Cantilever Holder

- Fluid perfusion ports
- Fused silica construction

### Cell Body

- Gas perfusion ports
- Electrical feedthroughs
- Fused silica construction

### Sample Stage

- Integrated cooling/heating in several temperature ranges
- Variable material construction
- FFKM diaphragm for distortion-free imaging

# Superior Performance, Widest Range of Capabilities

The Environmental Scanner adds unprecedented functionality and flexibility to the industry's highest resolution fast scanning Cypher platform. Customize the Environmental Scanner to meet your experimental research needs.

# Expand Your Research Capabilities

**The Environmental Scanner is compatible with all standard and advanced scan modes such as:**

- Contact
- Tapping/Non-contact
- Phase
- Force Measurements
- Force Mapping
- STM
- MFM
- PFM
- C-AFM
- EFM
- SKPM
- Dual AC™
- AM-FM/Loss Tangent
- Frequency Modulation

## Choose Cypher for Your Research

- Materials
- Polymers
- Energy Research
- Life Sciences
- Chemistry

# Specifications

The cell is comprised of three user-selected components: cantilever holder, cell body, and sample stage. All components are compatible and interchangeable.

## Cantilever Holders

### Gas
- Gas environments only
- Electrical connection to cantilever
- C-AFM compatible
- Materials: Fused Silica, FFKM, Stainless Steel

### Fluid
- Fluid environments only
- Two fluid ports for perfusion
- Electrical connection to cantilever
- C-AFM compatible (with Stainless Steel clip)
- Materials: Fused Silica, FFKM, and PEEK or Stainless Steel

### High Voltage
- Gas environments only
- Isolated high voltage electrical connection to cantilever
- Not C-AFM compatible
- Materials: Fused Silica, FFKM, Stainless Steel

### STM
- Gas or fluid environments
- Two fluid ports for perfusion
- Materials: Fused Silica, FFKM, Stainless Steel, Epoxy

## Cell Bodies

### Gas
- Gas or droplet fluid environments
- Two gas ports for perfusion
- Three electrical connections to sample (required for C-AFM)
- Materials: Fused Silica, Nickel, Epoxy

### Fluid
- Gas or fluid environments
- Two gas ports for perfusion
- No electrical connections (not compatible with C-AFM)
- Materials: Fused Silica

### High Voltage
- Gas or droplet fluid environments
- Two gas ports for perfusion
- Three electrical connections to sample (required for C-AFM)
- One high voltage sample connection
- Materials: Fused Silica, Nickel, Epoxy

## Sample Stages

### Heater
- Gas environments only
- Ambient - 250°C
- Materials: FFKM, Ceramic

### Cooler-Heater
- Gas or fluid environments
- 0°C - 120°C
- Materials: FFKM, Anodized Aluminum

### Ambient
- Gas or fluid environments
- Ambient temperature only
- Materials: FFKM, Stainless Steel

## Side Door

- Multiple feedthroughs for easy connection of gas/fluid perfusion lines
- Multiple syringe ports
- Adjustable gravity flow stand
- Optional flowmeter for controlling gas perfusion rates

## Scanner

### Scan Range
XY range is 30/40µm (closed/open loop). Z range is 5/7µm.

### XYZ Sensor Noise*
Digital LVDT sensors. XY noise is <60pm. Z noise is <50pm. Closed loop scan performance achieves lattice resolution (<10nm scans) with feedback gains equivalent to large scan (>1µm) values.

### XYZ Open Loop Noise
XY: <8pm Adev in a 1Hz to 10kHz BW
Z: <4pm Adev in a 1Hz to 10kHz BW

### Vibration Immunity
<10pm coupling for 1mm/s$^2$ floor acceleration.

### XY Drift
<20/200nm per °C (with/without temperature control module).

### Out-of-Plane Motion
<3nm over closed loop scan range.

### Sample Dimensions
15/7mm (diameter/thickness).

*Noise measurements are quoted as average deviation (Adev) in a 0.1Hz to 1kHz bandwidth unless otherwise noted.

Preliminary specifications. Subject to change.

**Cypher is a Class 1 Laser Product**



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