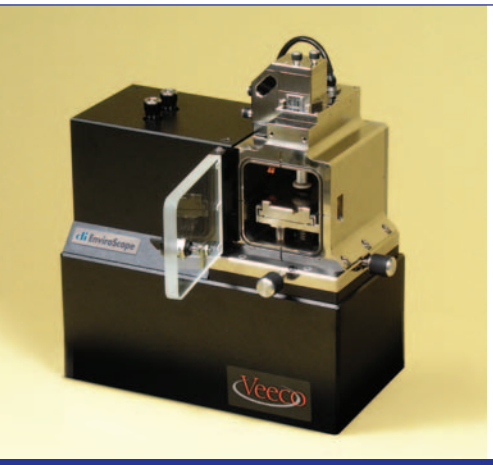
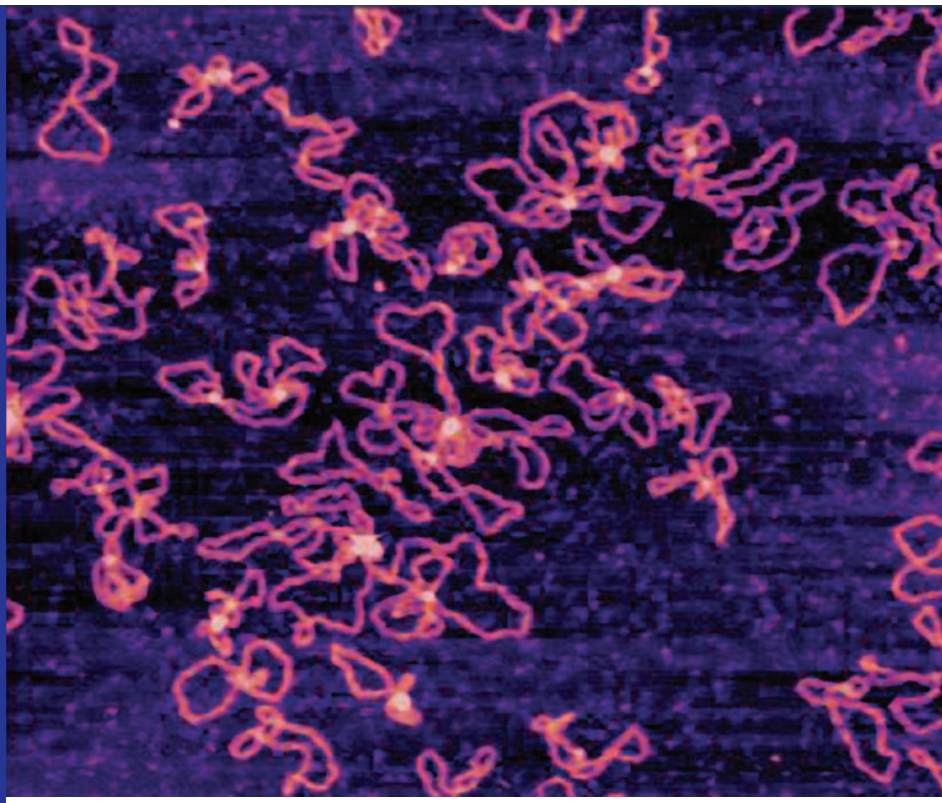
Veeco Solutions for a nanoscale world.™

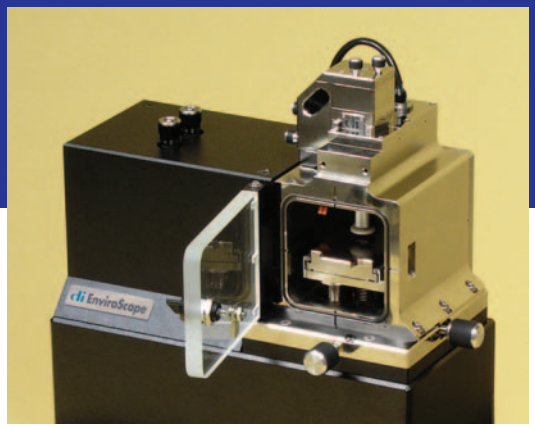


# di EnviroScope

## Atomic Force Microscope (AFM) System



- Advanced Environmental Control
- Flexibility, Ease of Use, and Performance
- Full Range of Imaging Modes



# di EnviroScope

## Proven Environmental Control for Co

The EnviroScope™ atomic force microscope (AFM) combines enhanced environmental controls within a sealed hermetic sample chamber, and the world's most advanced scanning technology to deliver greater application flexibility to research and industrial laboratories looking for a competitive edge. The system allows observation of sample reactions in a variety of complex environmental conditions, including high vacuum, liquid, and gas purge and exchange, as well as high temperature and fluid heating. Based on the industry-standard Dimension™ AFM head, the EnviroScope scanner provides proven scanning probe performance and reliability while performing an extensive range of imaging modes, from contact AFM and magnetic force microscopy to patented techniques like TappingMode™ AFM and PhaseImaging™.

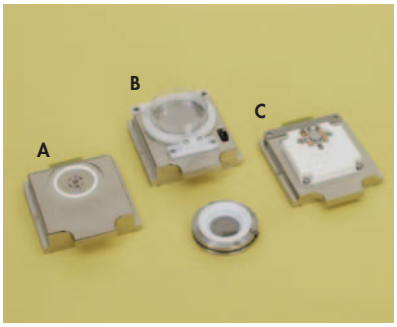
- Hermetically sealed sample chamber
  - **Permits scanning in high-vacuum, gas, liquid, and temperature-controlled environments**
  - **Enables comprehensive sample reaction studies**
- Modular stage design
  - **Provides easy sample setup**
  - **Enables application specific sample preparation**
- Dimension AFM scanning head
  - **Proven performance over a wide range of environmental conditions**
  - **Utilizes patented TrakScan™ technology for spot-on laser-beam reflection**
- Specialized electrochemistry module
  - **Temperature control**
  - **Atmospheric control above fluid cells**
  - **Prevents reactivity of the fluid and sample with the gaseous environment**

### Flexibility over Research Environments

The EnviroScope continues Veeco's tradition of outpacing conventional systems by imaging a sample as it reacts with environmental conditions enabling more comprehensive sample characterization. The EnviroScope is specifically designed to be a no-fuss, high-performance tool for research in material sciences, electrochemistry, polymer technologies, life sciences, and other applications.

The sophisticated, sample chamber is hermetically sealed. It can be purged with inert gas to slow or inhibit reactive processes and reduce moisture effects. The easy-to-use modular sample stages and an exclusive cantilever replacement tool enable users to vary their environmental experiments. For example, the optional fluid/heater stage allows fluid to surround the sample for observation of growth, etching, or corrosion at ambient and elevated temperatures.

For temperature-sensitive applications, the EnviroScope provides a high-temperature stage for observing reactions or crystallization in various temperature ranges over time. Software specially designed for the sample heating system allows programmable image acquisition linked to temperature for multiple-image thermal experiments.



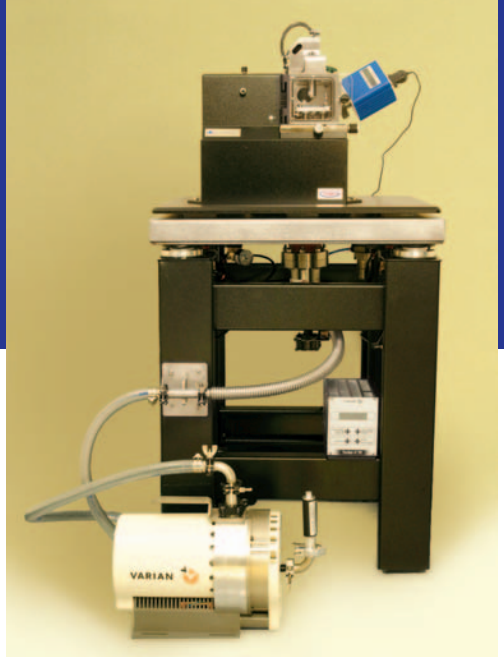

**EnviroScope modular stages. A) standard, B) fluid/heater, C) high temperature heater.**

### Turnkey Options for Customized Research

The EnviroScope also has an optional all-in-one turnkey vacuum system. This system utilizes a turbo pump that is mounted directly below the custom isolation table and is properly isolated from the AFM. It also has a roughing pump that can be remotely positioned to ensure no interference during imaging.

The electrochemistry (EC) option includes a fluid cell. The chamber allows gas flow above the cell to control sample evaporation and chemistry. Studies of interest include corrosion, etching, electroplating, electroadsorption, and electrodesorption. This option can accommodate samples up to 1 inch and provides true reference electrodes in the EC cell.

# omplex AFM Studies




**Turnkey vacuum system.**

## Unmatched Scanning Technology

The EnviroScope scanner is based on the industry-leading Dimension AFM head. A conformal coating has been added to this head to provide protection from environmental changes in the chamber. In addition, a built-in temperature sensor monitors the piezo temperature and provides a warning and shut-off if the piezo exceeds safe temperature levels. This scanner incorporates patented TrakScan technology to ensure that the laser beam reflects from the same spot on the AFM cantilever during raster scanning.

In addition, the EnviroScope offers a choice of high-performance NanoScope controllers. The NanoScope IIIa controller combines advanced analog and digital circuit designs with premium software and hardware to precisely control the SPM. The superior performance and utility of the NanoScope IIIa controller has led to more publications than all other SPM controllers combined.

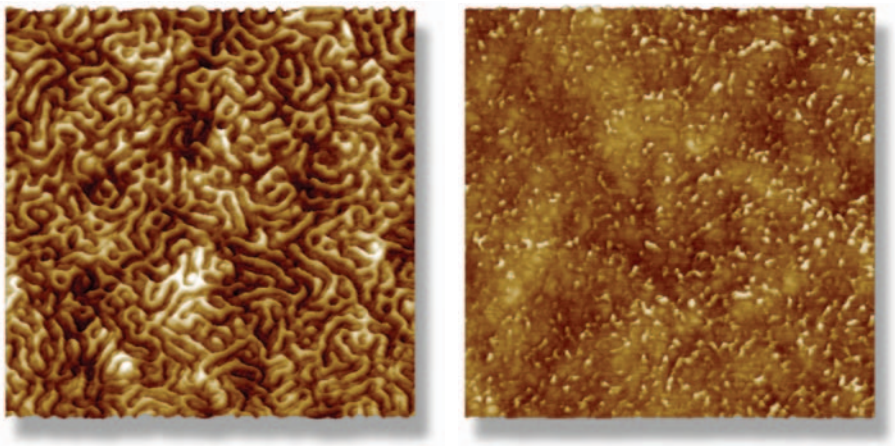
The NanoScope IV controller incorporates all of the same features, as well as up to ten-times-faster scanning, increased functionality, bandwidth, flexibility, and expandability. The NanoScope IV incorporates Quadrex™ technology with lock-in detection and advanced signal routing to enable the patented PhaseImaging technique. Particularly applicable for advanced studies of mechanical properties, Quadrex allows the detection of variations in adhesion, viscoelasticity, and other properties by mapping the phase of the cantilever oscillation during a scan. Using either controller, the EnviroScope can scan from 90 microns X-Y and 4.8 microns in Z with full, 16-bit resolution on all scan waveforms and on each axis.

## Complete Range of Imaging Modes

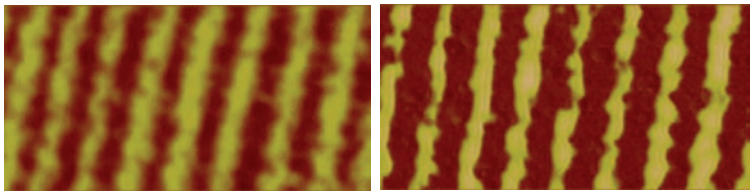
The EnviroScope combines its environmental capacities with Veeco's unmatched list of imaging techniques for the detailed measurement of the mechanical properties and magnetic/electrical field of the surface.

- Torsional Resonance Mode (TRmode™)
- TappingMode
- Contact AFM
- MFM
- LFM
- EFM
- PhaseImaging
- Surface Potential Microscopy
- Force Distance/Force Volume Measurements

*Check with factory for compatibilites.*

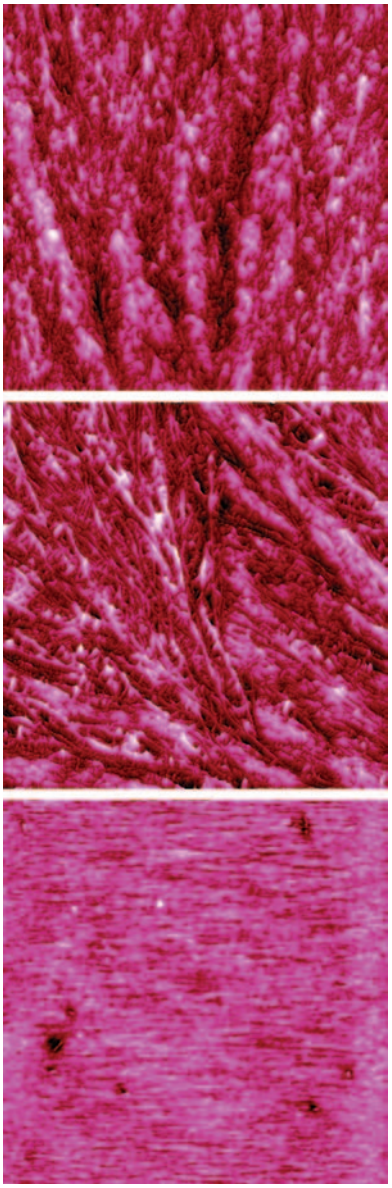


**Poly-sbs block co-polymer. 26 Celsius, 760 Torr (left). 130 Celsius, 2x10$^{-5}$ Torr (right). 1µm scans, 5nm Z range.**



**Cover image: DNA in fluid. 2µm scan imaged with EnviroScope AFM.**

**MFM image of video tape in air at ambient (a), and in vacuum at $10^{-5}$ torr (b) showing higher amplitude variations and resolution. 5µm scans.**



**a.**

**b.**

**c.**

**SPP Polymer imaged with EnviroScope high-temperature heating stage at ambient (a), 60°C (b) and 140°C (c) temperatures. 5µm scans.**

## EnviroScope Specifications

**Sample stage range:** – 6mm X-Y, 14mm Z sample movement range while maintaining vacuum

**Sample size:** – 30mm X-Y; 12mm Z

**Sample leveling:** – Automatic mechanical

**Temperature range while imaging:**
- 185°C in ambient environment
- Ambient to 275°C in vacuum (to 300°C nominal at the sample)
- Ambient to 60°C in fluid (including EC)
- Temperature stability ±1°C

**Scan size:** – 90µm X-Y; 5µm Z

**Noise level:**
- <0.05nm -RMS at ambient pressure
- Laboratory noise limit for best performance: 62 dBc

**Linearity:** – Software-corrected

**Optics:**
- Resolution on integrated top-view video microscope 3-4 µm
- Fixed ~0.5mm field of view at the sample

**Ports:** – Gas purging, vacuum, or interface plate for user customization

**Electronics controller:** – Digital Instruments NanoScope IIIa with Quadrex or NanoScope IV

**Vacuum level:** – $10^{-5}$ Torr (requires optional purchase)

Note: Performance specifications are typical and subject to change without notice.

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