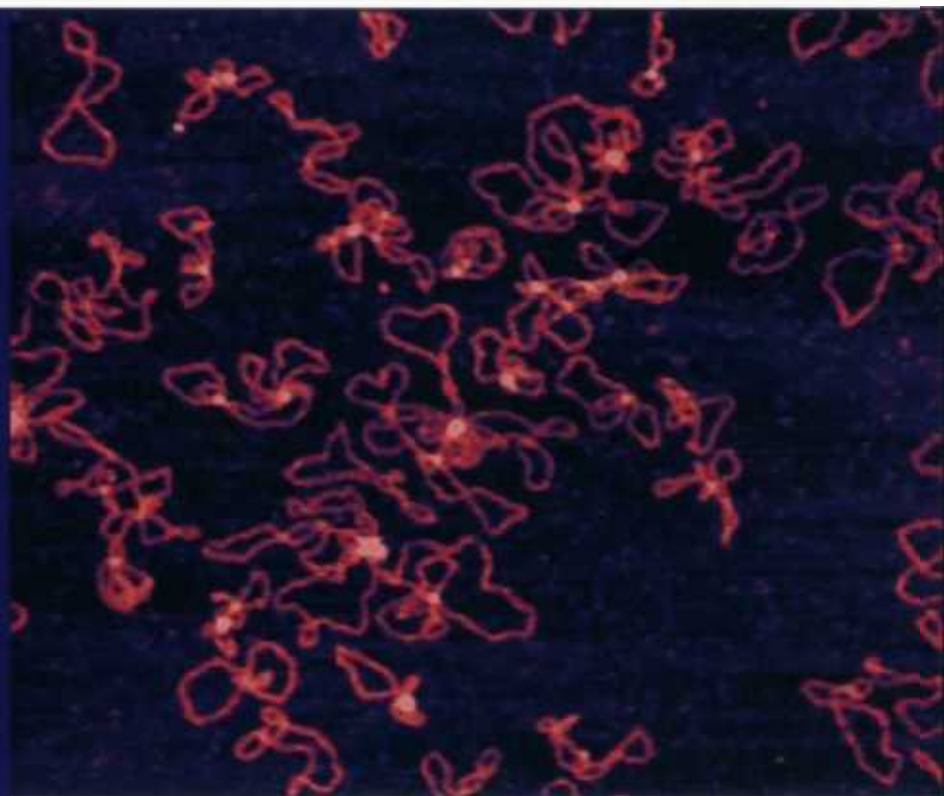


Veeco Solutions for a nanoscale world.



diEnviroScope

Atomic Force Microscope (AFM) System



- **Advanced Environmental Control**
- **Low-Noise Scanning**
- **Full Range of Imaging Modes**



di EnviroScope

Complete Environmental Control for

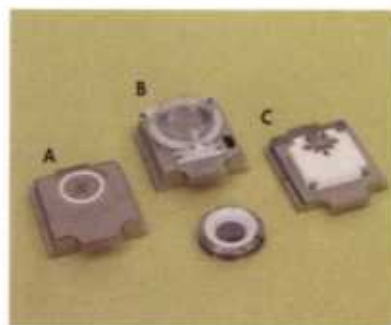
The EnviroScope™ atomic force microscope (AFM) combines the world's best scanning technology with sophisticated environmental controls and a sealed hermetic sample chamber to deliver unsurpassed power and application flexibility to today's cutting-edge research and industrial facilities. The system allows observation of sample reactions in a variety of complex environmental conditions, including high vacuum, gas and liquid 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 a full 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
 - Delivers research-specific sample preparation
- ▶ Dimension AFM scanning head
 - Maintains industry's lowest noise levels
 - Utilizes patented TrakScan™ technology for spot-on laser-beam reflection
- ▶ Specialized electrochemistry module
 - Controls the atmosphere above fluid cells
 - Prevents reactivity of the fluid and sample with the gaseous environment

Full Environmental Capacity and Flexibility

The EnviroScope takes scanning probe microscopy one step further than conventional systems by imaging a sample as it reacts with changing environmental conditions. This permits more comprehensive sample characterization, while still offering all the benefits of the world's best nanoscale metrology. The EnviroScope is specifically designed to be a high-performance tool for research in material sciences, life sciences, electrochemistry, polymer technologies, and other applications.

The sophisticated, yet easy-to-use sample chamber is hermetically sealed. It can be purged with inert gas to slow or inhibit reactive processes and reduce moisture effects. Optional modular sample stages and an exclusive cantilever replacement tool enable users to easily vary their environmental experiments. For example, the fluid/heater stage allows gas and/or fluid to be injected around the sample via the system's ports 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 temperatures ranges over time. Software specially designed for the sample heating



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

system allows programmable image acquisition linked to temperature for multiple image thermal experiments.

Customized Options for Increased Functionality

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 but is highly isolated from the AFM. It also has a roughing pump that can be remotely positioned to ensure no interference during imaging.

An electrochemistry (EC) option includes a fluid cell that 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 on the EC cell.

Advanced AFM Studies

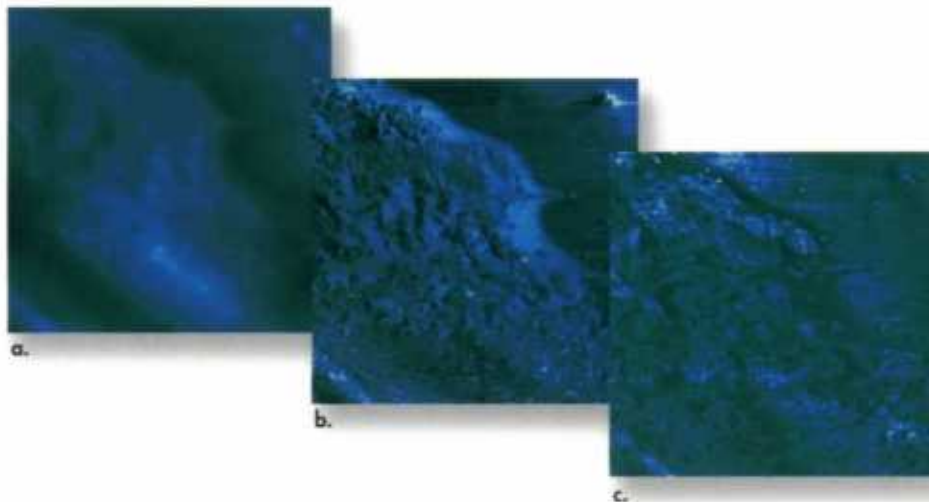
Industry-Best Components

The EnviroScope scanner is based on the industry-leading Dimension AFM head. A conformal coating has been added to this head to provide additional protection from environmental changes in the chamber. In addition, a 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. This head also maintains the extremely low-noise levels essential for resolving single atomic steps and measuring sub-Ångstrom surface roughness on ultrasmooth surfaces.

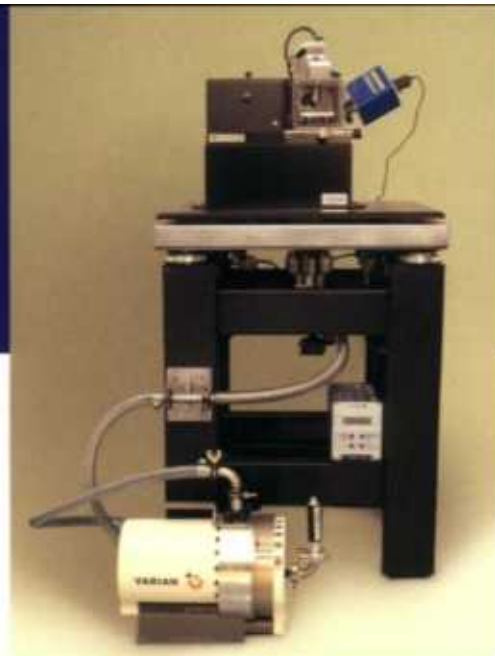
In addition, the EnviroScope offers a choice of high-performance NanoScope controllers. The NanoScope IIIa controller combines advanced analog and digital circuit designs with premium software and hardware to precisely control the SPM. The superior performance and utility of the NanoScope IIIa controller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

The world class NanoScope IV controller incorporates all of the same features, as well as

up to ten-times-faster scanning, increased functionality, bandwidth, flexibility, and expandability, making it the most advanced SPM controller in the world. [The NanoScope IV incorporates Quadrex™ technology with lock-in detection and advanced signal routing to enable the patented Phasemaging technique. This allows the detection of variations in composition, 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 5 microns in Z with full, 16-bit resolution on all scan waveforms and on each axis.



PDES polymer imaged in vacuum. (a) height and Torsional Resonance Mode, (b) Phase, Tapping Mode, and (c) Phase, Torsional Resonance Mode. 10µm scans.

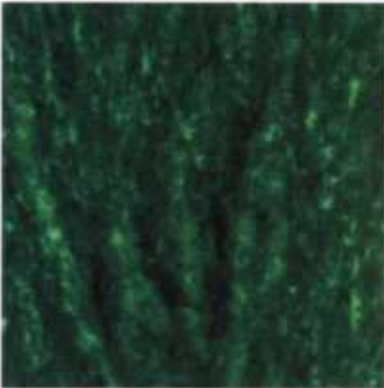


Turnkey vacuum system.

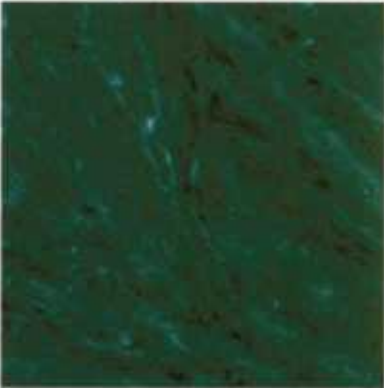
Complete Range of Imaging Modes

The EnviroScope combines its environmental capacities with Veeco's unmatched list of imaging techniques for the detailed measurement of surface characteristics like topography, elasticity, friction, adhesion, and magnetic/electrical fields:

- TRmode
- TappingMode
- Contact AFM
- MFM
- LFM
- EFM
- Phasemaging
- Surface Potential Microscopy
- Force Distance/Force Volume Measurements



a.

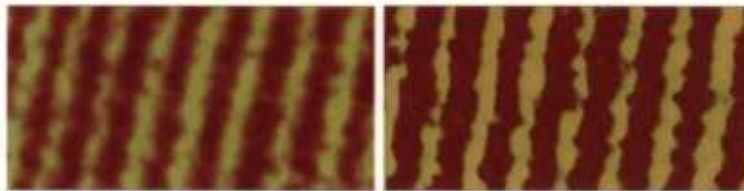


b.



c.

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



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.

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 300°C in vacuum
 - 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
- Linearity:** – Software-corrected
- Optics:**
 - Integral top-view video microscope
 - 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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Worldwide Customer Support from the Industry Leader

Veeco Instruments Inc. provides solutions for nanoscale applications in the worldwide semiconductor, data storage, telecommunications/wireless and scientific research markets. Our Metrology products are used to measure at the nanoscale and our Process Equipment tools help create nanoscale devices. Veeco's manufacturing and engineering facilities are located in New York, New Jersey, California, Colorado, Arizona and Minnesota. Global sales and service offices are located throughout the United States, Europe, Japan and Asia Pacific.