Agilent Scanning Tunneling Microscopy Scanners

Data Sheet

Features and Benefits

- Wide range of current sensitivity provides guaranteed atomic-resolution imaging of conducting surfaces
- Designed for imaging in ambient, controlled gas, or in a fluid environment
- Top-down configuration protects electronics and piezo elements from damage caused by harsh imaging environments
- Full compatibility with Agilent's modular AFM/SPM microscopes offers simple upgrade path for extended capabilities
- Easy fluid exchange permits greater EC-STM versatility

Overview

Scanning tunneling microscopy (STM) is a scanning probe microscopy (SPM) imaging technique that takes advantage of the extreme distance sensitivity of the tunneling current between two conducting electrodes. By measuring the tunnel-current variations as a probe is scanned over a sample's surface, STM is able to deliver the highest resolution SPM images.

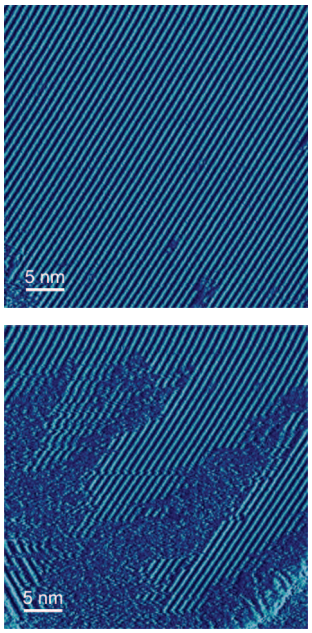
Agilent STM scanners are designed to deliver outstanding results on a variety of conducting materials. These low-current and ultra-low-current STM scanners provide stable imaging at pico-ampere and sub-pico-ampere currents to resolve individual atoms and molecules. Over the past ten years, Agilent STM scanners have delivered superior research results and have consistently outperformed other STM scanners in achieving the best atomic resolution within the shortest time.

A hermetically sealed, top-down configuration provides complete isolation of the scanning elements and electronics from the imaging environment. This design allows total environmental control, fluid-friendly operation, and superior thermal stability. As a result, samples can be imaged at high temperatures up to 250°C over an extended period of time (tested up to 10 hours).

Agilent's versatile STM scanners are available in two ranges, atomic (1µm) and small (10µm). Both scanners are capable of atomic resolution and are designed to work with Agilent's AFM/SPM microscope systems. In addition, an STM nose cone option is available for Agilent's multipurpose scanners.

Temperature Control

While imaging with Agilent STM scanners, a wide range of sample temperatures (from -30°C to 250°C) can be precisely controlled with up to ±0.025°C accuracy, in ambient or in liquid.



Scan size 40nm x 40nm

Figure 1. STM images of ordered bipyridine molecules undergo a phase transition with temperature change. (a) 29.7°C and (b) 33.51°C.

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Applications

- **Electrochemistry**
  Designed for electrochemistry, Agilent STM scanners deliver high resolution and ease of use in an extremely clean fluid environment.

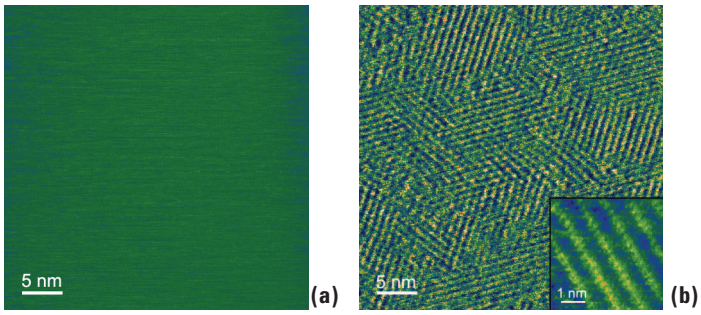

Figure 2. Potential-induced phase transition of 2,2′ bipyridine molecules on Au(111) surface imaged in situ. (a) At 0V (versus Ag/Ag+), randomly and loosely bound molecules were not observed. (b) At 0.27V, molecules were strongly bound to the surface and packed in ordered rows along the three distinct directions of the underneath [Au] atomic lattice. (b insert) High-resolution of closely packed individual bipyridine molecules at 0.27V. 4.6nm x 4.6nm.

- **Molecular Chemical Identification**
  Agilent STM scanners have an integral role in the identity of individual molecules based on their chemical properties.

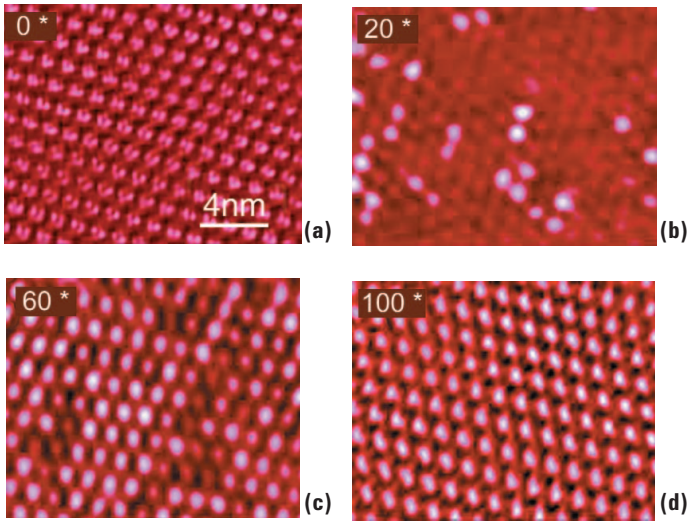

Figure 3. Protoporphyrin and Fe-Protoporphyrin on Au(111) imaged with EC-STM. 18nm x 14nm.

Specifications

Atomic STM	
Size:	1 m x 0.7 m
Noise Level:	< 0.6 Å RMS x < 0.06 Å RMS
Sensitivity:	0.1 nA/V, 1 nA/V (standard), or 10 nA/V
STM Probe:	0.25 mm Pt-Ir or W wire.
Small STM	
Size:	10 m x 1.6 m
Noise Level:	< 1.0 Å RMS x < 0.2 Å RMS
Sensitivity:	0.1 nA/V, 1 nA/V (standard), or 10 nA/V
STM Probe:	0.25 mm Pt-Ir or W wire.

AFM Instrumentation from Agilent Technologies

Agilent Technologies offers high-precision, modular AFM solutions for research, industry, and education. Exceptional worldwide support is provided by experienced application scientists and technical service personnel. Agilent's leading-edge R&D laboratories are dedicated to the timely introduction and optimization of innovative, easy-to-use AFM technologies.

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