

Truly Variable Temperature STM

Fast Scanning Probe Microscopy *during* large temperature variations:
>500K temperature change during scanning

Wide temperature range:
300K (45K) ... > 1200K

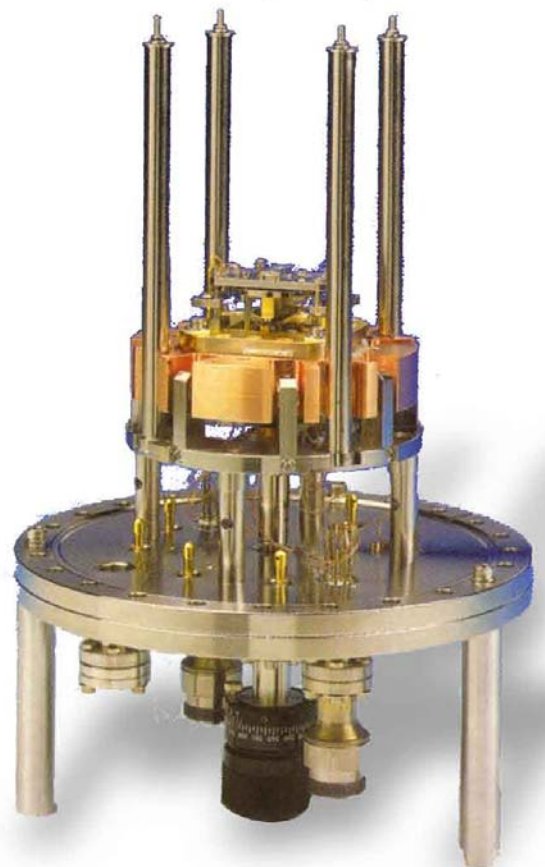
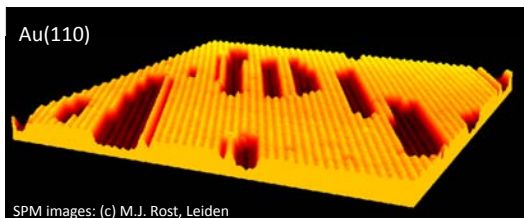
Direct line-of-sight to sample
Atomic resolution

Fast scanning: > 10 frames/sec

Excellent damping stage

Tip/sample exchange

Minimal drift during temperature ramp



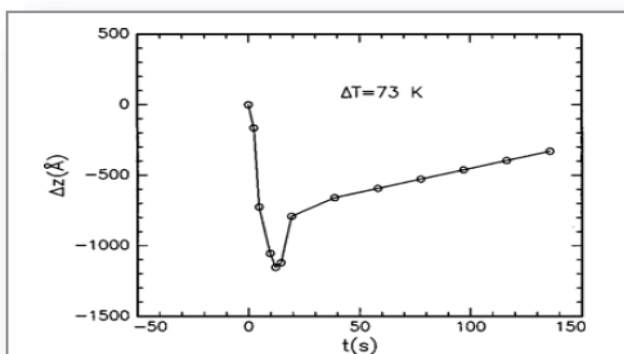
- ▶ Life observation of nucleation, growth, self assembly
- ▶ Scan as function of temperature with atomic resolution
- ▶ Imaging during deposition

Truly Variable Temperature STM

Unique thermal drift compensation

The VT-STM head allows a wide range of temperatures to be accessed during scanning over the same atomically resolved area, without the need of retracting the probe or waiting long for the thermal drift to slow down.

A unique feature of this STM is that when the temperature is ramped, thermal expansion of the sample is restricted to a small unidirectional shift, dependent only on the sample material. Drifts during temperature ramping are much lower than with alternative designs and a specific area can thus be continuously imaged over a large temperature range without coarse repositioning of the tip!

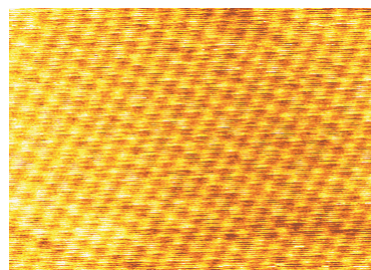


Measured thermal drift in de z-direction due to the application of 1.8W heating power at $t=0$ s (corresponding to a temperature rise from RT to 370K. The net drift of the tip and sample after 135 sec is 33nm.

Time Resolved STM at variable temperatures

An additional benefit of this is that the microscope is ultra stable by design, allowing high speed imaging of even rough surfaces. Furthermore, the eddy-current damping stage ensures optimal isolation from the environment: the atomically resolved image of the Cu(100) surface shown in the figure below was recorded in a standard laboratory with the turbo-molecular and rotary pumps running.

In short, the STM is very robust against external vibrations and temperature variations, making it an ideal platform for studying dynamic processes at variable temperature. If equipped with the LPM conical scan piezo and the LPM Video-Rate SPM Controller, real video-rate imaging can be obtained.



Atomically resolved Cu(100) surface. Scan conditions: $V = -130$ mV, $I = \sim 1$ nA, acquisition time = 52 sec. Courtesy: K. Schoots and J.W.M. Frenken, Leiden University. For movies obtained with the VT-UHV STM, see: www.leidenprobemicroscopy.com

Specifications

- Excellent resolution performance:
Z-resolution < 1pm
- scan range X,Y: 3 μ m
- Unique thermal drift compensation
- Wide temperature range:
default: room temperature - 800K (1200K)
low temperature option: ~ 35 K - 800 K
- Tip/sample/scanner exchange
- Suitable for video-rate scanning
- Eddy current damping/spring suspension
- Open design: good line-of-sight access to tunnel junction

Applications

- Dynamic phenomena such as step, kink, adatom and vacancy diffusion
- Creation and activation energy studies
- High speed dynamics
- Nucleation, growth, ion-bombardment during imaging, ...
- Segregation
- Catalysis