OPEN

Flexible integrated research AFM

NT-MDT

OPEN is a fully automated desktop AFM. It is much more than just topography imaging tool. Coupled with PX Ultra controller, the OPEN provides the largest suite of AFM measuring techniques.

High-resolution imaging

Low noise performance

The OPEN provides high performance with low noise characteristics. At the heart of the system is a low level of cantilever deflection noise and a robust design of the mechanical loop between the sample and probe achieving 15 pm intrinsic noise in a 1 kHz bandwidth. In addition, the low noise closed loop capacitance sensors and low noise high voltage amplifier of the PX Ultra controller satisfy demanding high resolution imaging requirements.

Low drifts and high stability

The drift level of the OPEN is ~30 nm/hour. Using the optional thermally stabilized acoustic enclosure allows decreasing this value down to ~10 nm/hour. This provides stable data acquisition even during long-term, ultimate resolution, experiments.
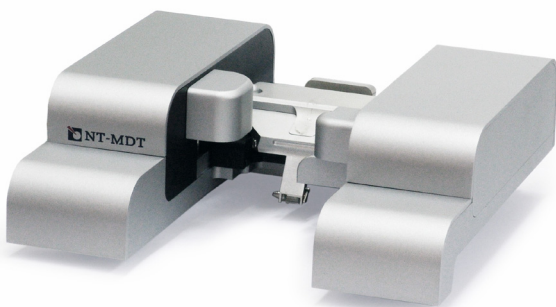
Measuring head for "scanning-by-sample" configuration
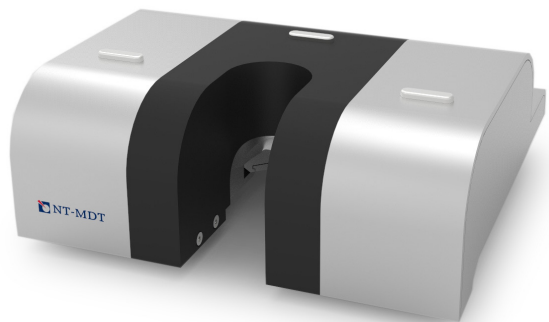
Measuring head for "scanning-by-probe" configuration

Flexibility

Wide range of samples of different size

All experiments begin with the sample. The OPEN can be used in either scanning-by-sample or scanning-by-probe configurations. Scanning-by-sample configuration is optimized for small samples and ultimate resolution experiments. Scanning-by-probe configuration is convenient for larger samples, for example 2-inch diameter wafers or standard microscope slides.

Sample temperature and environment control

A variety of optional sample stages for the OPEN allow heating or cooling the sample and performing experiments in different environmental conditions like liquid or controlled atmosphere.

The largest suite of AFM and STM modes

PX Ultra controller realizes advanced modes of AFM operation for characterization of electrical, magnetic and nanomechanical properties of the sample.

Automation

The OPEN delivers a remarkable level of automation, which is valuable for both beginners and experts..

Gentle approach algorithm

Probe sharpness is critical for acquiring perfect AFM images, but sometimes the probe might be damaged during the approach procedure even before the beginning of the experiment. NT-MDT has developed a phase sensitive algorithm that guaranties gentle approach.
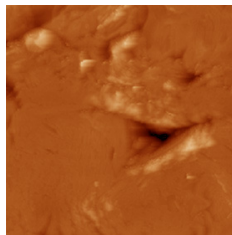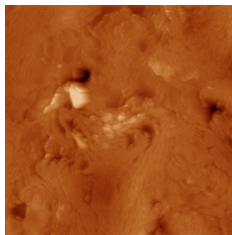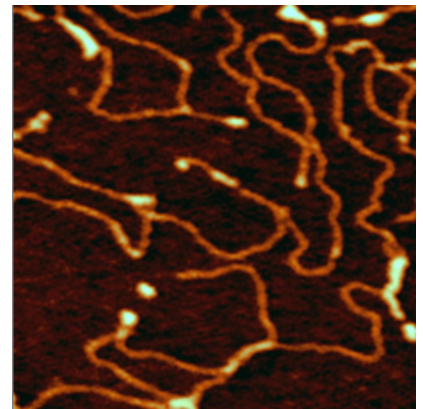

Paraffin wax topography images after probe approach:
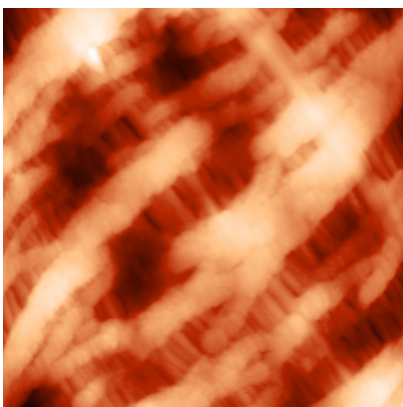(a) – phase control, (b) – amplitude control. 6×6 μm scan
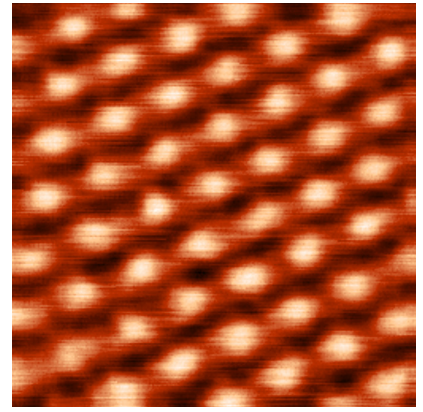
HOPG, topography image.
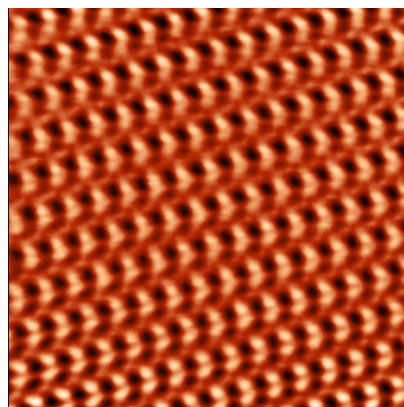AM-AFM. Scan size 1.5×1.5 nm
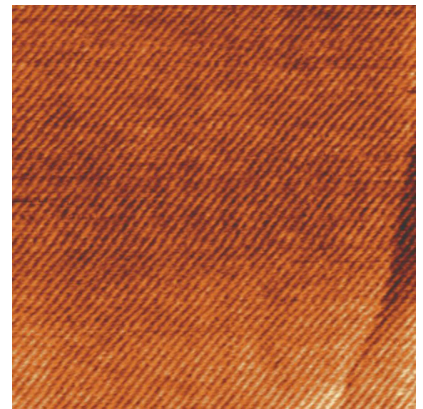
Alkanes C60H122. AM-AFM.
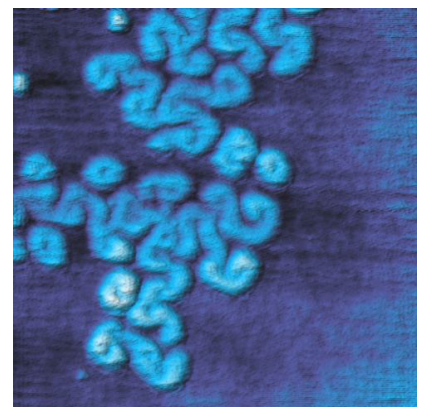Scan size 400×400 nm

DNA on mica, topography.
AM AFM. Scan size 1×1 μm

Celgard, AM-AFM.
Scan size 1×1 μm

Calcite atoms, AM-AFM in water.
Scan size 11×11 nm

Fluoroalkanes F14H20, AM-AFM.
Scan size 500×500 nm

Specifications

Scanning-by-sample configuration

Sample size: up to 30 mm in diameter, up to 24 mm in height

Scanning range:
100 × 100 × 10 µm (CL)
3 × 3 × 2.5 µm
1 × 1 × 2.5 µm

Automated sample positioning system:
XY travel range: 15 × 15 mm
Minimal step: 0.3 µm
Optical encoders: available up on request

Sample temperature and environment control:
RT .. 150 ^{0}C in air
RT .. 65 ^{0}C in liquid

Top view optics:
Resolution: 1 µm

Scanning-by-probe configuration

Sample size: up to 50 mm in diameter (up to 100 mm diameter wafer is possible with limited XY sample positioning range), up to 24 mm in height

Scanning range:
100 × 100 × 10 µm (CL)

Automated sample positioning system:
XY travel range: 35 × 35 mm
Min step: 0.3 µm

Sample temperature and environment control:
-20 .. 150 ^{0}C in air
RT-15 .. 65 ^{0}C in liquid
Electrochemical cell

Top view optics:
Resolution: 2 µm

Modes

Contact AFM
Topography
Feedback
Lateral Force (LFM)
Force Modulation (FMM)

Amplitude modulation AFM
Topography
Phase
Feedback

AFM spectroscopy
Force-distance
Amplitude-distance
Phase-distance
I(V)

Raster Spring Imaging

Spreading Resistance Imaging

Magnetic Force Microscopy
Two-pass DC/AC
Lift DC/AC

Electrostatic Force Microscopy
Single-pass, Two-pass
Amplitude Modulation
Frequency Modulation
dC/dZ imaging
dC/dV imaging

Kelvin Probe Force Microscopy
Single-pass, Two-pass
Amplitude Modulation
Phase Modulation

PFM & Switching Spectroscopy

Nanolithography
Voltage
Current
Force

AFM-based Nanoindentation
Elastic modulus mapping
Work of dissipation

STM

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