BRUKER DIMENSION NEXUS AFM

Dimension Nexus AFM: new high performance, smaller footprint AFM from Bruker

John Thornton
Sr. Applications Engineer
john.thornton@bruker.com

Latest Addition to the Dimension Product Family

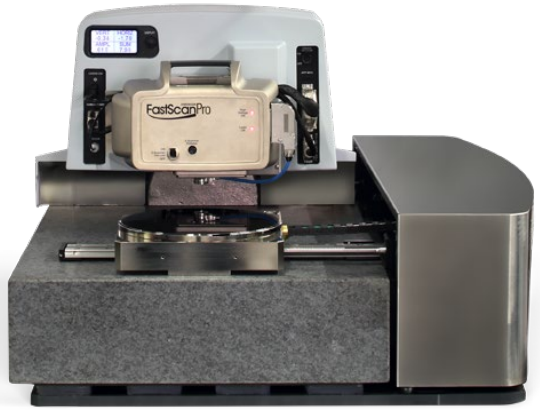
NEW Dimension Nexus

Dimension Icon

Dimension FastScan

Dimension IconIR

NanoScope 6 Controller



Dimension Pro

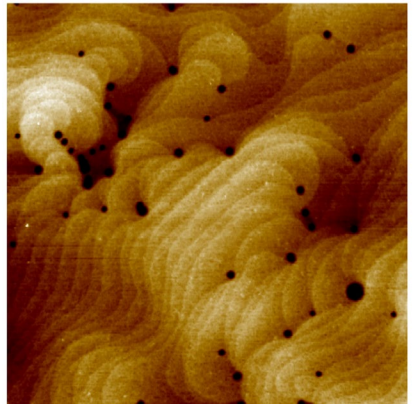
Large-sample capabilities in a compact AFM system

- 150mm diameter sample chuck, compatible with:
  - 6” wafer (maximum)
  - 15mm sample puck (single or multiple)
- Tip scanning design + open access to stage allows range of sample sizes and customized setups.
  - XYZ scan range = 90µm x 90µm x 10µm
- Integrated acoustic enclosure = compact footprint

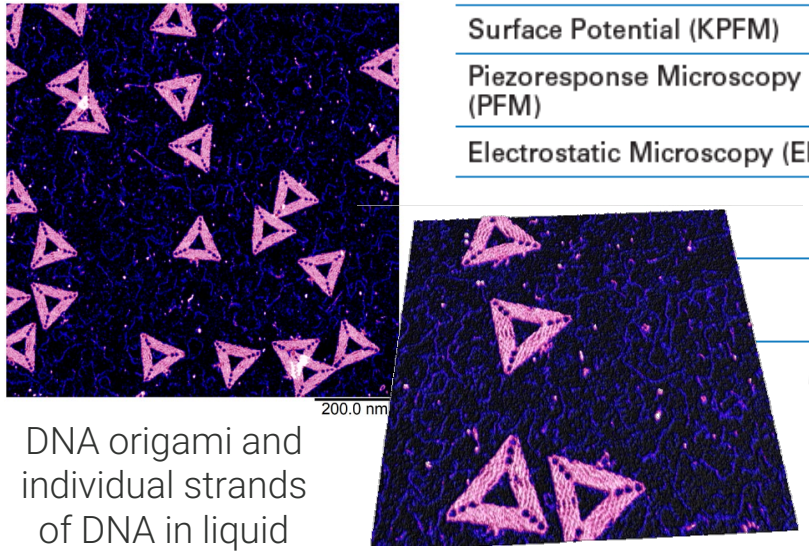
High performance tabletop AFM with large sample capabilities

Wide range of measurement techniques

- Highly configurable with full range of advanced AFM modes
- Addresses all major application areas in materials research
- Many modes are unique to Bruker, including:
  - Full suite of PeakForce Tapping modes
  - ScanAsyst self-optimizing imaging
    - ScanAsyst Plus for Contact, Tapping, PeakForce
  - Torsional Resonance (TR-Mode)/ TR-DFM
  - Environmental control: Fluid imaging, heating stages, …



GaN on Silicon Carbide (10um)



DNA origami and individual strands of DNA in liquid

AFM Modes and Capabilities Available

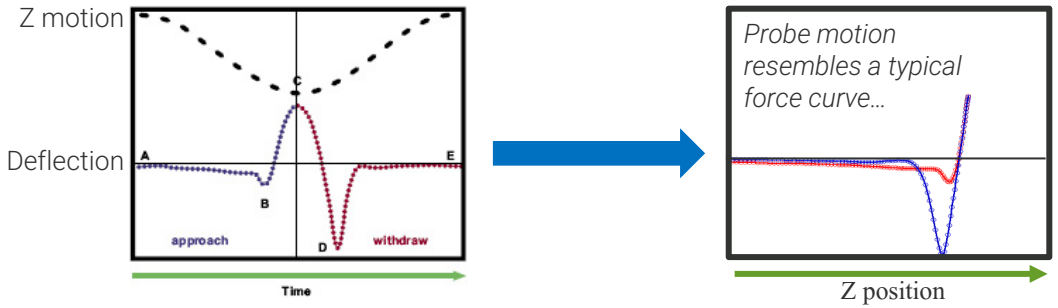
Standard	Optional
PeakForce Tapping	PeakForce QNM (PF-QNM)
ScanAsyst	PeakForce TUNA (PF-TUNA)
TappingMode	PeakForce KPFM™ (PF-KPFM)
Contact Mode	PeakForce EFM (PF-EFM)
Lateral Force Microscopy (LFM™)	DataCube Modes
PhaseImaging™	Ramp & Hold
LiftMode™	Nanolithography
Force Spectroscopy	Dark Lift Mode
Force Volume	Conductive AFM (C-AFM™)
Surface Potential (KPFM)	Tunneling AFM (TUNA)
Piezoresponse Microscopy (PFM)	Fast Tapping
Electrostatic Microscopy (EFM)	Torsional Resonance Mode (TR-Mode™)
	Torsional Resonance Dynamic Friction Microscopy (TR-DFM)
	Fluid Imaging (PeakForce Tapping, TappingMode, Contact Mode)

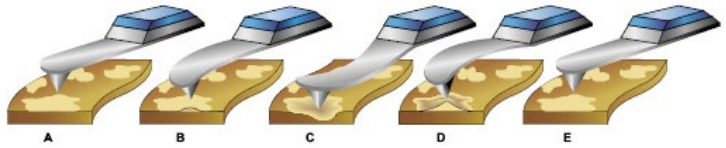
Inquire for additional modes and capabilities

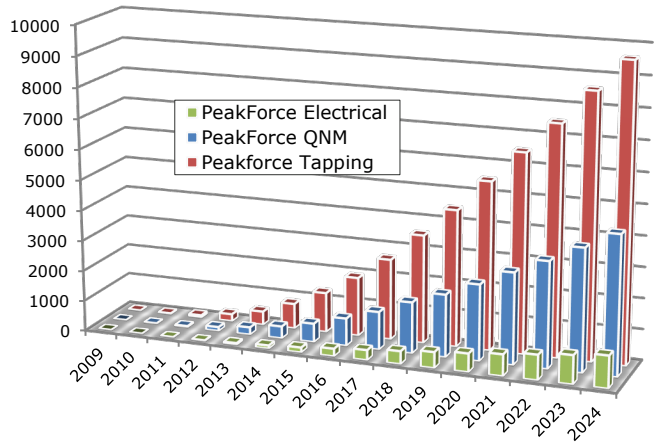
PeakForce Tapping mode

- Probe oscillated at low amplitudes at sub-resonant frequencies (e.g. 1-2kHz), Feedback on “peak” force

- Benefits:
  - Precise control of tip-sample interactions enables lowest imaging forces
  - Tip and sample integrity maintained over extended periods
  - Consistent, repeatable high-resolution imaging
  - Images acquired at standard imaging rates
  - Simultaneous acquisition of quantitative nanoscale sample properties (mechanical, electrical, etc.)
    - PeakForce Tapping/ScanAsyst
    - PeakForce QNM
    - PeakForce TUNA
    - PeakForce KPFM
    - PeakForce MFM
    - PeakForce sMIM
    - . . .



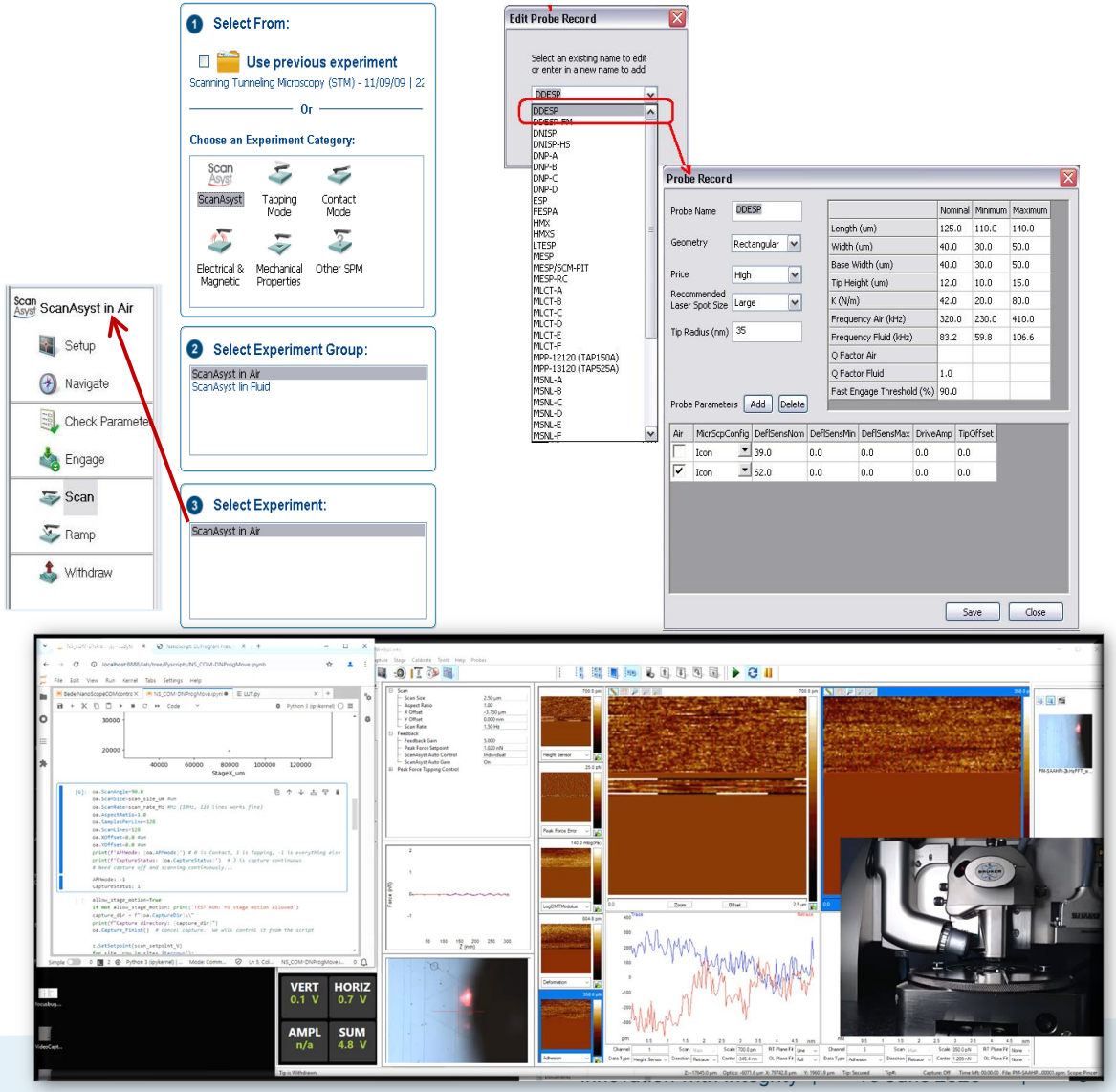




Almost 10k publications = 2 each day for the past fifteen years!

Designed to be productive and easy to use

- Ease of use features benefit new and experienced users
  - Tip alignment station
  - Intuitive UI, guided workflow
  - Probes Database
  - Automated tip-surface engagement
  - ScanAsyst self-optimizing imaging
- Programmable, motorized XY-Stage for multi-site and multi-sample measurements (150mm x 150mm)
- Scripting capabilities for automation of XYZ movement and data collection (NanoScript)



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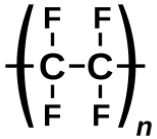
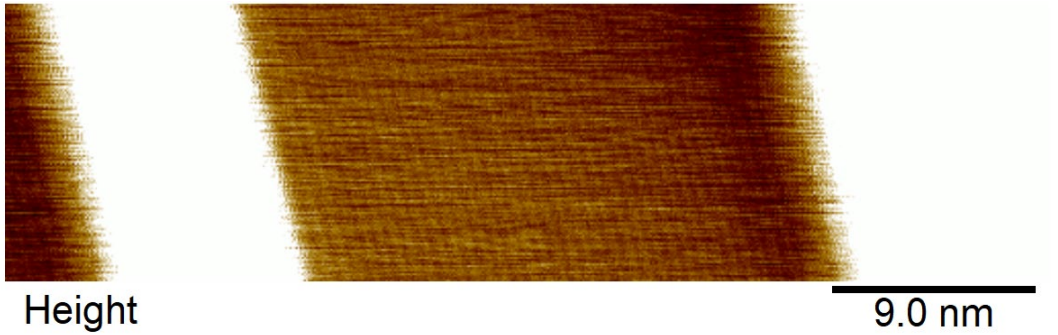
Application Examples

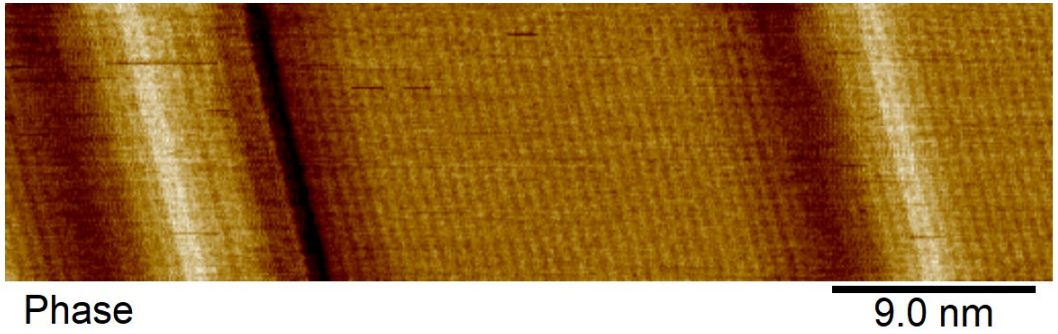
Tapping Mode on PTFE crystal lattice

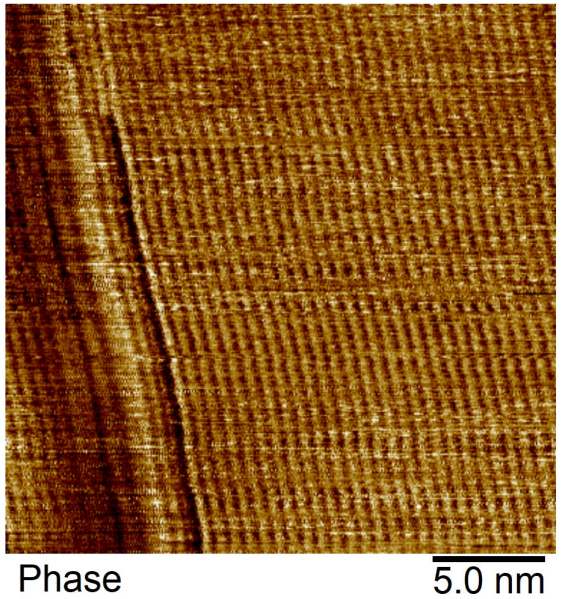
- Sample: Polytetrafluoroethylene (PTFE) or Teflon, rubbed on surface.

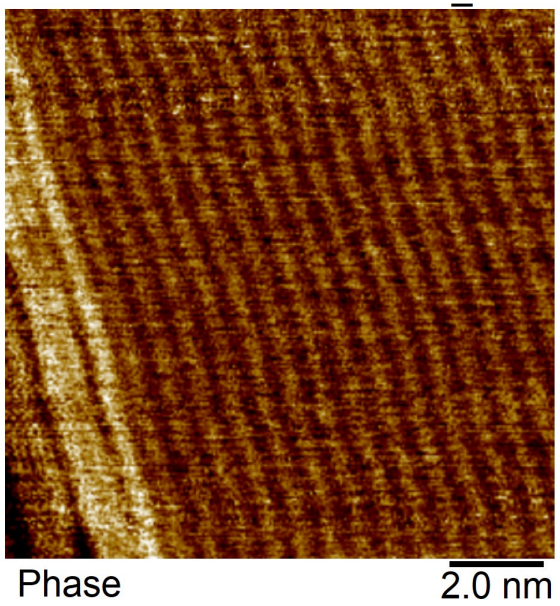


- High spatial resolution: lattice spacing is 0.5 nm, visible in height, height sensor and phase channels



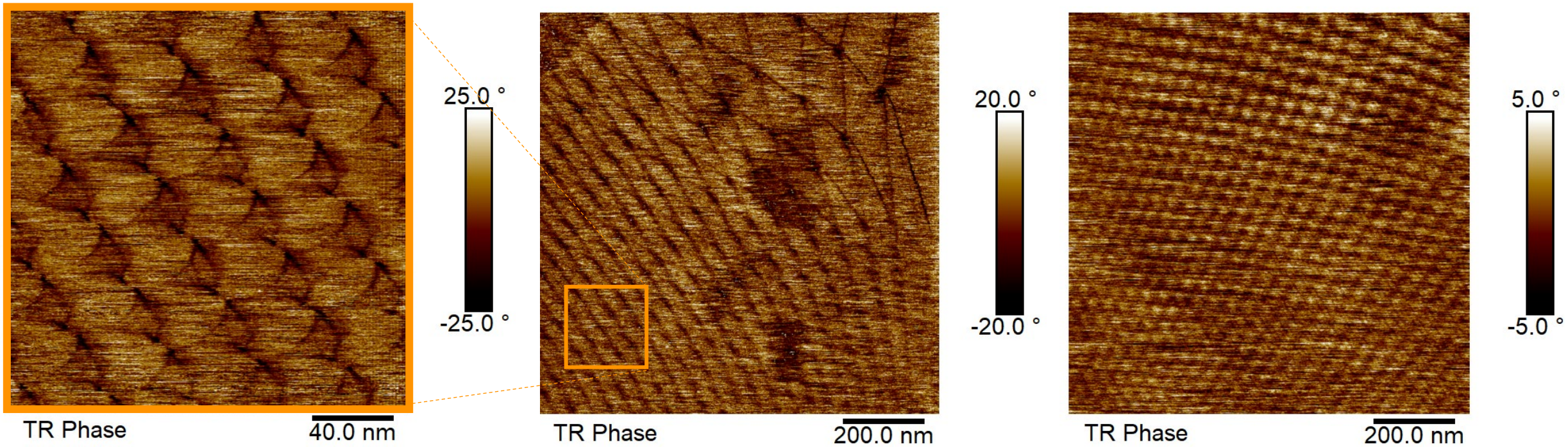






TR-DFM on 2D with Moiré Pattern

- Torsional Resonance Dynamic Friction Mode (TR-DFM) = contact mode feedback with small lateral tip oscillation at the cantilever torsional resonance.
- Images collected at 10 Hz linerate



PeakForce Tapping on SiO_2 6” Wafer (500 nm scans)

- Extreme low drift is observed: X: 0.10 nm/min, Y: 0.02 nm/min
- Excellent repeatability: 129 repeats: Ra roughness = 208 pm, std dev = 2 pm

Image #1

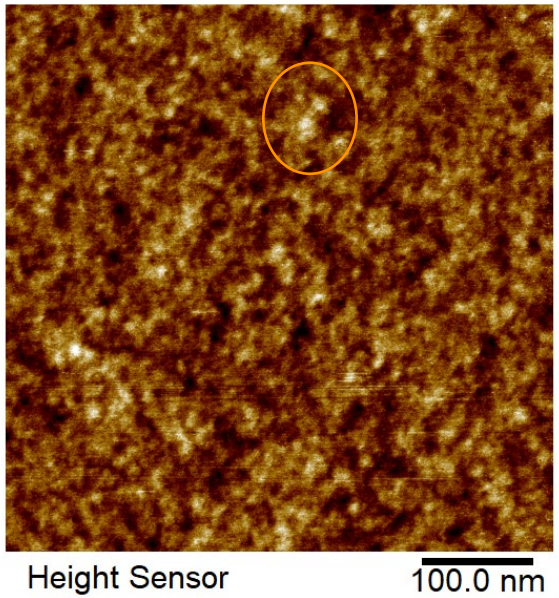
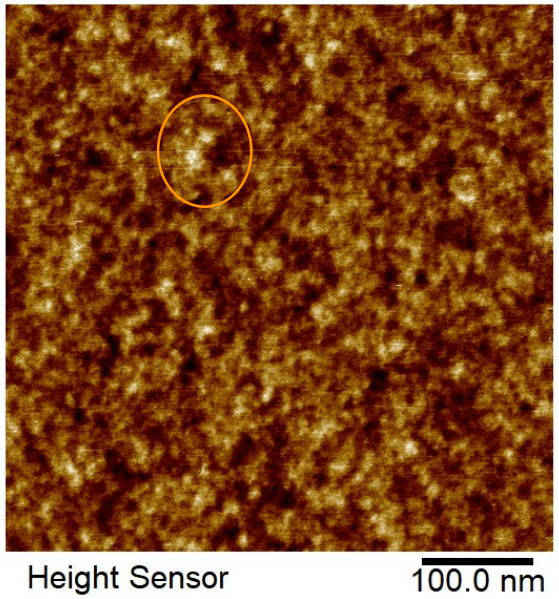
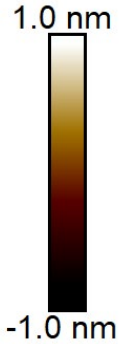
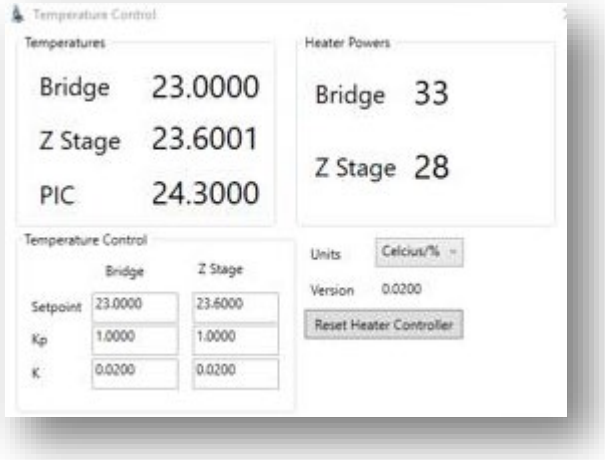


image #129



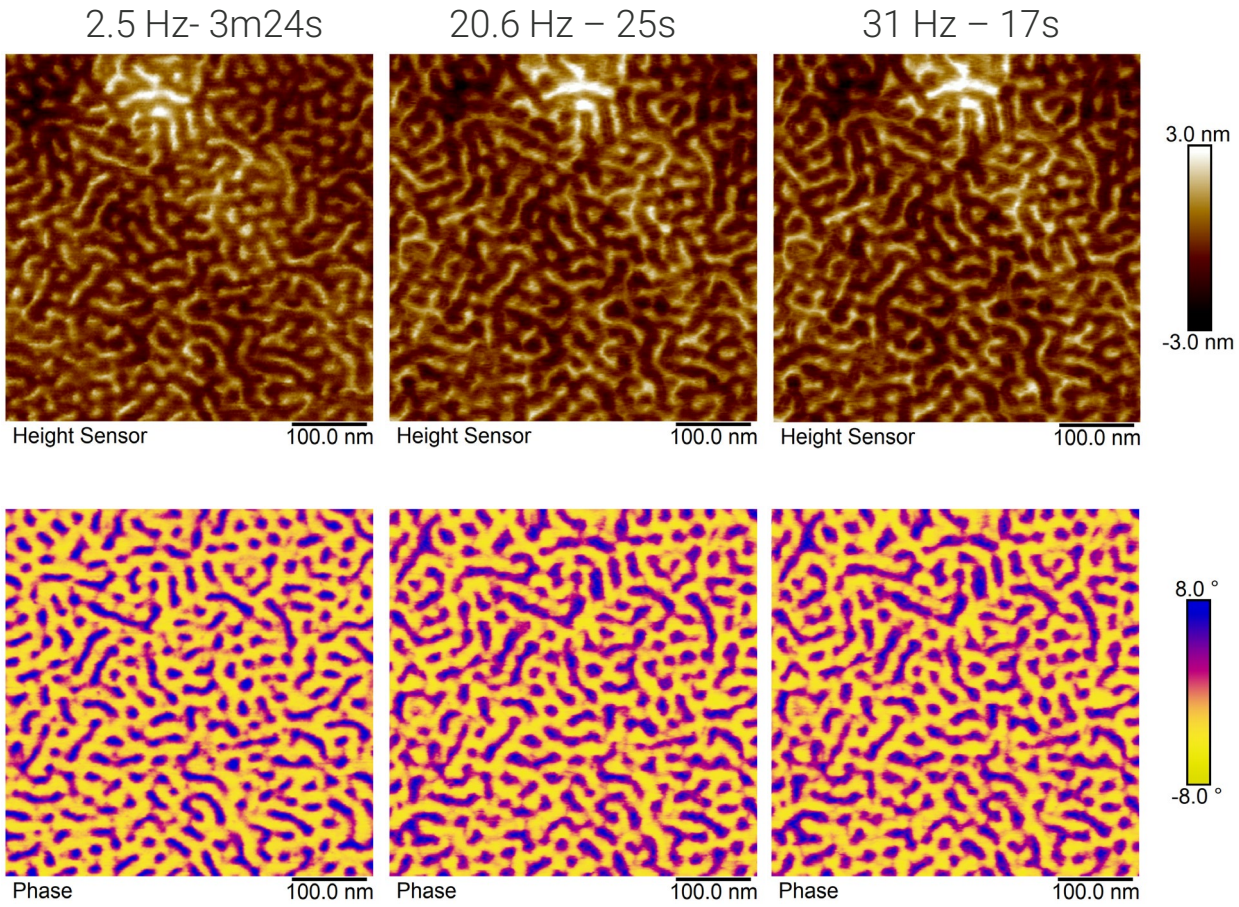


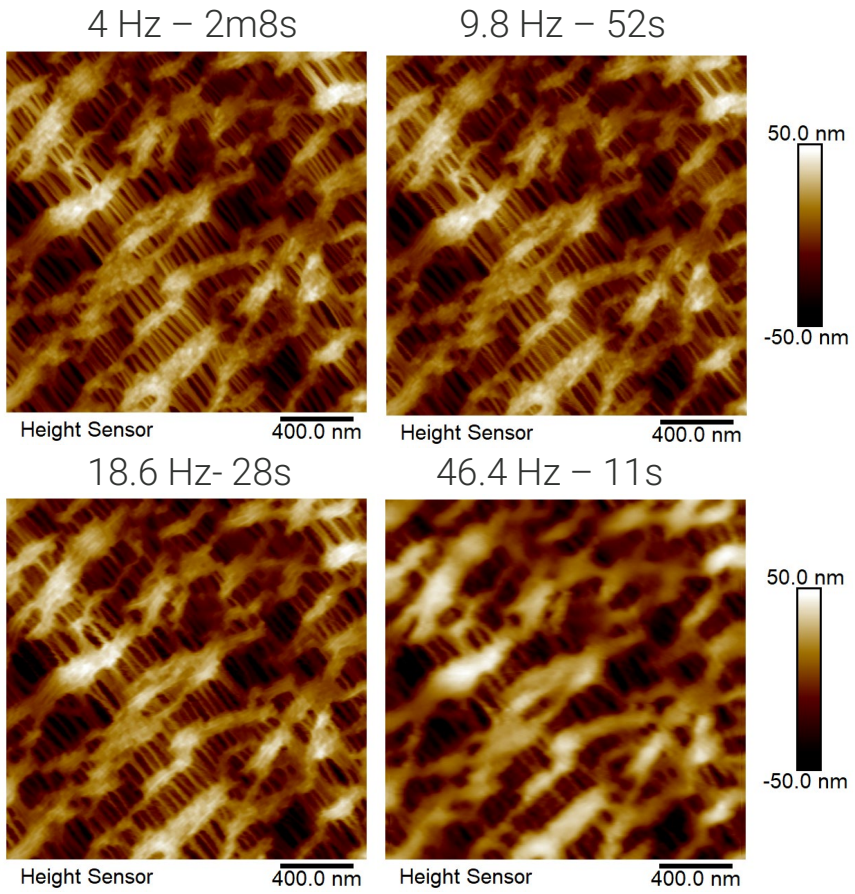
Active control of temperature of key instrument components



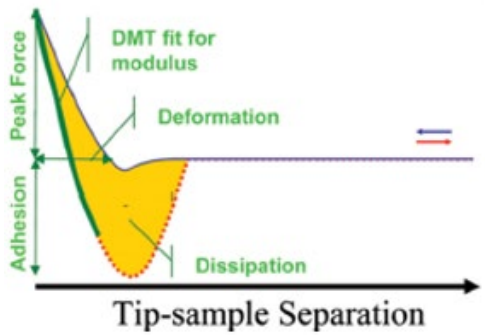
Tapping on SBC Polymer & Celgard

- Good throughput can be obtained. All images 512x512 pixels.

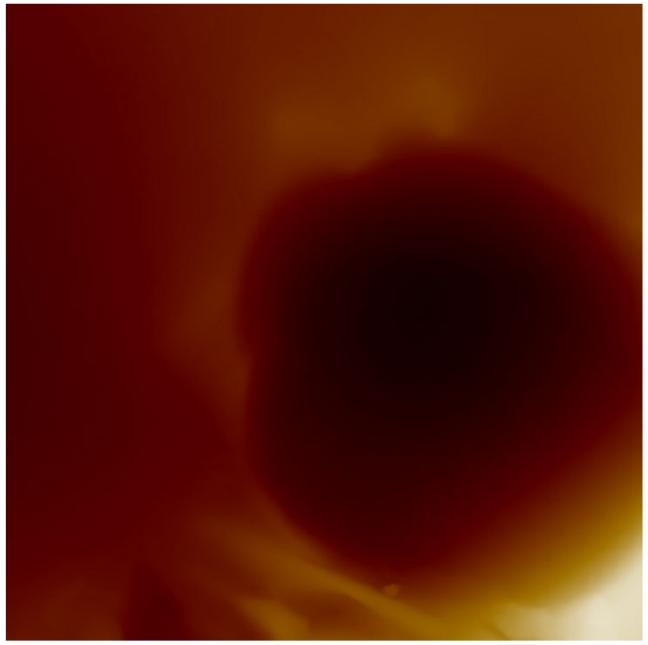


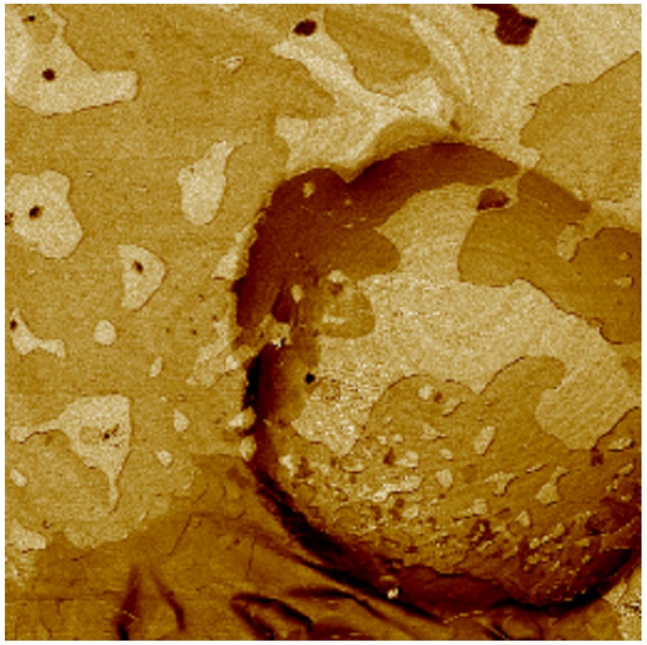


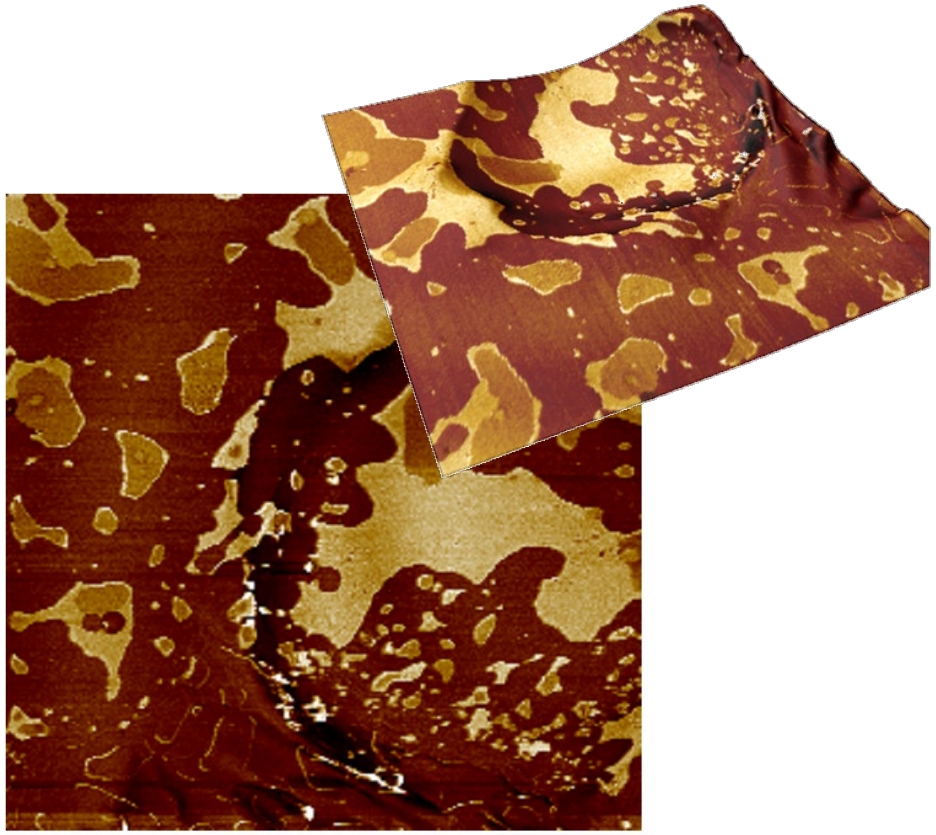
PeakForce QNM on PS-PMMA-PVC blend



- Accurate mechanical property measurements at standard imaging speeds
- Adhesion, Modulus, Deformation, Indentation
- Sample courtesy: Ph. Leclere, Uni Mons, Belgium





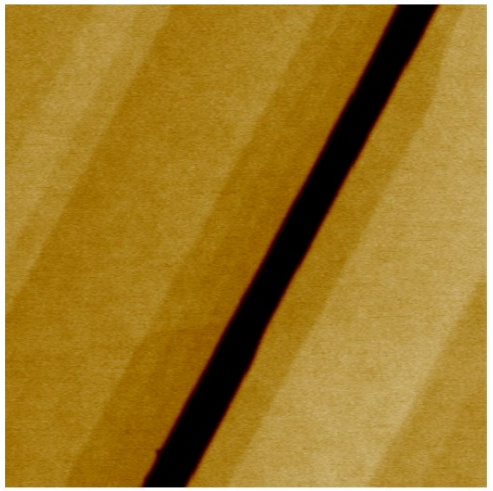


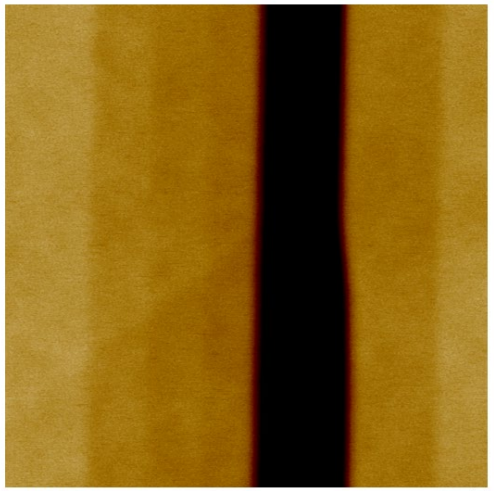
Kelvin Probe Force Microscopy: a suite of implementations

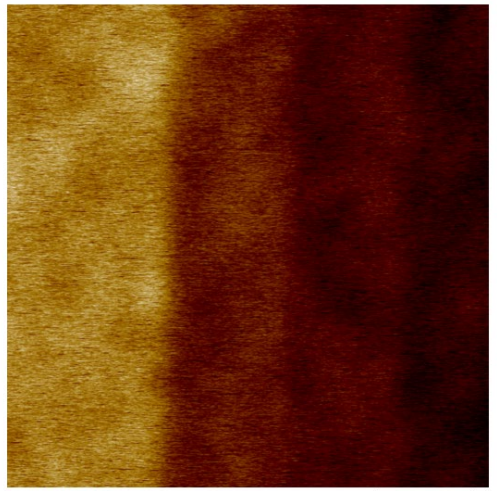
- Five different implementations for surface potential measurements

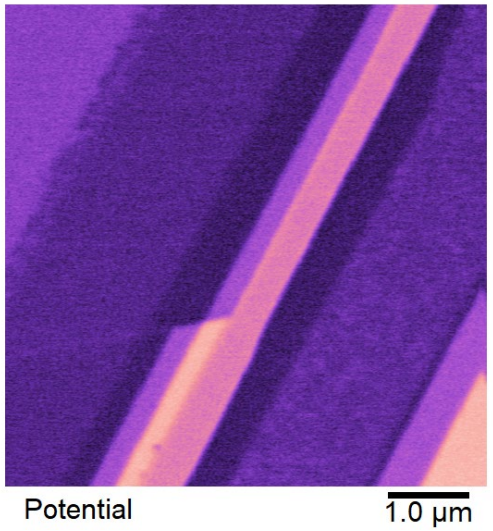
Name in Software	Type	Topography	Surface Potential
PeakForce KPFM	Two-scans	PeakForce Tapping (with QNM)	FM-KPFM (in lift mode)
PeakForce KPFM-AM	Two-scans	PeakForce Tapping (with QNM)	AM-KPFM (in lift mode)
PeakForce KPFM-HV	Two-scans	PeakForce Tapping (with QNM)	Open loop FM-KPFM (in lift mode)
Surface Potential (AM-KPFM)	Two-scans	Tapping	AM-KPFM (in lift mode)
Surface Potential (FM-KPFM)	Single scan	Tapping	FM-KPFM

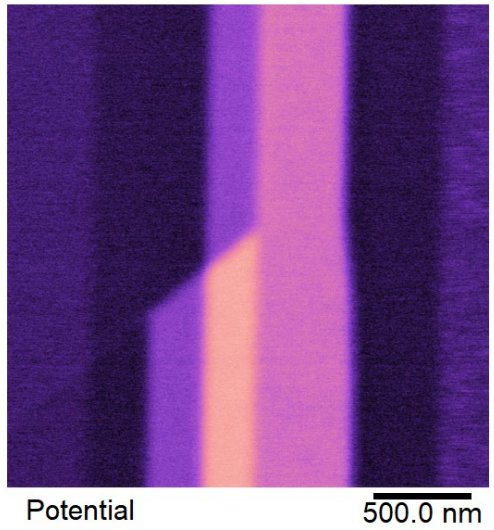
FM-KPFM on hBN: high spatial resolution and sensitivity

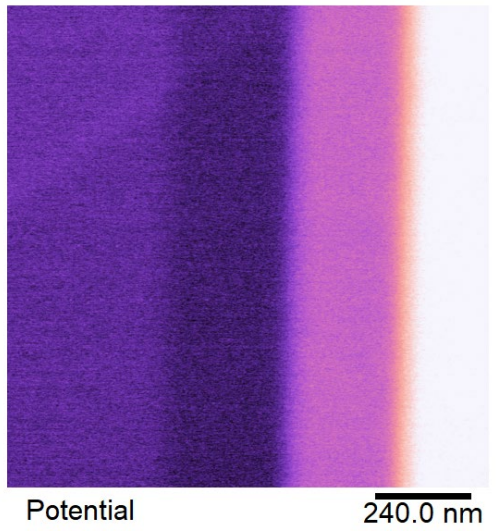




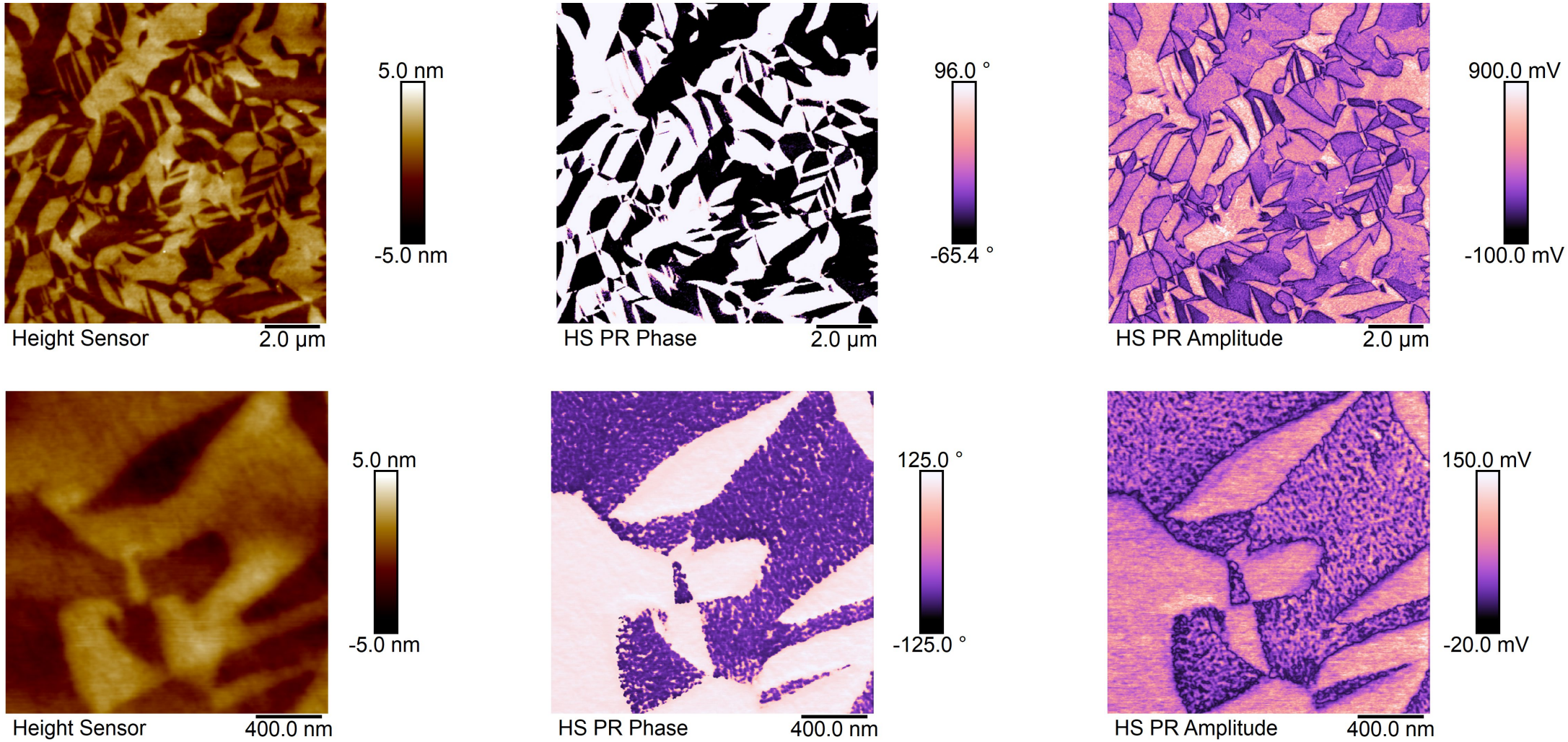






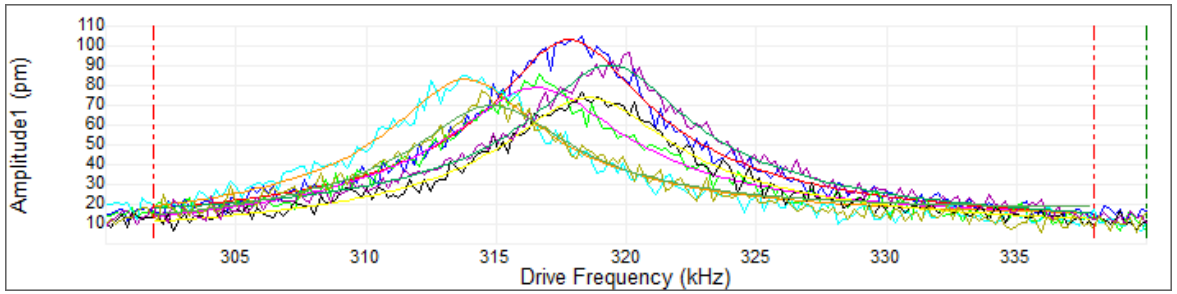


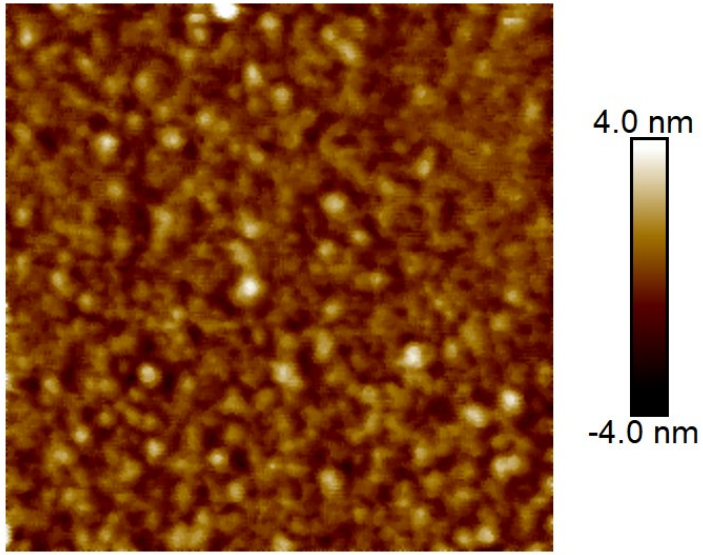
Piezo Force Microscopy (PFM): single crystal lead PMN-PT

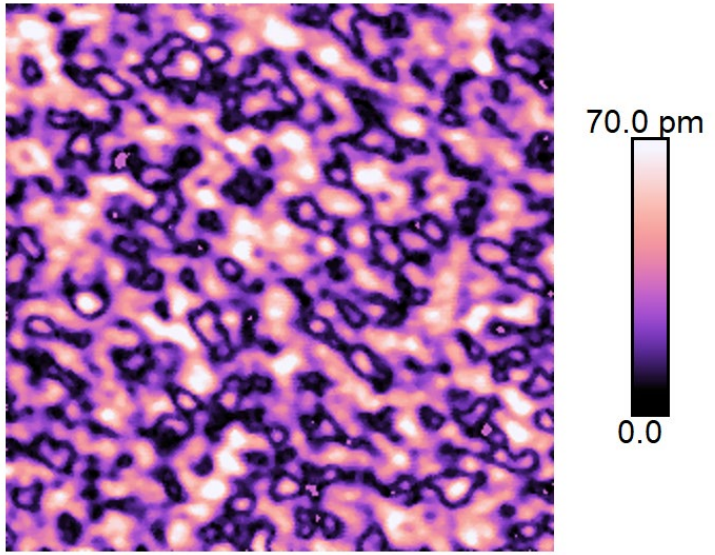


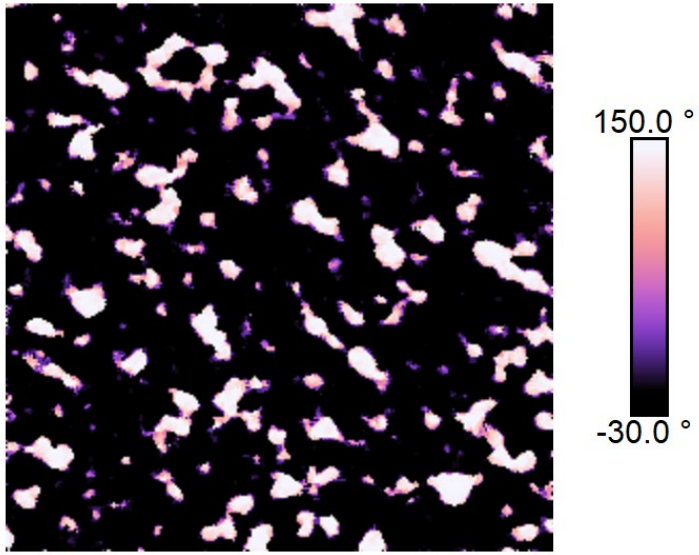
DataCube Contact Resonance PFM: stay tuned

- BFO sample test.
- Sweeping the AC frequency during hold.
- Following the contact resonance at every pixel.

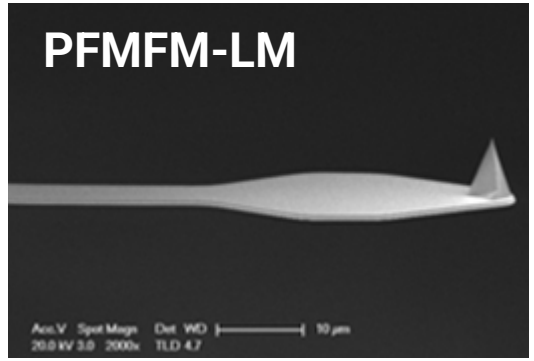




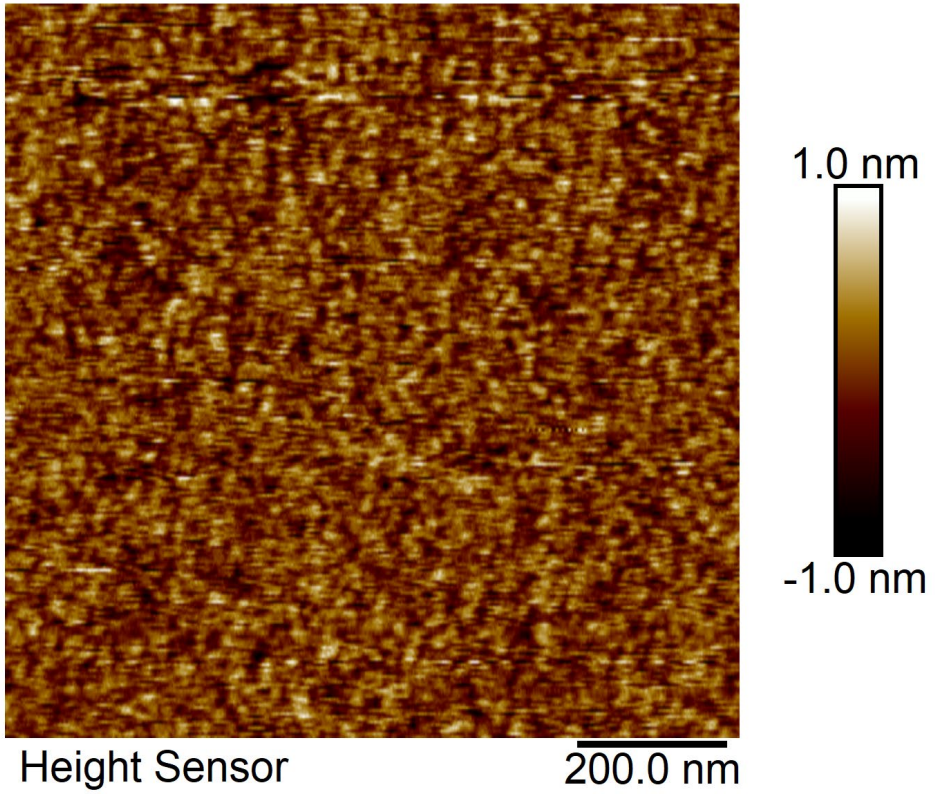


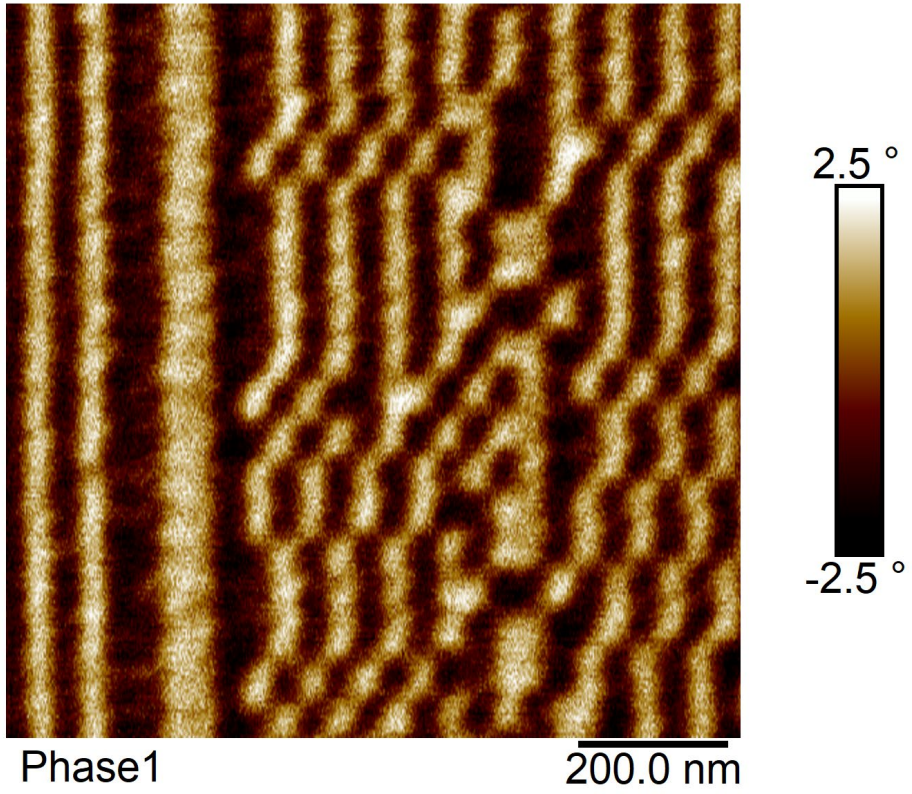


PeakForce Magnetic Force Microscopy (PF MFM): 20 TB HDD



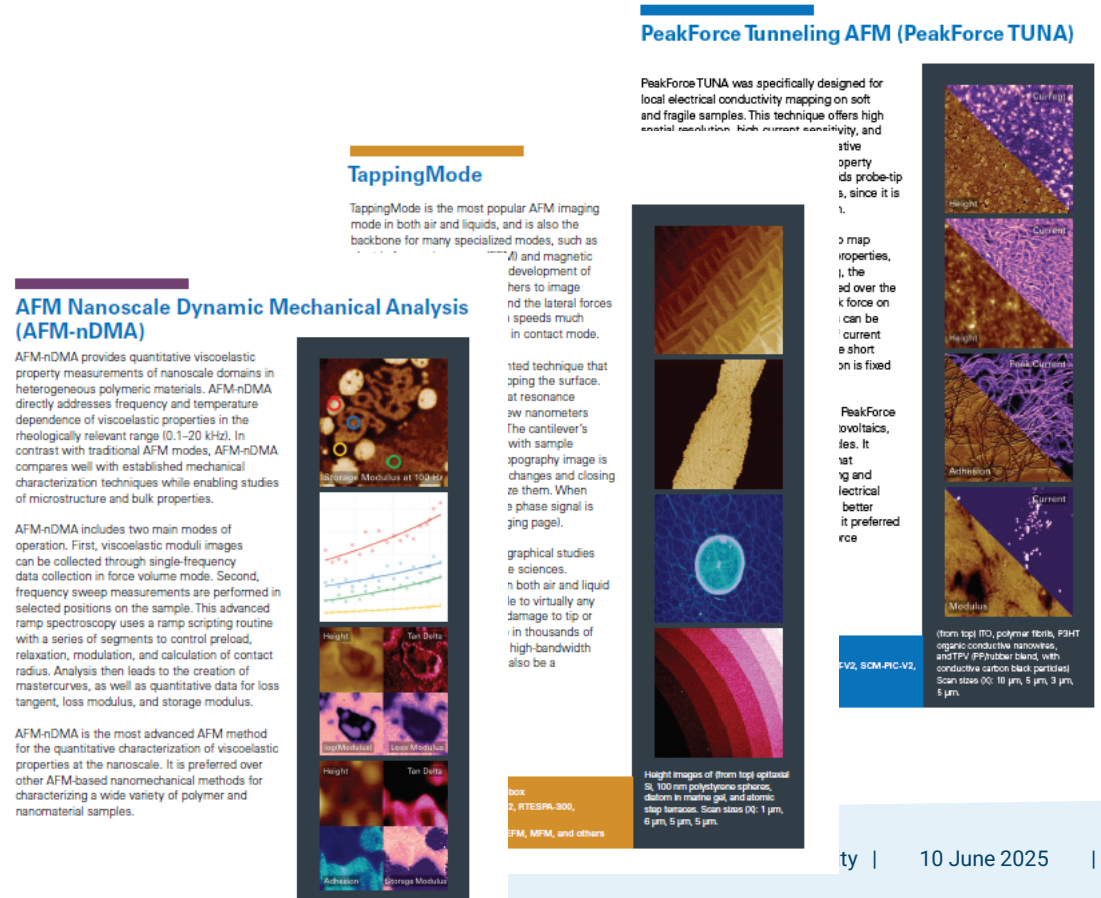
- Improved sensitivity and resolution owing to special probes.
- k ~ 0,5 N/m, f_{res} ~ 110 kHz, Q ~ 60.
- Higher sensitivity (Q/k) and higher speed (f/Q).





AFM Modes Handbook

- Download from https://www.bruker.com/en/products-and-solutions/microscopes/materials-afm/resource-library/e-book-the-definitive-afm-modes-handbook.html



Summary

- **Come by our booth to see the Nexus live**

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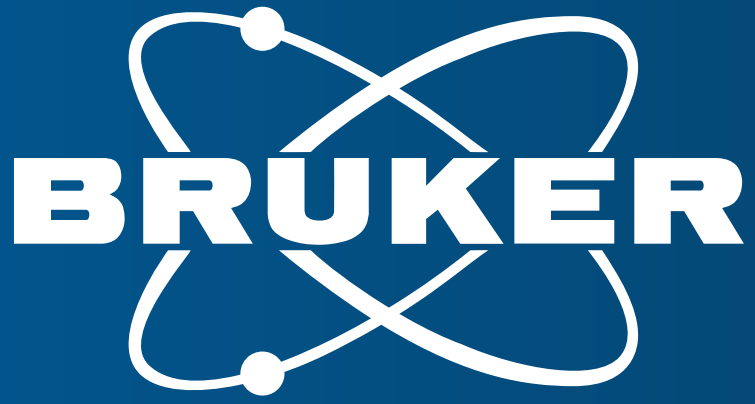
John Thornton, john.thornton@bruker.com

https://www.bruker.com/en/meta/forms/bns-form-pages/brochures/afmi/dimension-nexus.html

Thank you!

Join our Journal Clubs Today!



Innovation with Integrity