BRUKER

LASER APPROACHED NanoWizard V

BIOSCIENCE AFM
NanoWizard® V

Automated quantitative nano-mechanical imaging
Fastest scanning of corrugated samples

NanoWizard® V
Simply the Best BioAFM

The JPK **NanoWizard® V** combines high spatio-temporal resolution with a large scan area, flexible experiment design, and outstanding integration with advanced optical microscope systems. The automated setup, alignment, and re-adjustment of system parameters opens new possibilities for long-term, self-regulating experiment series.
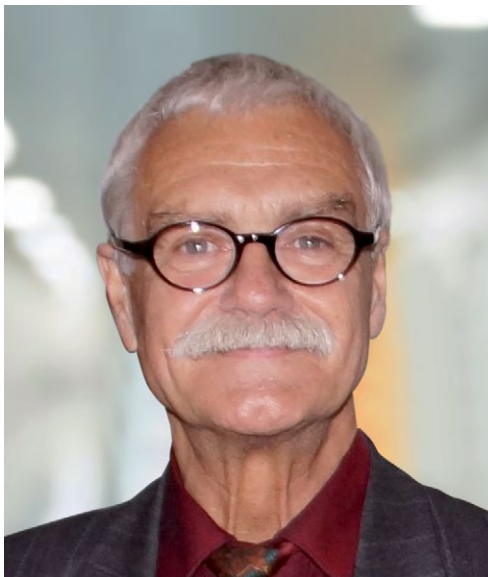
The **NanoWizard V** is expected to significantly advance our understanding of dynamic cellular processes and molecular mechanisms. Its PeakForce-QI mode enables fast and flexible quantitative nano-mechanical measurements, significantly extending the capabilities of AFM.

NanoWizard V features novel scanner and sensor technologies and state-of-the-art control software that encompasses an intuitive, workflow-based graphical user interface (GUI) to ensure true, easy-to-use AFM operation.

> " The NanoWizard V is excellent for medical component analysis. "

Prof. Dr. rer. nat. Hans Bäumler
Head of Research Department, Institute of Transfusion Medicine, Charité University Hospital Berlin (Germany)

Discover the 5th generation BioAFM

- Latest generation packed with novel innovations
- From the pioneers of BioAFM with over 25 years of experience in developing BioAFMs
- Recognized by an install base of over 1000 JPK/Bruker BioAFMs across the globe
- Proven by 8500+ publications with biological significance
- Supported by dedicated cantilever development for high-resolution imaging and customized applications
- Paving the way for new scientific discoveries with:
  - PeakForce-QI, PeakForce Tapping®, PeakForce QNM®, QI
  - Single Molecule Force Spectroscopy (SMFS)
  - Single Cell Force Spectroscopy (SCFS)
  - DirectOverlay 2 for AFM in conjunction with advanced optical microscopy
  - New software environment V8
  - Features the latest ExperimentPlanner and ExperimentControl
  - Accessories for high NA optics and AFM, environment control, and more

Perfected performance, increased productivity

NanoWizard V is the future of BioAFM today
- Unmatched ease of use
- Speed for dynamics and improved throughput
- Automated, high pixel density mapping and imaging

Latest Technology for Maximum Efficiency

Highest performance BioAFM

Featuring an enhanced, workflow-based design with intuitive user guidance in the new SPM V8 software, the NanoWizard V empowers beginners and experts alike to acquire highest quality, reproducible data. The system's high degree of automation improves productivity and maximizes throughput. State-of-the-art analysis and batch processing routines ensure scientific accuracy and statistical data reliability.

- Adaptive intelligent scanning routines enable faster scanning rates of up to 400 lines/sec
- Lowest noise scanner and detection system ensure high-resolution data and unrivalled performance on inverted optical microscopes
- PeakForce-QI, the symbiosis of PeakForce Tapping and QI modes, delivers the fastest, most advanced force control for highly delicate samples

Fastest Automated BioAFM for corrugated samples on an inverted microscope

- Visualize dynamics with Bruker's Nested Scanner and latest feedback technologies
- Bruker's proven DirectDrive increases cantilever excitation stability
- Active balancing provides faster scanning over large scan ranges
- Improved productivity and maximized throughput enables better statistics
- Intelligent optimization routines deliver quantitative nanomechanics

Most intuitive BioAFM operation

- Fundamental ease-of-use features
- User management, ideal for multi-user facilities
- Automated setup and workflow
- Single-click cantilever calibration
- Single-click optical image calibration
- Extended optical viewing field for AFM with stitching feature
- Long-term, unattended experimental procedures
- Remote operation capabilities
- Optimized storage of parameters and favorites
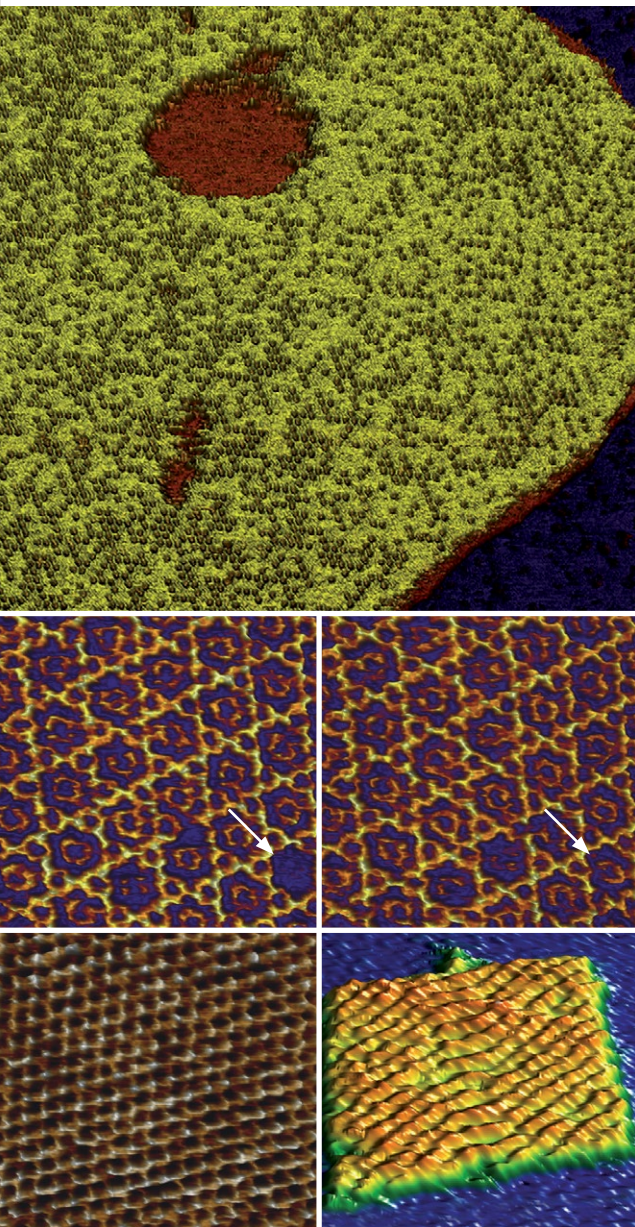- Intuitive integration of data processing routines

Image top
Tapping mode topography image of Annexin 5 protein on lipid membrane in buffer acquired at 40 Hz line rate showing the occupation density of centric trimers in 2D honeycomb structure.

Scan size: 1.3 µm × 1.3 µm
Height range: 8.0 nm

Image middle-left/right
Fast tapping mode topography image acquired at 170 Hz line rate of Annexin 5 protein on lipid membrane in buffer. The arrows depict the occupation of a centric trimer from solution in the 2D crystal structure 12 seconds (8 frames) later.

Scan size: 96 nm × 96 nm
Height-range: 1.0 nm

Image bottom-left
Topography image of atomic lattice of mica in liquid. Image taken in closed-loop on an inverted microscope.

Scan-size: 10 nm × 10 nm
Height-range: 210 pm

Image bottom-right
DNA origami (GATTA-AFM, Gattaquant, Germany) Tapping Mode topography image acquired at 400 lines/sec in TAE buffer.

Scan size: 96 nm × 96 nm
Height range: 3.1 nm

Understanding Forces in Biology

The leading BioAFM for Mechanobiology

By providing the right model for the right experiment, Bruker delivers easy solutions to complex scientific questions. Automated measurement procedures allow researchers to concentrate on what's important – their research - and to question why and not how.

- Investigate single molecules, live cells, and tissue samples
- Study corrugated and delicate, soft sample structures under native conditions
- For a detailed understanding of viscoelastic properties and adhesion processes
- Highest level of automation thanks to Autoalign, HybridStage or motorized stage, ExperimentPlanner, ExperimentControl, and GUI features

Complete set of nanomechanical modes for any application	
Stiffness, Elasticity, Dissipation	PeakForce-QI, QI, Fast Force Mapping
Viscoelastic properties	MicroRheology, Contact Resonance
Friction and sample alterations	Lateral Force, Force Modulation, NanoManipulation
Hardness	NanoIndentation
Single molecule spectroscopy	Molecular recognition, Single molecule folding/unfolding

PeakForce-QI

A new chapter in quantitative imaging

The pioneers of quantitative biological imaging, with PeakForce Tapping (2000+ publications) and QI (~1000 publications), now bring you the next generation: **PeakForce-QI**.
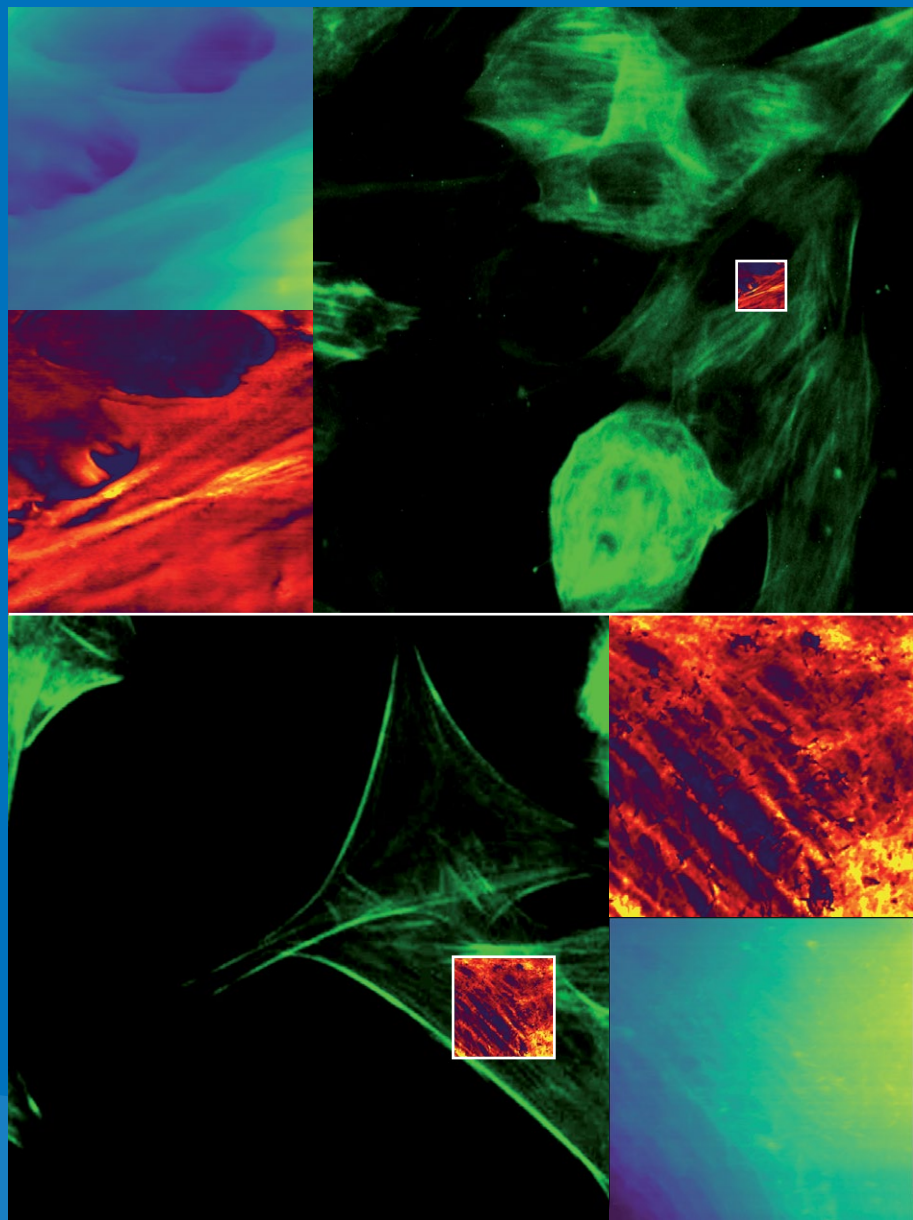
- Fastest nanomechanical imaging with latest piezo and sensor technologies
- Easy, precise batch processing
- True, real-time force curve monitoring

Correlated PeakForce-QI and fluorescence data set of live NIH-3T3 fibroblasts (murine) cells acquired at 37 °C in cell medium.

AFM sets blue: PeakForce-QI topography images of live fibroblasts
Height ranges: top 2.35 μm
                bottom 3.5 μm
AFM sets red: Young's modulus images extracted from PeakForce-QI
Z-ranges: top 5.2-13.1 kPa,
           bottom 0-30 kPa
Scan sizes: top 10 μm × 10 μm
             bottom 23 μm × 23 μm
Overview: Overlay of fluorescently labelled fibroblasts with CellMask™ Green Actin Tracking Stain and Young's modulus images, sample courtesy Dr. Wedepohl, Freie Universität Berlin (Germany)

Quantitative Data and Intelligent Analysis

Automated Force Spectroscopy Reloaded

The pioneers of Single Molecule Force Spectroscopy (SMFS) and Single Cell Force Spectroscopy (SCFS) now bring you even more flexibility, higher precision, and increased throughput.

- Proven ForceRobot technology now built-in
- Bruker's intuitive and powerful RampDesigner
- Automated calibration
- Molecular recognition imaging
- Most sensitive force control and tip-saving features

Powerful Data Slices

- Flexible creation of topography images at different forces
- Proprietary contact point imaging
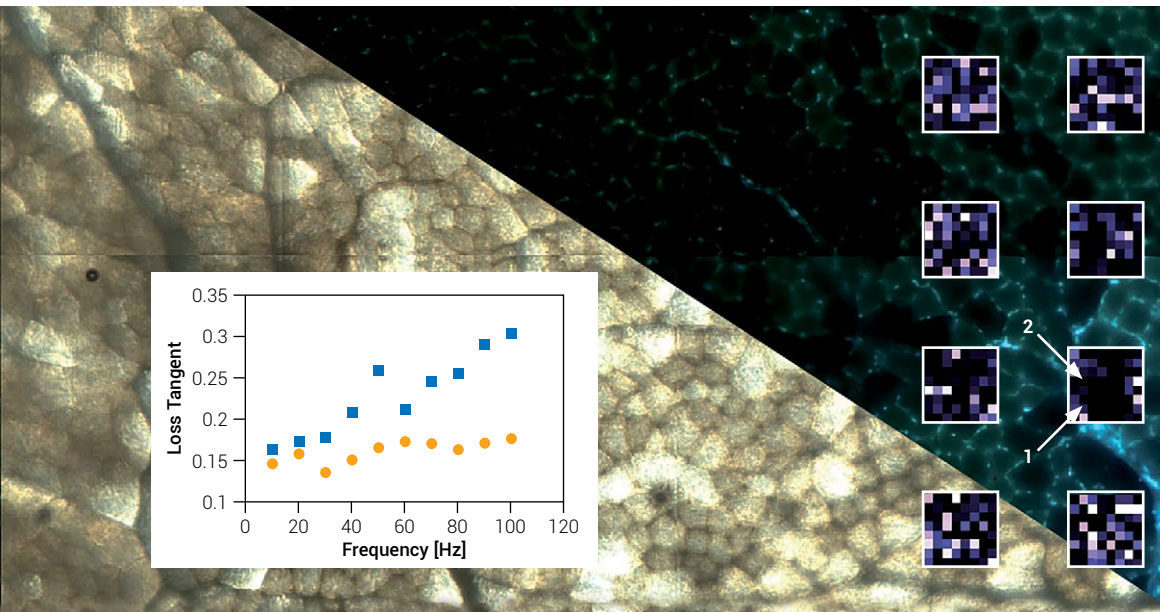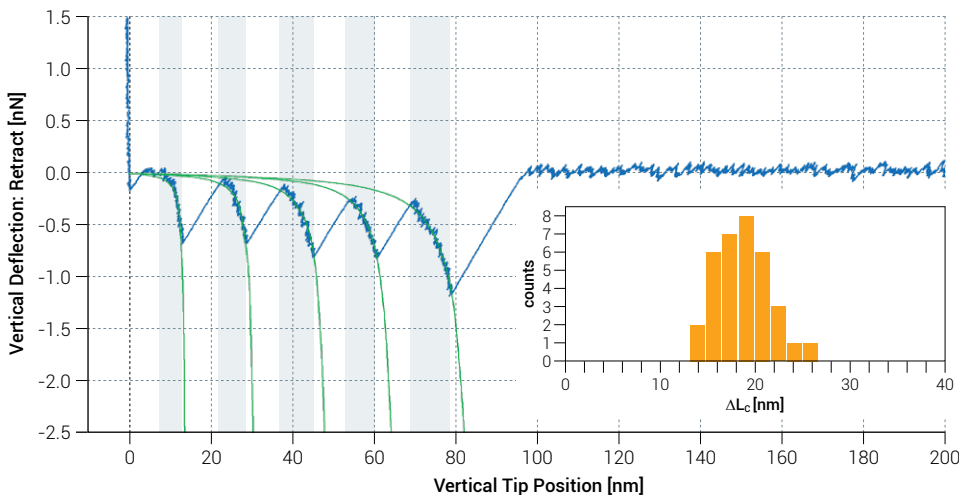- Image stack output of any channel from batch processing

For complex experiments, from single molecules to cells and tissues

- Optimized environmental control options
- Comprehensive nano-mechanics with RampDesigner
- Complex experimental routines with ExperimentPlanner
- Integration of several modes in long-term, unattended experiments

> " The system's promised speed and resolution, ease of use, and up-to-millimeter-range capabilities make this a game changer for AFM investigations in nano-medicine and biomedical applications. "

Dr. David Martinez Martin
Biomedical Engineering,
University of Sydney (Australia)

Force curve
Unfolding of a single GB1 protein acquired in an automated, long-term experiment of ~54000 curves in ~16 hours, Inset: Contour length difference plot. Sample courtesy of Prof. Cao, Nanjing (China)

Left
Map of rat muscle tissue slice. Optics: Tiled 1.60 mm x 0.85 mm phase contrast and Hoechst 33342 fluorescence using HybridStage, Inset maps: Young's modulus acquired automatically with MultiScan (z-range 10-260 kPa), Inset plot: Loss tangent vs. frequency of two positions inside map (see arrows), Orange dots and blue squares positions 1 and 2, respectively. Sample courtesy of Prof. Ansgar Petersen, Julius Wolff Institute, Charité, Berlin (Germany)

Correlated Microscopy Newly Defined

Leading BioAFM in combination with advanced optical microscopy

- Perfect integration into advanced optical techniques
- Optical super-resolution (STED, FLIM,…)
- Upright for tissues, implants etc.
- DirectOverlay 2/MIRO
- One-click optical image import
- 980 nm OBD option
- DirectTiling, for larger scale efficiency
- Stitching
- MultiScan
- Seamless integration of multiple optical, external and AFM channels

Optical modes/combinations

Brightfield

DIC, Phase or modulation contrast

Confocal microscopy

Spinning disc

TIRF and IRM

FRET, FLIM, FRAP, FCS

Calcium imaging

Superresolution (STED, PALM/STORM, SIM)

Macroscope combination

Optical tweezers with OT-AFM

Background image
Fluorescence image of live *E.Coli* bacteria labeled with Hoechst 33342 acquired on coverslip in buffer

Middle image
Tapping Mode topography image of dividing *E.Coli* bacteria utilizing nested scanner technology.
Scan size: 1.7 μm × 3.6 μm
Height range: 1.0 μm

Left image
Nested scanner Tapping Mode topography image zoom resolving outer membrane protein network.
Scan size: 200 nm × 150 nm
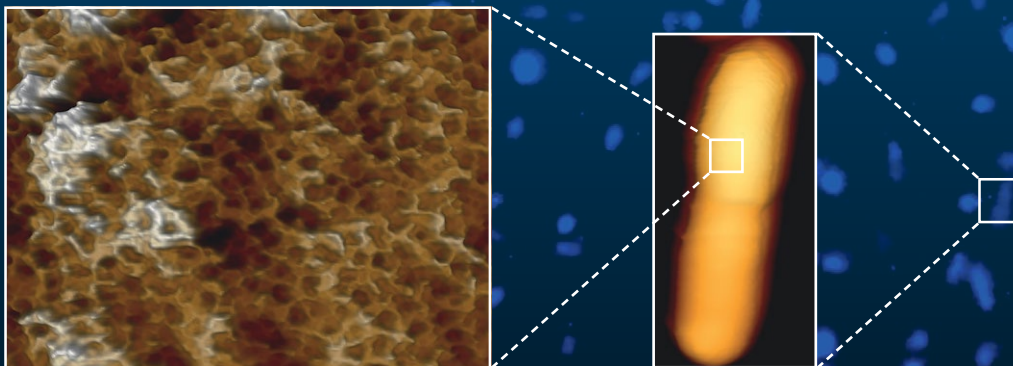Height range: 3.5 nm

Images bottom left
NanoWizard V with Zeiss LSM 800. Setup courtesy of Prof. Dr. Marie Weinhart, Freie Universität Berlin and Leibniz Universität Hannover

Images bottom middle
NanoWizard V with BioMAT workstation

Images bottom right
NanoWizard V on Olympus IX83 with Picoquant MicroTime 200 STED
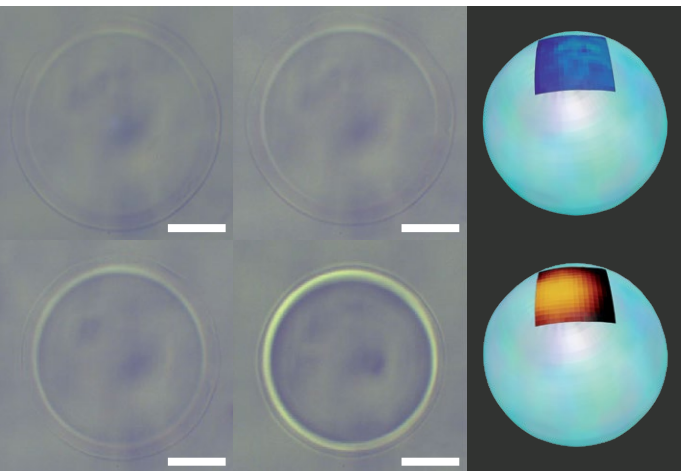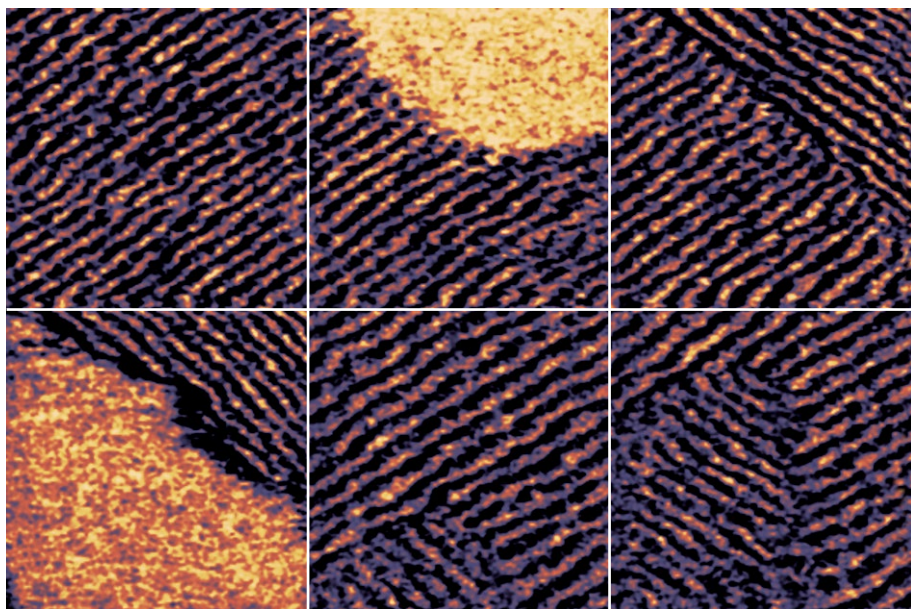

LSM 800

Unrivalled Flexibility by Design

Optimized for use in microbiology and virus research

The NanoWizard V BioAFM enables direct access to pathogens and infectious agents in a BSL facility. Each step, from sample preparation, loading and disposal to running the experiment, can be performed directly in the biosafety lab.

- Suitable for working with native pathogens and biohazardous material
- No "additional preparation" steps
- BSL-3 compliance achieved (in accordance with lab's safety regulations)

Ready to Go!

Explore an extensive range of accessories for versatile experimental setups and environmental control:

- HybridStage
- PetriDishHeater (PDH)
- BioCell
- CoverslipHolder (CSH)
- SideView cantilever holder
- 30 µl liquid cell
- StretchingStage
- and many more

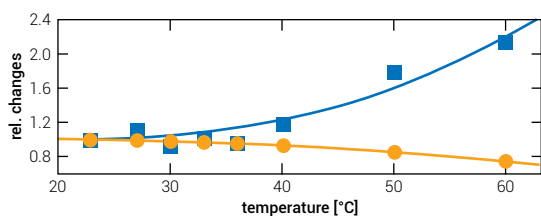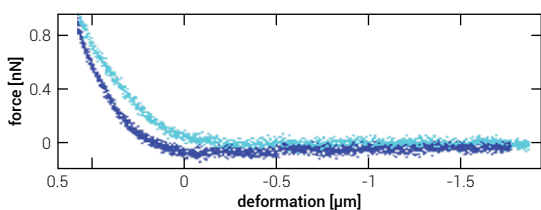## Go beyond imaging with injection and extraction capabilities

Seamless combination with the FluidFM® technology enables a host of novel experiment designs and applications.

- New FluidFM integration
- Broader range of force control
- Use of microfluidics in single cell manipulation applications
- Accurate positioning combined with perfect optical integration

Image sequence top
DMPC ripple phase formation imaged in Tapping Mode at 200 Hz line rate in EDTA buffer using the nested scanner feature. The sequence shows two different ripple phase formations with increasing/ decreasing temperature.
Scan size: 300 nm × 300 nm
Z-range: 5 degrees

Images & force curves left
P(NIPAM-NEAM) hydrogel microparticles for cell-inter-active scaffold engineering analyzed with QI at varying temperatures in the BioCell.

The images (top) demonstrate the QI topography & Young's modulus map on the particle, a series of optical phase contrast images (scale bars 20 µm) and corresponding QI force curve below.

The bottom plot shows the increase in Young's modulus (blue) and decrease in size (orange) with increasing temperature.

Sample courtesy of Prof. De Laporte, Aachen (Germany)

Technical Specifications

System specifications	• **Tip-scanning**, stand-alone system, with a rigid low-noise design and drift-minimized mechanics • **Vortis 2.1** SPM Controller generation • Atomic lattice resolution on inverted microscope in closed-loop	• Liquid-safe AFM with integrated vapor barrier, specialized encapsulated piezo drive and tip-moving design • $100 \times 100 \times 15\,\mu m^3$ scan range and $1.5\,\mu m$ extra z range with PeakForce-QI and fast scanning option
Software V8	• **Fully automated cantilever and detector alignment** routines • User-specific experiment design for unattended/remote long-term measurements • True multi-user platform, perfect for imaging facilities • **Fully automated sensitivity and spring constant calibration** using thermal noise or Sader method	• DirectOverlay 2 for combined optical and AFM information • Powerful Data Processing (DP) with full functionality for data export, fitting, filtering, edge detection, 3D rendering, FFT, cross section, video creation etc. • Powerful batch processing of force curves and images including WLC, FJC, step-fitting, JKR, DMT model and other analysis methods
Stages and sample holders	• Stages are available for **all major inverted optical microscope manufacturers,** such as Zeiss, Nikon, Olympus and Leica • Motorized Precision Stage with $20 \times 20\,mm^2$ travel range, with joystick and/or software control • Manual Precision Stage with $20 \times 20\,mm^2$ travel range	• Holders for petri dishes, coverslips, microscope slides or metal SPM discs are available • Large $\varnothing\,140 \times 18\,mm^3$ free sample volume, up to 14 cm in z with new Head-Up stage
Widest range of accessories and probes (see accessories handbook)	• **Large choice of temperature controls** (for ambient, liquid and gas) and liquid cells even for aggressive solvents	• **Complete range of probes** for all operating modes • Vibration and acoustic isolation from leading suppliers
Optical configurations	• Fully simultaneous AFM operation with **brightfield optical phase contrast and DIC** using standard condensers • Combine AFM with advanced commercial confocal microscopes and fluorescence optical techniques, such as FCS, FRET, TIRF, FLIM, FRAP, STED, STORM/PALM, SIM and more	• **Upright Fluorescence kit** – enables the combined use of AFM and upright optical fluorescence microscopes • TopViewOptics, video optics for opaque samples with 12× zoom • BioMAT option for high-NA upright fluorescence optics combined with AFM on opaque samples • Large range of cameras supported
Standard operating modes	• **Now with PeakForce-QI**, PeakForce Tapping and QI • Including fast PeakForce Tapping and PeakForce-QI with **nested scanner** technology • Contact mode with lateral force microscopy (LFM)	• TappingMode™ with PhaseImaging™ • **ExperimentPlanner** for designing a specific measurement workflow • Static and dynamic force spectroscopy • Advanced Force Mapping
Optional modes	• Advanced spectroscopy modes such as various force clamp modes or ramp designs • **Fast scanning option** with line rates of up to 200Hz (400 lines/sec) • QI Advanced mode for quantitative data, perfect for soft samples • **ScanAsyst** automated gain and setpoint adjustment in PeakForce Tapping and PeakForce-QI • Advanced AC modes such as FM and PM with Q-control & Active Gain Control • Microrheology in **CellMech Package** • Kelvin Probe Microscopy • MFM and EFM • Conductive AFM • STM • Electrical spectroscopy modes • Piezoresponse Microscopy for high voltages • **Electrochemistry & Scanning Electrochemistry** with temperature control and optical microscopy • NanoLithography and NanoManipulation • NanoIndentation • Scanning Thermal AFM • **FluidFM®** solution from Cytosurge® • ExperimentControl feature for remote experiment control • Additional XY and/or Z sample movement stages available with **CellHesion, TAO and HybridStage module**	

JPK BioAFM Business
Nano Surfaces and Metrology Division
Bruker Nano GmbH

Am Studio 2D · 12489 Berlin, Germany
tel.: +49 30 670990 7500 · fax: +49 30 670990 30
www.bruker.com/bioafm

www.bruker.com

BioAFM Products
www.bruker.com/bioafm

Contact us!