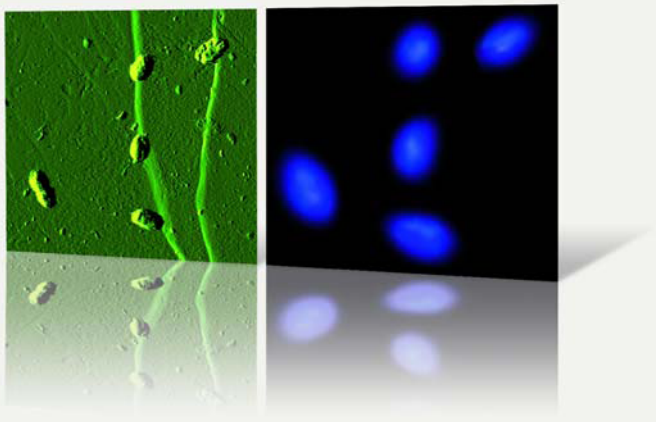
BioMAT™ Workstation. No Compromises. Perfect Results in Imaging Opaque Samples From the Micro to the Nano Scale.



JPK Instruments

Nanotechnology for Life Science

Precise Sample Position fo

Brings a New Degree of Ac

Bacterial growth on metallic surfaces, biochips, bionics or surface chemistry, fluorescent polymers and coatings – whether life or materials science: the more specialized the application, the greater the wish to combine the capabilities of optical microscopy and AFM (Atomic Force Microscopy), even with opaque samples. While AFM gives surface information and allows the investigation of mechanical or electrical properties as well as the manipulation of objects on the nano scale, optics deliver more bulk details and, by fluorescence, compositional contrast. The main problem limiting the effective combination of these techniques on non-transparent samples has been providing access for both techniques at the sample surface. To reach the full capabilities of optical microscopy, objective lenses are required with an extremely short working distance, leaving no space for AFM access to the same location. Previous attempts to combine simultaneous optical microscopy and AFM on opaque samples have required serious compromises to both techniques. Now JPK Instruments is offering a solution which integrates the specific advantages of upright optical microscopy and AFM. Without limiting the power of either technique. In a unique complete system: BioMAT™ Workstation, developed for uncompromising performance in optics and AFM in the investigation of opaque samples, even in liquids.

The new research instrument: perfect precision in optics and AFM

The key element of the BioMAT™ Workstation design is a portable shuttle stage that carries the actual sample. The shuttle stage employs high-end linear bearings and a precision mounting support to achieve the necessary positioning accuracy on both sides of the microscopy setup – the optical microscope stage and the BioMAT™ base where the AFM head is operated. The transfer of the shuttle stage from AFM to microscope or vice versa allows to precisely transport the sample between the field of view of the optics and the AFM scan range without losing position. This transfer can be repeated as often as necessary, allowing the sequential measurement of optics and AFM for time lapse studies. The setup is compatible with in-fluid operation by the use of dipping lenses and the NanoWizard® head, which is optimized for both air and liquid measurements.

On the cover:
(Left) Acidithiobacillus ferrooxidans on pyrite, scan area 10 x 10 µm².
(Right) Corresponding DAPI fluorescence image, water immersion objective 100x.

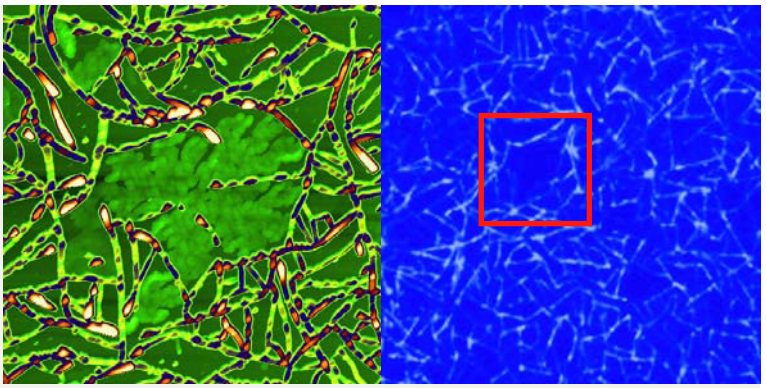
Images courtesy of S. Mangold, group of W. Sand, University of Duisburg, Germany.

or AFM and Optics: BioMAT™

ccuracy into Your Lab.

Biology and engineering: a whole new world of applications

With the BioMAT™ Workstation JPK is offering a solution for the countless applications where samples on non-transparent substrates are investigated, such as metals, plastics, ceramics, or semiconductors. Thus high-performance AFM becomes available for applications like bacterial growth studies on metallic surfaces, biochips, cell-electronics interfaces, plant biology, bionics research, supported lipid bilayers, or studies on tissue sections. Even outside biological applications, the combination with optics provides added value for studies in surface chemistry, fluorescent polymers and coatings, or micro-mechanical systems. The combination with Raman or IR microscopy with AFM is an additional option.

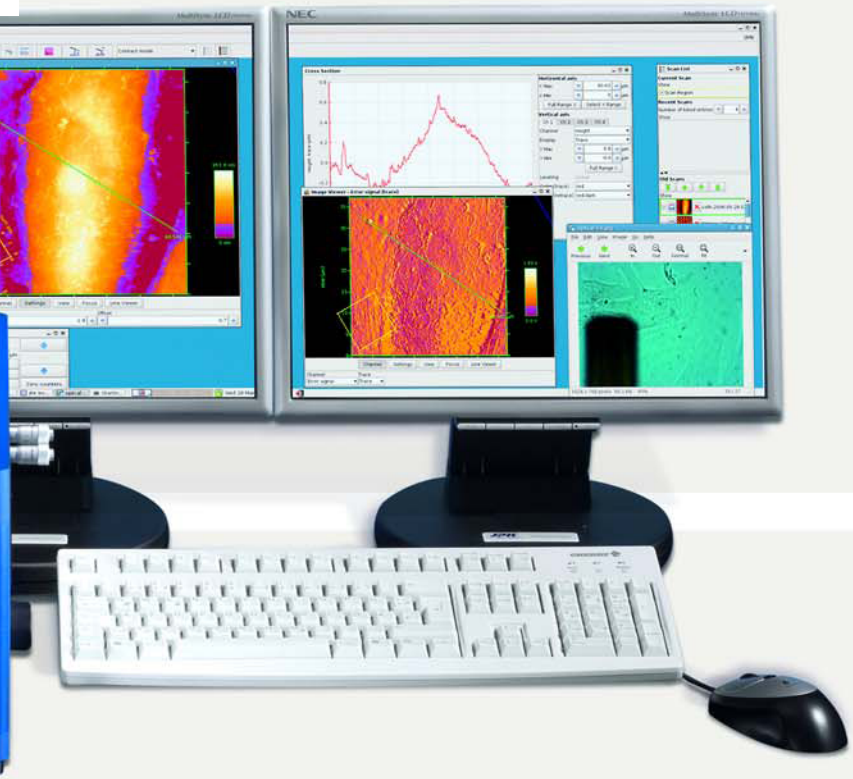


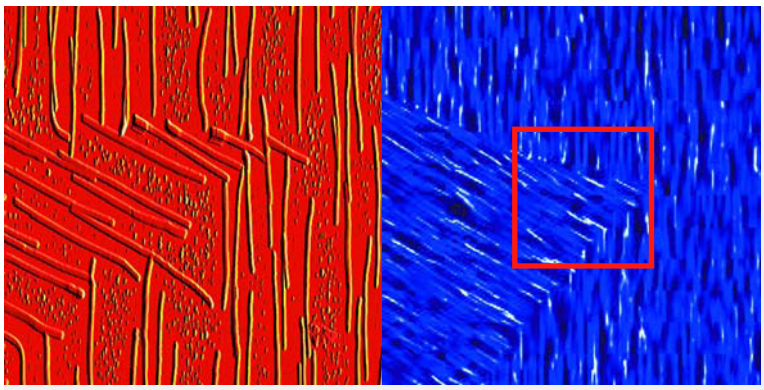
(Left) p-hexaphenyl nanofibres on Au-coated mica, scan area 14.4 x 14.4 µm². (Right) corresponding fluorescence image, Ex/Em 395/420 nm, water immersion objective 63x.

Sample courtesy of F. Balzer, University of Oldenburg, Germany and H.-G. Rubahn, University of Southern Denmark, Sonderborg.

BioMAT™ Workstation: the advantages of a perfectly designed system

- Completely integrated system comprising optical microscope and AFM
- Developed for the investigation of opaque samples in life and materials sciences
- 100% performance of both techniques, without any limitations
- Outstanding reproducibility of the focussed position (ROI) with both systems
- Unique capability to investigate the ROI precisely with optics and AFM
- Wide range of applications
- Also perfect during operation in liquids
- Flexible concept with shuttle stage
- Both techniques can be operated even in different laboratory rooms.
- Superior engineering from JPK Instruments





(Left) P-hexaphenyl nanofibers on mica, scan area 19.5 x 19.5 µm². (Right) Corresponding fluorescence image, Ex/Em 395/420 nm, objective 63x.

Sample courtesy of F. Balzer, University of Oldenburg, Germany and H.-G. Rubahn, University of Southern Denmark, Sonderborg.

Shuttle stage

- 10 mm manual travel range in XY
- < 5µm (typically 3µm) Repeatability of AFM and optical microscope repositioning
- Fully liquid proof design
- Precision sample clamp for a large variety of samples

Non-transparent samples: application fields for BioAFM and optics

- Biochips such as DNA or protein chips
- Cell chips or patterned substrates for cell adhesion
- Nanostructured surfaces from PDMS or other imprints
- Lipid bilayers
- Bacterial or yeast studies on non-transparent substrates like metals or plastics
- Biofouling research
- Pharmaceutical studies
- Tissue engineering and implants
- Bionics studies such as mechanical properties
- Plant biology
- Nanoparticles, powders, foams, paintings or thin films
- Organic coatings on metals, plastics or silicone substrates for biocompatible surfaces
- Fluorescent molecules and dyes
- Biomarkers such as quantum dots, rods, CNT etc.

BioMAT™ base

- Solid mechanical base for highest resolution AFM operation
- Integrated optical system for position calibration with focusing and illumination
- Precision positioning for the AFM alignment

Optical microscope

- All research grade upright microscopes can be used (e.g. Zeiss AxioImager series, Olympus BX51/BX61, Nikon Eclipse 80i/90i, Leica DM 4000/5000)
- No restrictions on imaging modes (brightfield, DIC, fluorescence techniques ...)
- Full compatibility with confocal laser scanning microscopes (CLSM)
- Use of water dipping objectives before or after AFM measurements
- Optical microscope location not fixed to the AFM

BioMAT™ Workstation: configuration and technical specification

Key components

- NanoWizard® AFM system consisting of AFM head, controller and software
- BioMAT™ base with built-in optics
- Upright optical microscope with modified sample stage
- JPK shuttle stage with clamp fixation and XY coarse adjustment

AFM specifications

- JPK NanoWizard® BioAFM system
- 100 x 100 x 15µm³ scan range (xyz)
- Highest AFM resolution (atomic lattice, single molecules)
- Capacitive position sensors for convenient picture-in-picture zooming and metrology applications
- Easy and safe operation in fluids

Options and accessories

- Top-view optical system for the AFM
- Antivibration and acoustic isolation systems

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