Measurement technic Moravia

Sales and service of laboratory instruments

X-ray diffraction, elemental analysis

Surface analysis

Measurement of light and radiance

Systems for deposition and etchning

Spectral methods

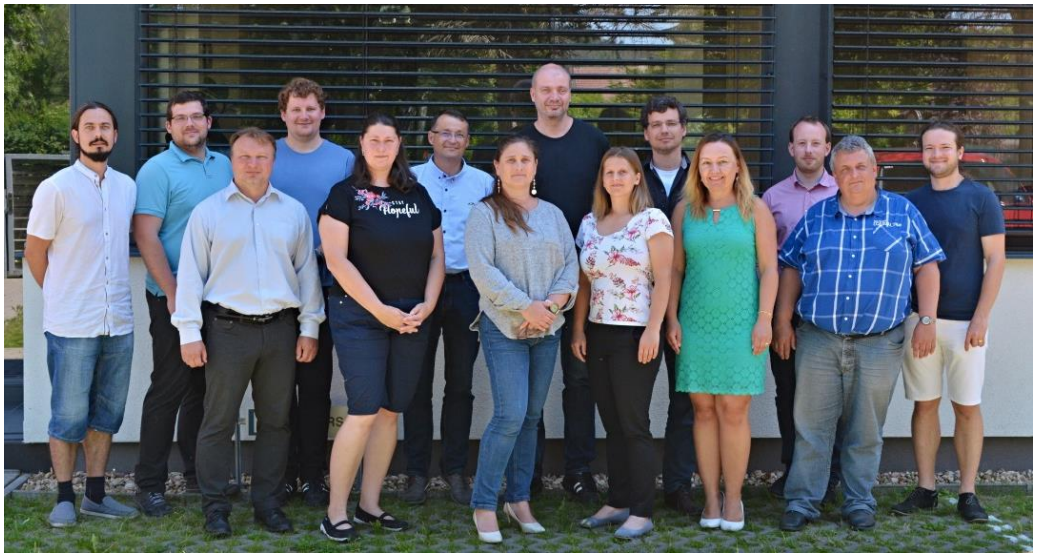
Others

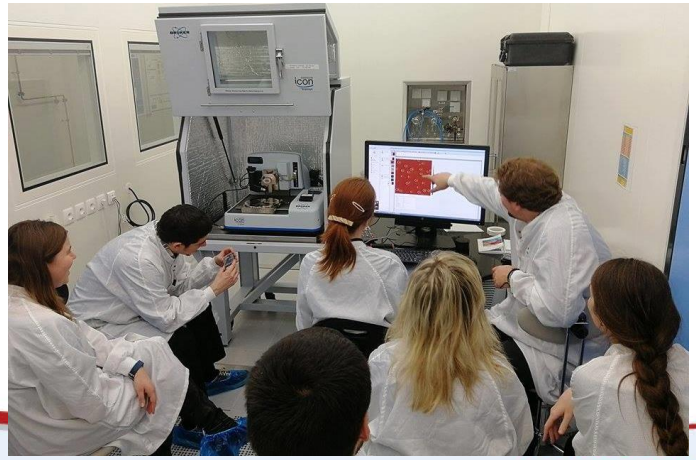
Presenter

Ing. Jakub Horák, Ph.D.

- Doctoral studies in physical chemistry (FCH BUT)
- Sales manager for a wide portfolio of methods and applications
- Experience in research and application for materials from life science to space research.

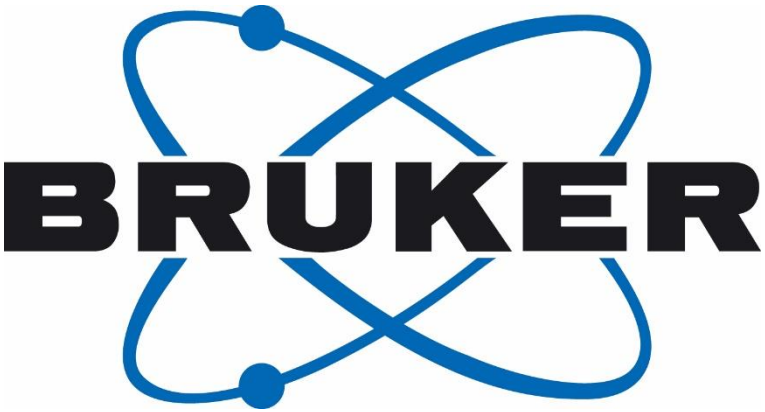
Měřicí technika Morava





Our partners


MTI Corporation



Měřicí technika Morava s.r.o.

- Layers, coatings, thickness (in-situ, ex-situ)
  - XPS, PVD, CVD, PE/PACVD, ALD, MBE, Elipsometry…
- Surface/material analysis
  - (bio)AFM, nanoindentation, tribology, optical and mechanical profilometry, tabletop SEM, 3D XRM/mCT/nCT
- Elemental analysis
  - XRF, XRD, mXRF, tXRF, (GI-)SAXS, EM detectors
- NMR and EPR
- Thermal and mechanical analysis
  - TGA, TMA, DSC, ITC, rheology, DMA, …
- Spectroscopy
  - UV/VIN/NIR
- Others
  - GloveBoxes, GMS/SPS, grind/melt/press, XRF accessories,…

New

- Kalendáře a knihy
- Reklamní předměty
- ADRA příspěvky

DOMŮ PRODUKTY O NÁS PODPORA AKTUÁLNĚ UDÁLOSTI E-SHOP KONTAKT

BRUKER

Dimension IconIR™

Mapování mechanických a chemických vlastností materiálů s rozlišením <10nm

ZJISTIT VÍCE

Analýza a zobrazování povrchů

- Mikroskopie skenující sondou – AFM, bioAFM, UHV AFM
  - Materiálové AFM
  - Bio AFM
- Povrchová analýza – XPS, SIMS, etc.
- Stolní elektronové mikroskopy – SEM
- 3D optické a mechanické profilometry
- Detektory pro elektronovou mikroskopii – EDS, WDS, EBSD, etc.

Příprava a charakterizace tenkých vrstev

- CVD – Chemická depozice z plynné fáze, ALD
- Elipsometry a reflektometry
- PVD – napařovací a naprašovací depoziční systémy – PLD, MBE
- Plazmochemická depozice a leptání – PECVD, RIE, PEALD

Rentgenové analytické techniky

- Rentgenové fluorescenční spektrometry
- Rentgenové monokrystalové difraktometry
- Rentgenová fluorescence μ-XRF a TXRF
- Rentgenové práškové difraktometry
- 3D rentgenová mikroskopie (XRM)

Magnetická rezonance

- Nukleární magnetická rezonance
- Elektronová paramagnetická rezonance

Fluorescenční a superrezoluční mikroskopy

- Multifotonové mikroskopy
- Light Sheet mikroskopy
- Superrezoluční mikroskopy
- Konfokální mikroskopy

Měření záření a světla

- Měření optických členů
- Jasové kamery
- Goniofotometry, systémy pro měření svítidel
- Spektroradiometry pro měření světla

Laboratorní příslušenství

- Spotřební materiál pro XRF
- Mlýnky, drtičky a síta
- Tavičky
- Lisy

Termická analýza

- Diferenční skenovací kalorimetry
- Termogravimetrické analyzátory
- Dynamické mechanické analyzátory
- Mikrokalorimetry
- Měřiče tepelné vodivosti

Mechanické testování

- Indentory a tribometry
- Dilatometry
- Reometry a viskozimetry
- ElectroForce – mechanické testery
- Testování gumy
- Flash Diffusivita

ADRA příspěvky

Měřicí technika
Babická 619
664 84 Zastávka

513 034 408
nt-m.eu

202

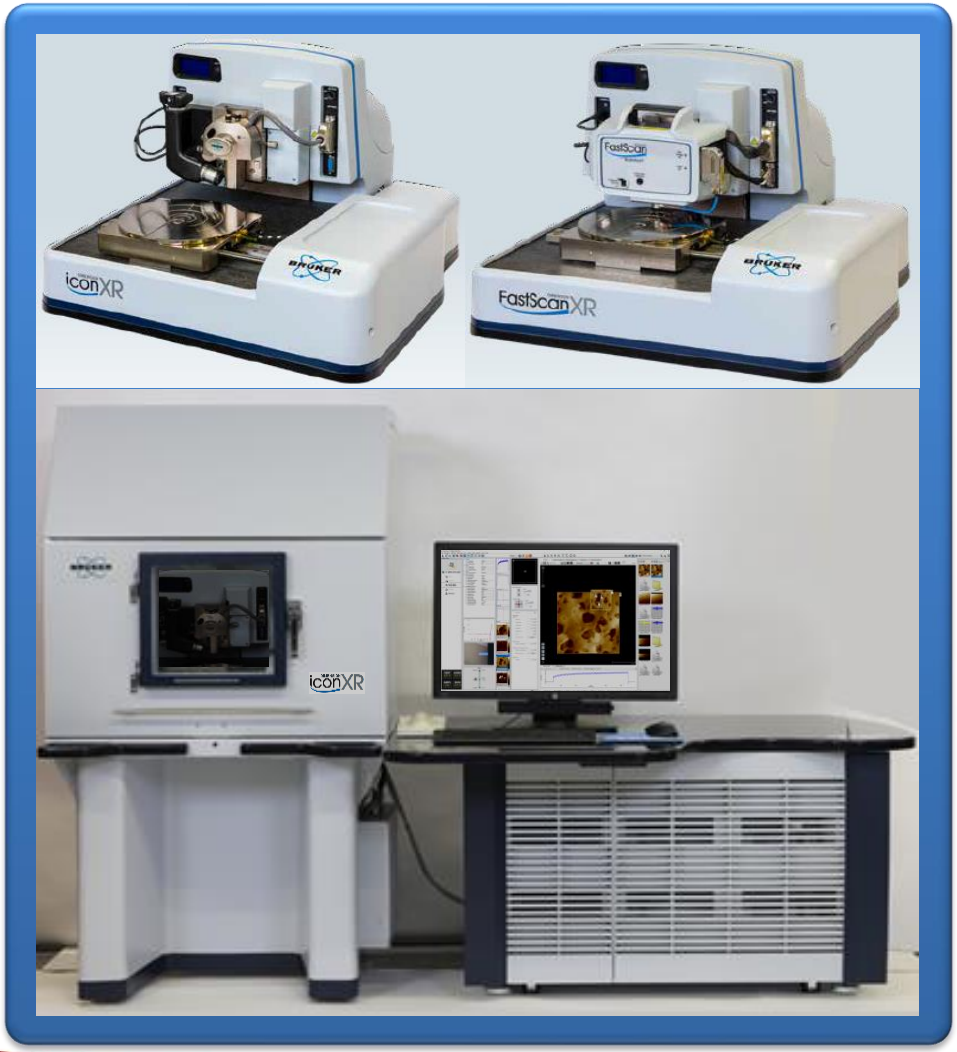
msabol.cz

měřicí technika morava

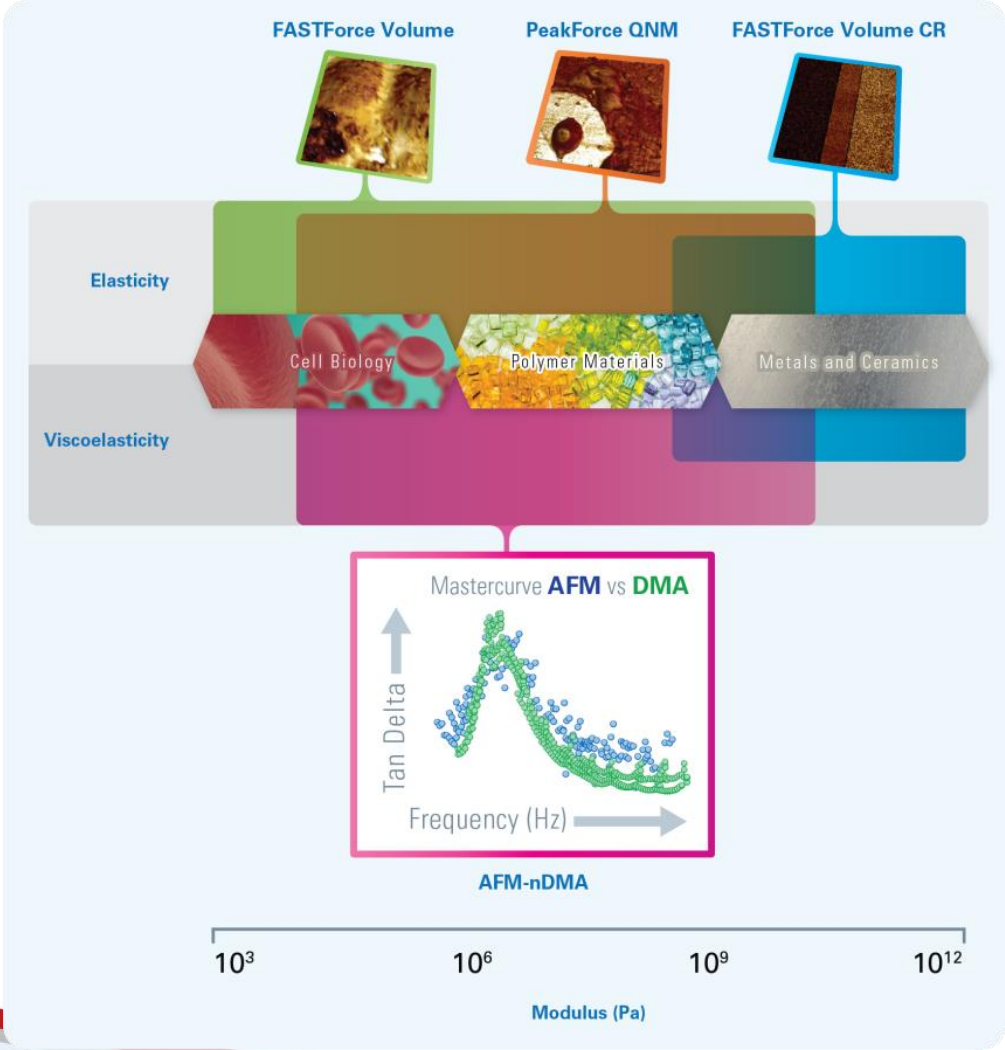
www.mt-m.eu

AFM

– Dimension XR
– nanoIR/AFM-IR



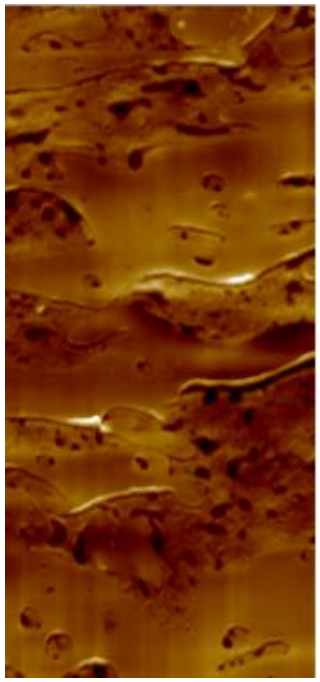
nDMA


FASTForce Volume
PeakForce QNM
FASTForce Volume CR
Elasticity
Viscoelasticity
Cell Biology
Polymer Materials
Metals and Ceramics
Mastercurve AFM vs DMA
Tan Delta
Frequency (Hz)
AFM-nDMA
10³
10⁶
10⁹
10¹²
Modulus (Pa)

AFM-IR

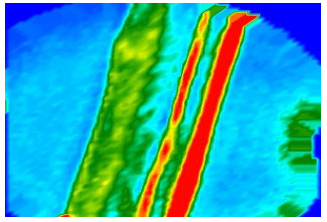
AFM community

IR spectroscopy community



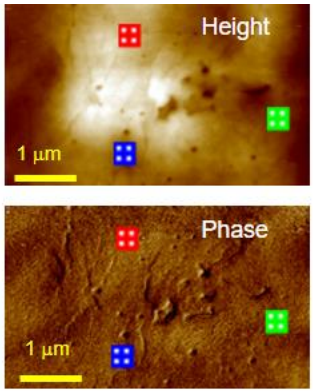
What the heck is that?

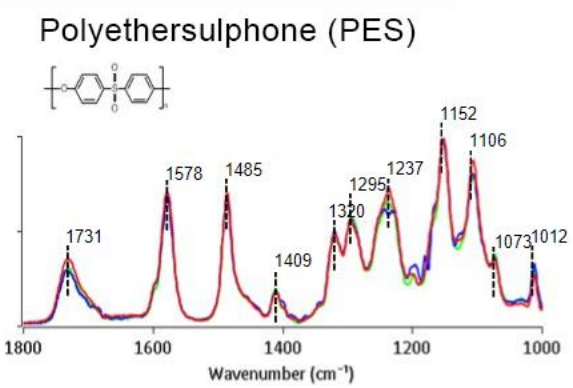
It's too small!



Combine the best of both worlds!

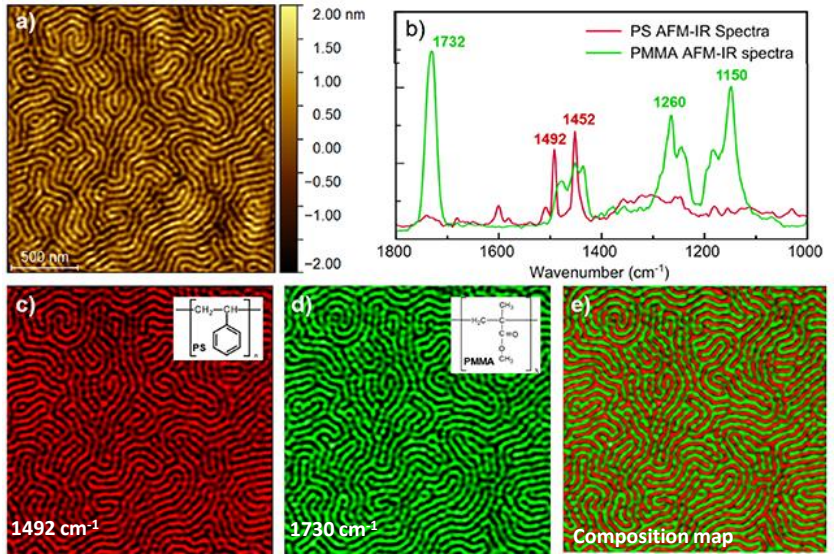
- Nanoscale IR chemical analysis with sub-10 nm spatial resolution
- Rich, interpretable spectra directly correlates to FT-IR
- Chemical composition & nanoscale property mapping
- Monolayer sensitivity!
- Excels for polymers, life sciences, organic materials





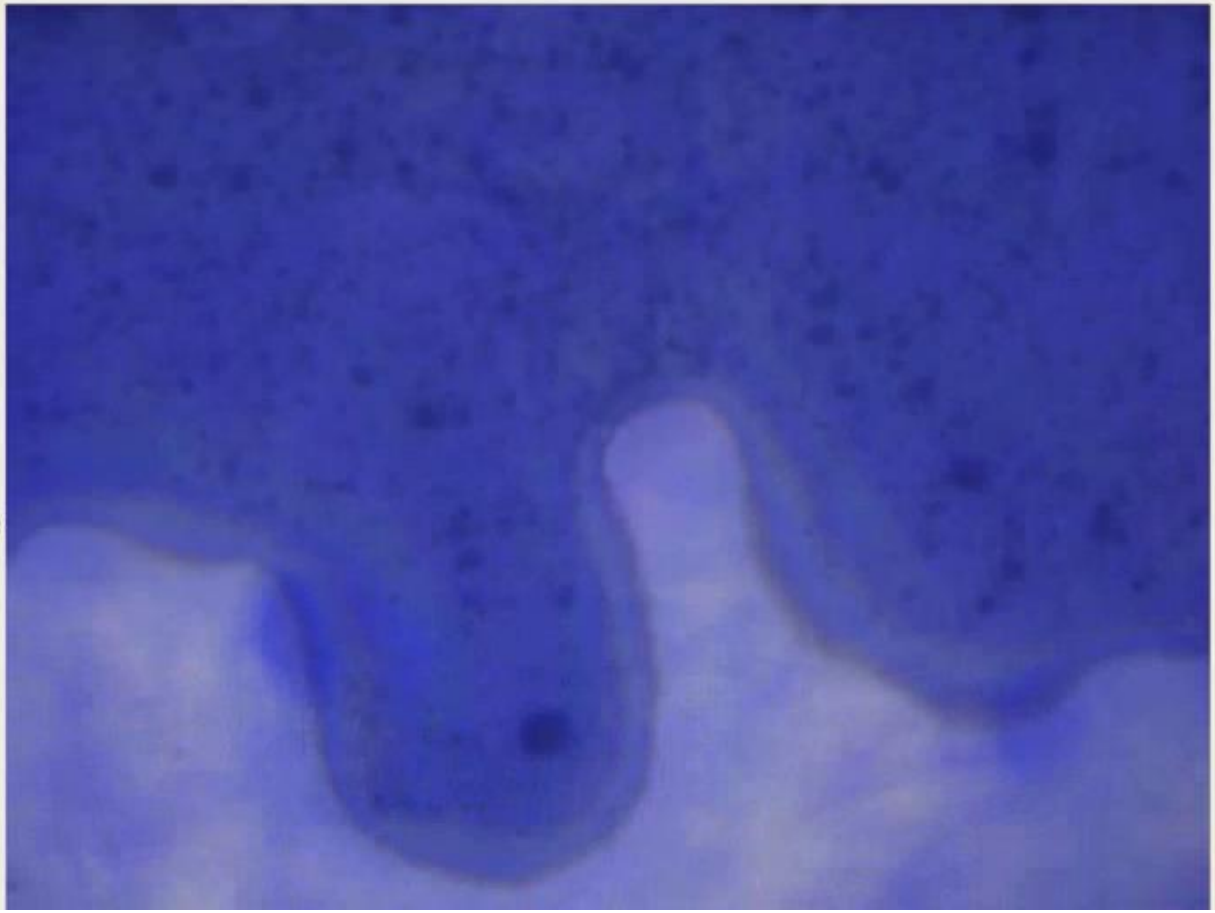
PS-co-PMMA Copolymer

2µm x 2µm

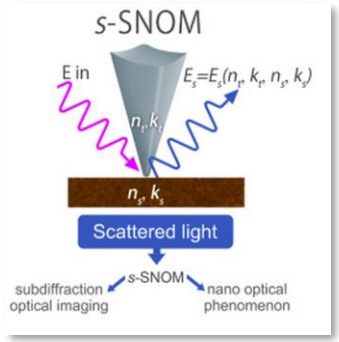


AFM-IR

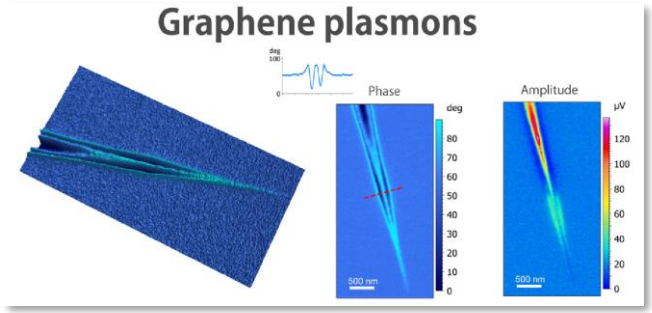
Optical microscope view



Two complementary Nanoscale IR techniques



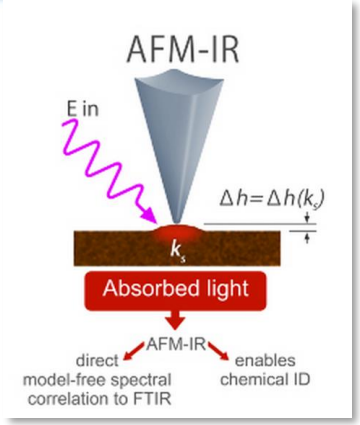
Analogous to IR ellipsometry



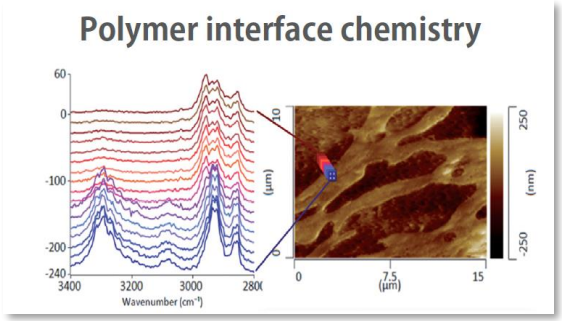
Sub-20 nm optical microscopy

Mapping of complex optical properties

Excels for inorganics, 2D materials, photonics



Analogous to FTIR



<10 nm spatial resolution

Direct IR absorption spectroscopy & chemical imaging

Highly interpretable spectra

Excels for polymers, life sciences

Current AFM-IR product family

Cover future needs with the most expandable AFM on the planet
Choose IR-Ready Icon and add full nanoIR capability at any time

Dimension IconIR

Next Generation nanoIR System

Highest Performance, Large sample AFM-IR & AFM

- Unrivalled AFM-IR performance
- PeakForce based correlative mapping
- Broadest range of AFM accessories

nanoIR3

New Capabilities

Analytical FT-IR at the nanoscale

- Analytical level nanoIR spectroscopy
- <10 nm chemical imaging resolution
- Bruker patented AFM-IR modes
- Environmental accessories & nano-Property mapping modes

800 – 3600 cm^{-1}
Multiple lasers

nanoIR3-s Broadband

S-SNOM Product Leadership

Highest Performance s-SNOM Spectroscopy & Imaging

- Highest Performance nanoFTIR broadband spectroscopy with two complementary nanoscale IR modes – s-SNOM & AFM-IR
- Most complete spectroscopy & imaging nanoIR spectroscopy system
- Visible and near IR capabilities

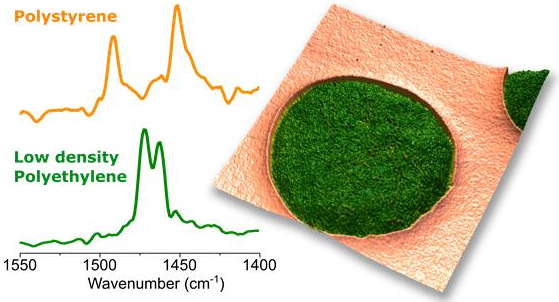
670 – 4000 cm^{-1}

New Dimension IconIR

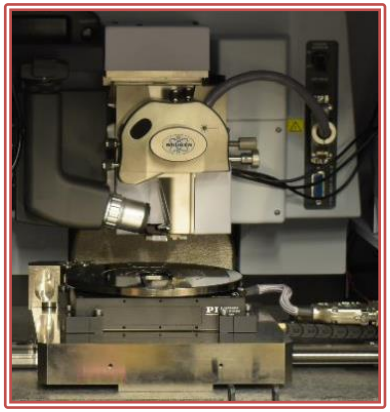
Cover future needs with the most expandable AFM on the planet
Choose IR-Ready Icon and add full nanoIR capability at any time

The IconIR system provides

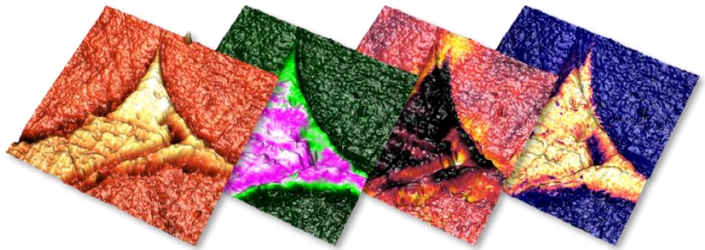
- Highest performance IR spectra with FTIR correlation
- Chemical imaging with <10nm resolution
- AFM-IR monolayer sensitivity
- Plus all the good stuff of Dimension Icon



High performance, sensitive, AFM-IR spectroscopy with correlation to FTIR

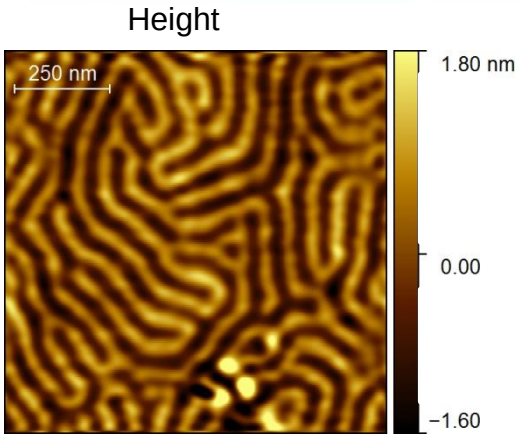


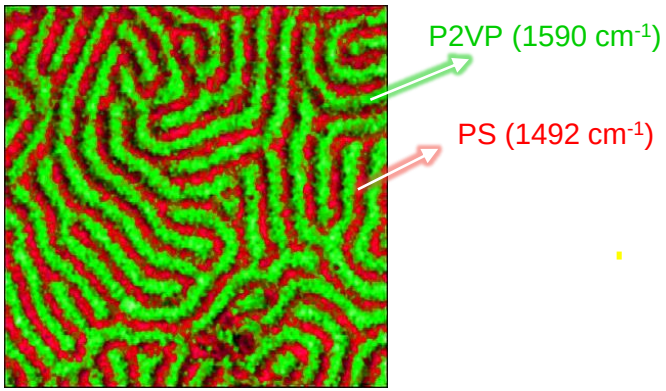
<10 nm chemical imaging spatial resolution & monolayer sensitivity



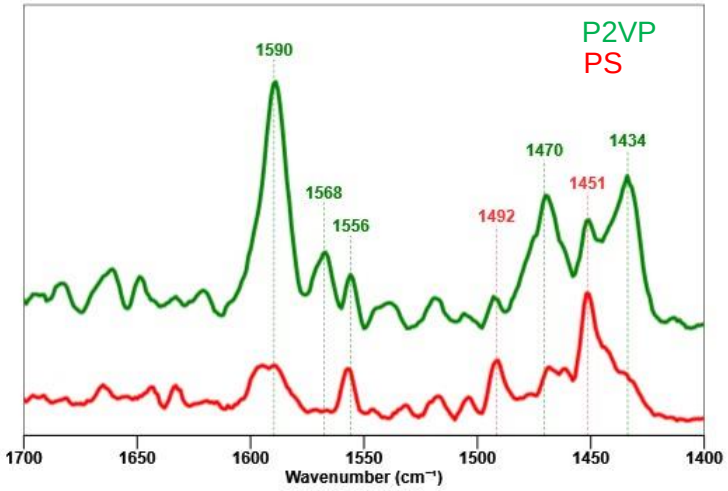
nanoscale property mapping and correlative microscopy

PS-P2VP block copolymer

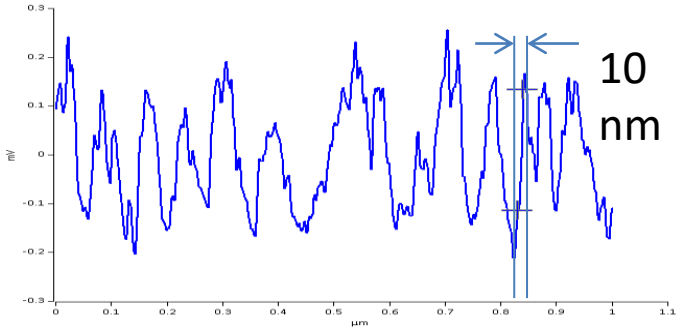




(Image Size: 1 µm x 1 µm)

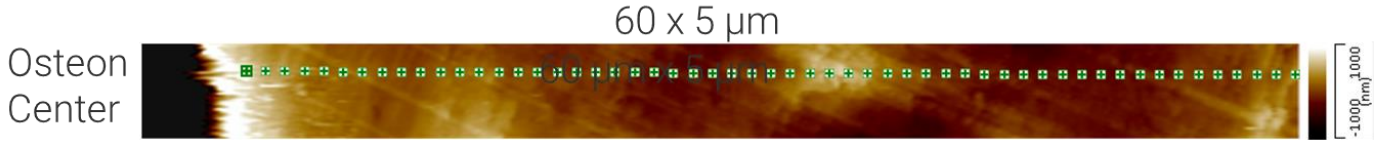


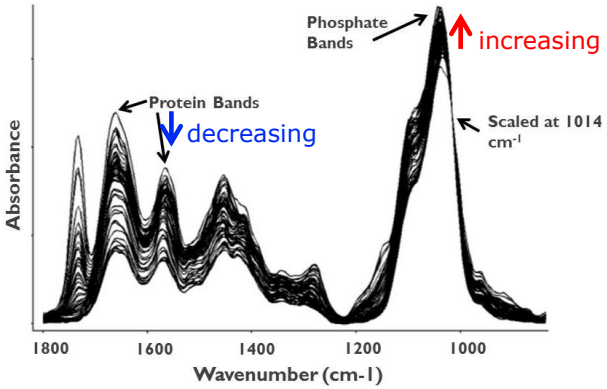
Intensity profile

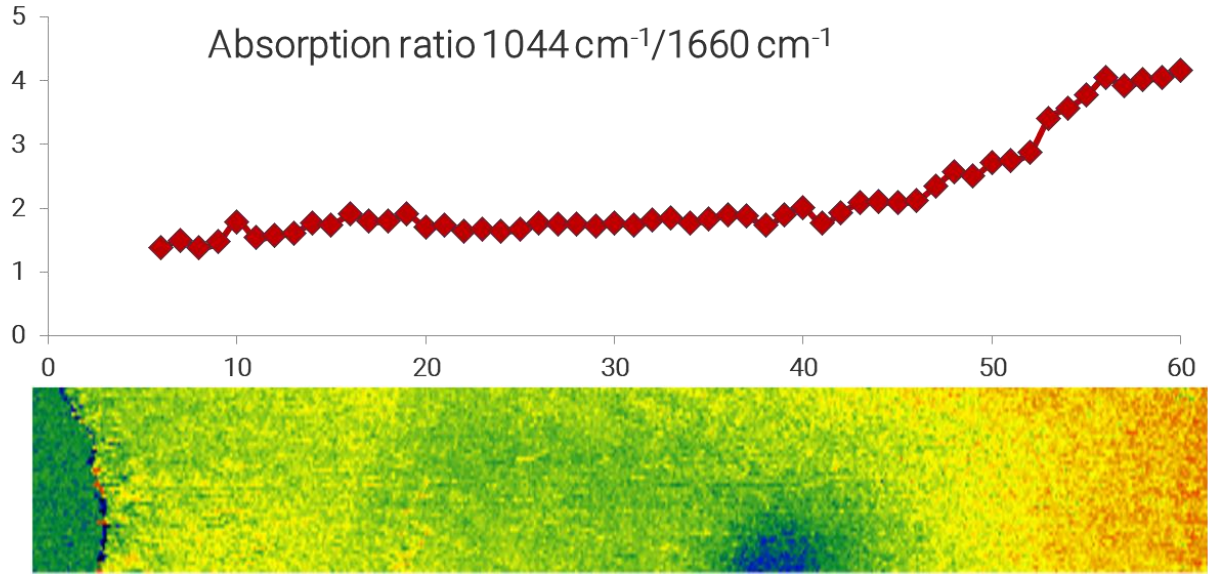


Chemical characterization of PS-P_2VP block co-polymer sample by Tapping AFM-IR. (a) Tapping AFM height image; (b) Tapping AFM-IR spectra clearly identifying each chemical component; (c) Tapping AFM-IR overlay image highlighting both components (PS@ 1492 and P_2VP@ 1588); (d) Profile cross section highlighting the achievable spatial resolution, 10 nm. Sample courtesy of Dr. Gilles Pecastaings and Antoine Segolene at University of Bordeaux.

Characterization of bone growth





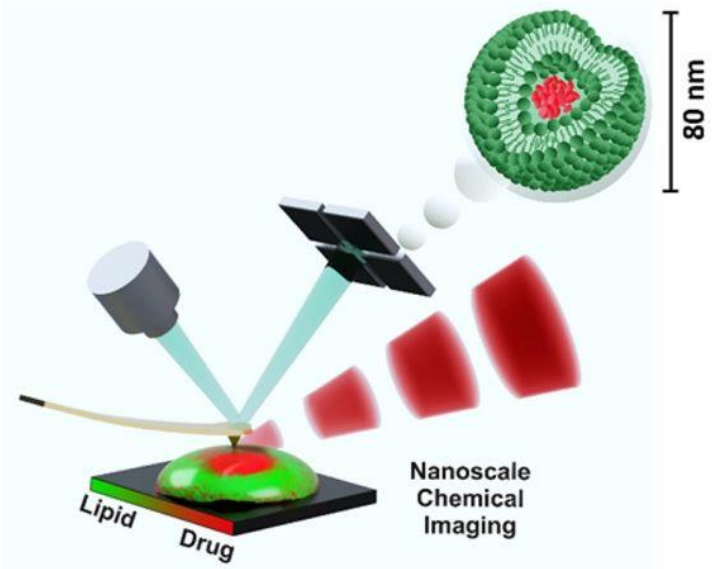


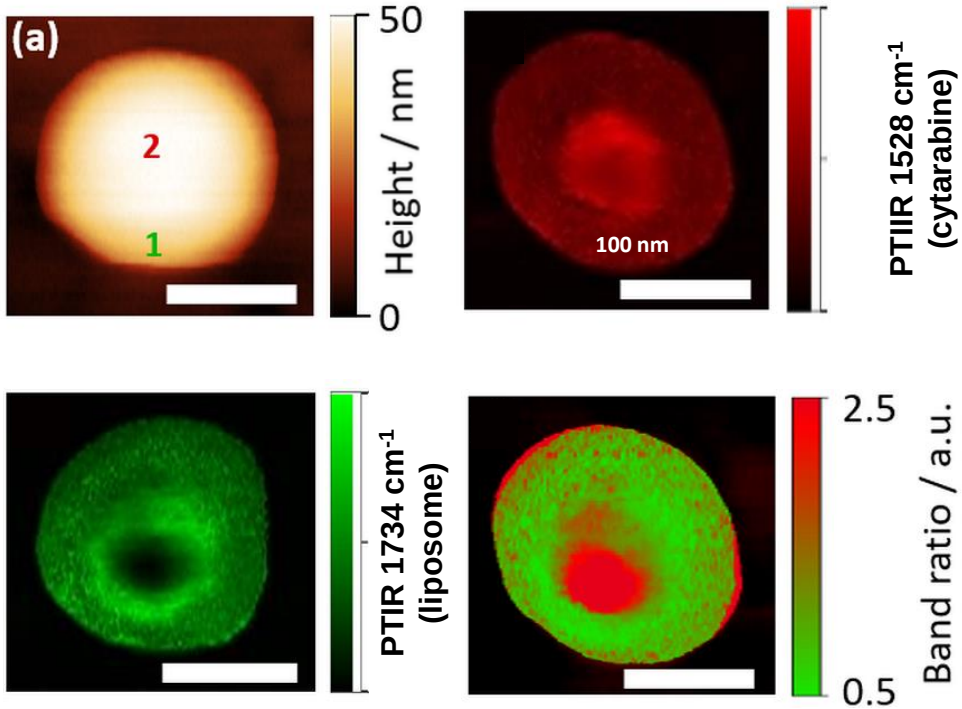
Calcified Tissue International
And Musculoskeletal Research

Gourion-Arsiquaud S et al., **2014,** 95, 413

Drug-loaded liposomes

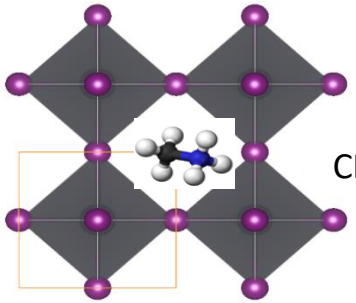
Nanoscale chemical imaging of individual chemotherapeutic cytarabine-loaded liposomal nanocarriers using Tapping AFM-IR

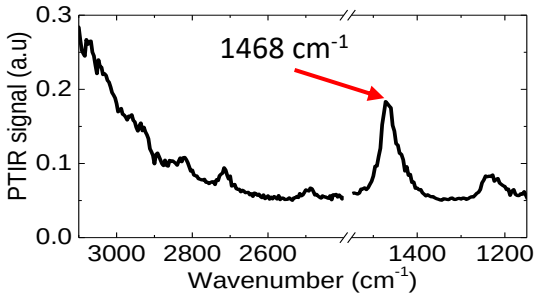


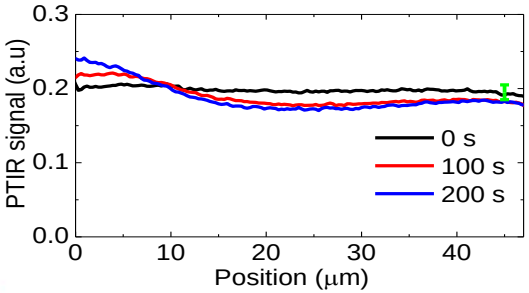


From: Wieland et al, Nano Research (2019), 9, pp.197-203

Perovskite Solar Cell: Evidence of $(CH_3NH_3)^+$ Electro-Migration

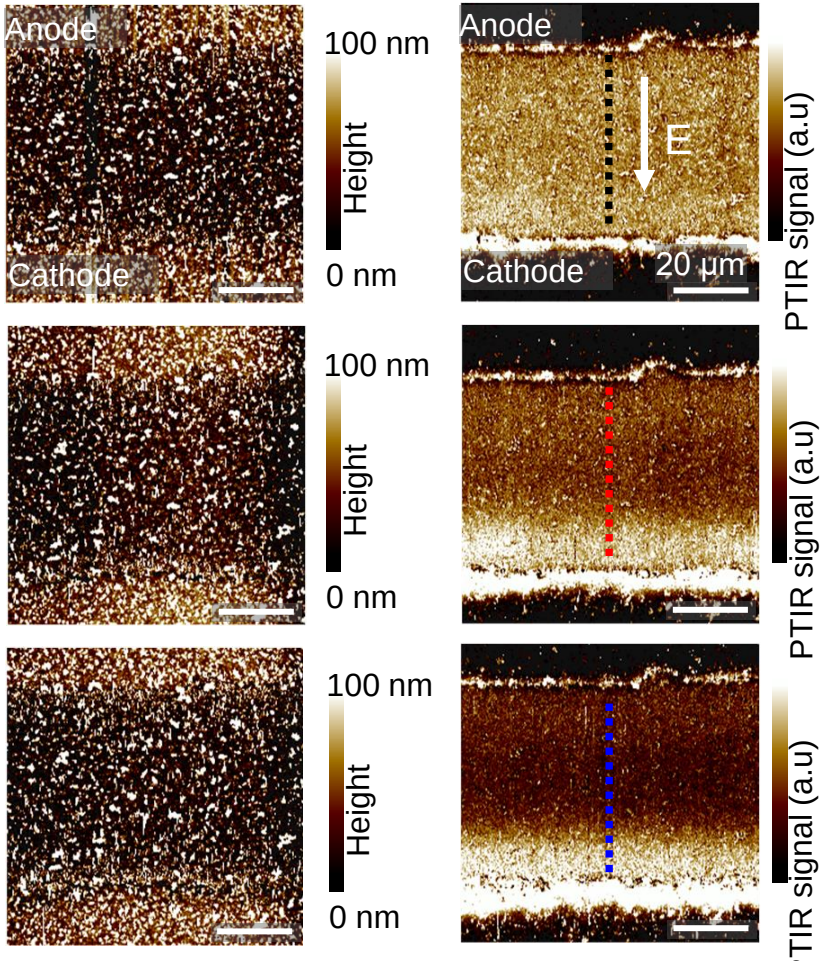






Topography

PTIR 1468 cm^{-1} (CH_3 asym. def.)



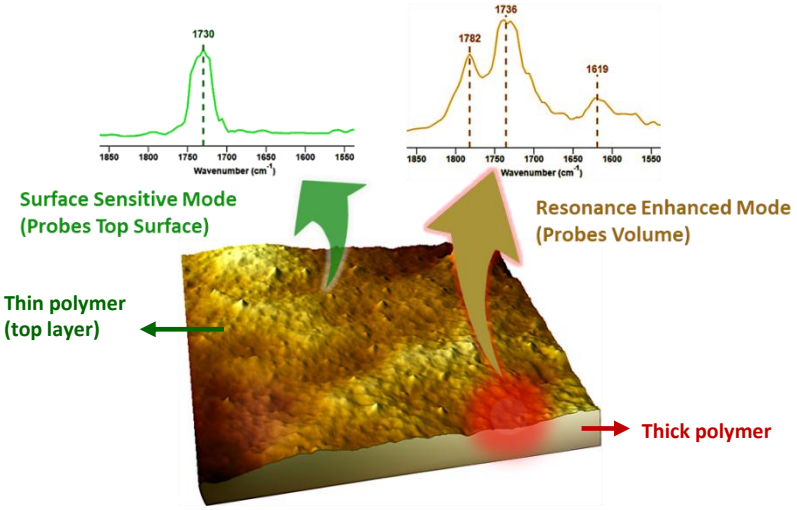
ΔV = 0 V

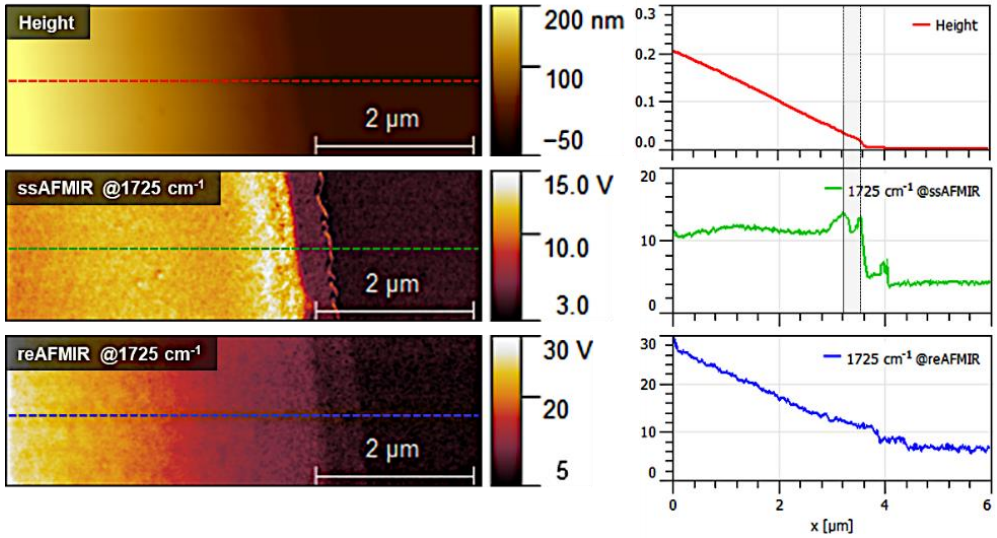
after
ΔV = 80 V, 100 s

after
ΔV = 80 V, 200 s

Yuan Y at al., **2015**, 5, 1500615

Surface Sensitive AFM-IR





Surface vs Volume Probing Technique

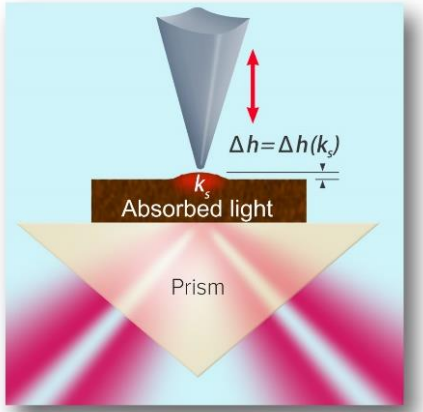
Surface Sensitive AFM-IR versus Resonance Enhanced mode of a Thin (<50 nm) polymer film on a thick (>20 um) polyimide surface

Quantitative Estimation of Surface Sensitivity

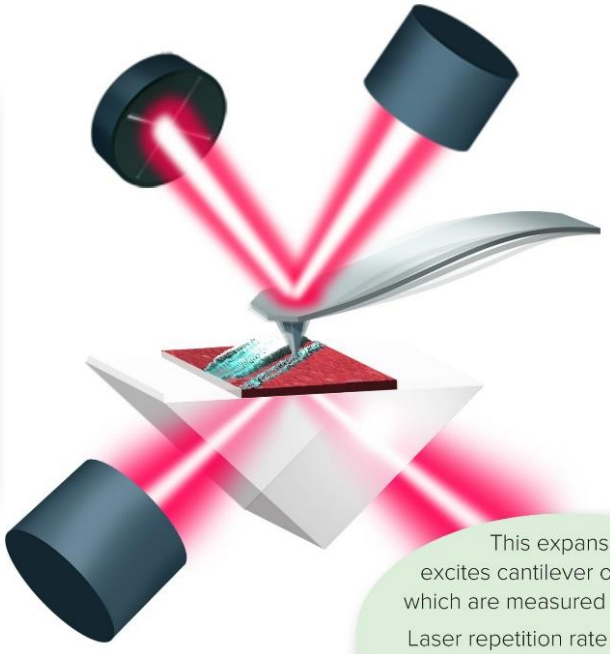
Surface Sensitive AFM-IR (green) is contrasted against Resonance Enhanced mode (blue).

nanoIR3 Fluid – AFM-IR in Liquid

Fluid AFM-IR mode

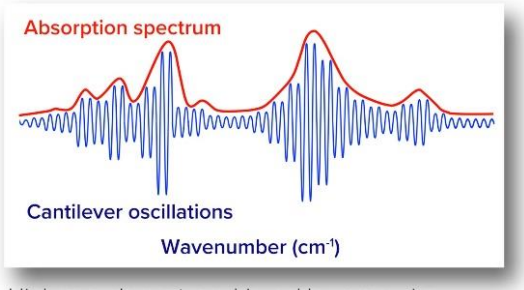


- The sample is placed on an IR transparent prism (e.g., ZnSe)
- A pulsed, tunable IR laser is irradiates the sample with a total internal reflection scheme.
- When IR wavelength matches the sample absorbance band, rapid thermal expansion occurs



This expansion excites cantilever oscillations which are measured by the AFM

Laser repetition rate is matched to a resonance of the cantilever, achieving maximum sensitivity



High speed spectra achieved by measuring cantilever oscillation amplitude as a function of IR wavelength creating a unique chemical fingerprint.

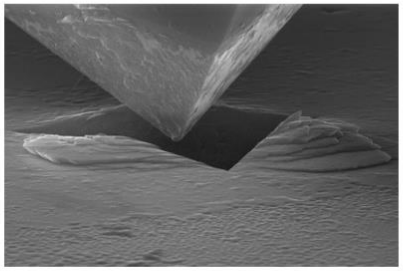
IR absorption map of FF Fibrils in H2O
DOI:10.1021/acsnano.8b01425

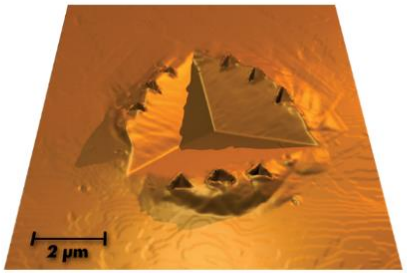
High resolution imaging is achieved with fixing the wavelength and scanning the sample in X-Y direction.

Nanoindentation

Nanoindentation

NanoIndentation

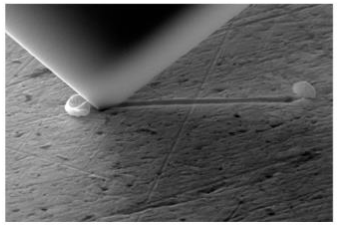




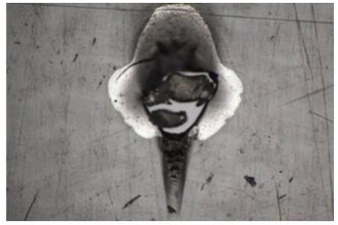
Hardess, Modulus, Creep, Stress Relaxation, Fracture Toughness
Dynamic: E', E'', tan-δ

NanoTribology

Scratch/Mar Resistance & Friction



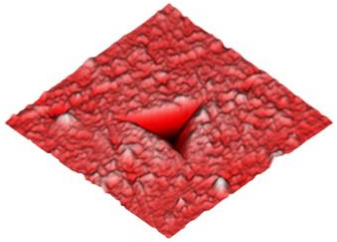
Thin Film Adhesion



Wear

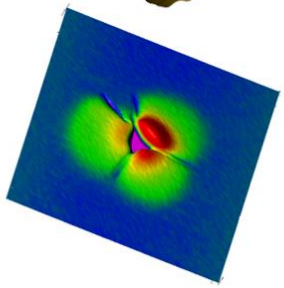
In-Situ SPM Imaging

Surface Roughness

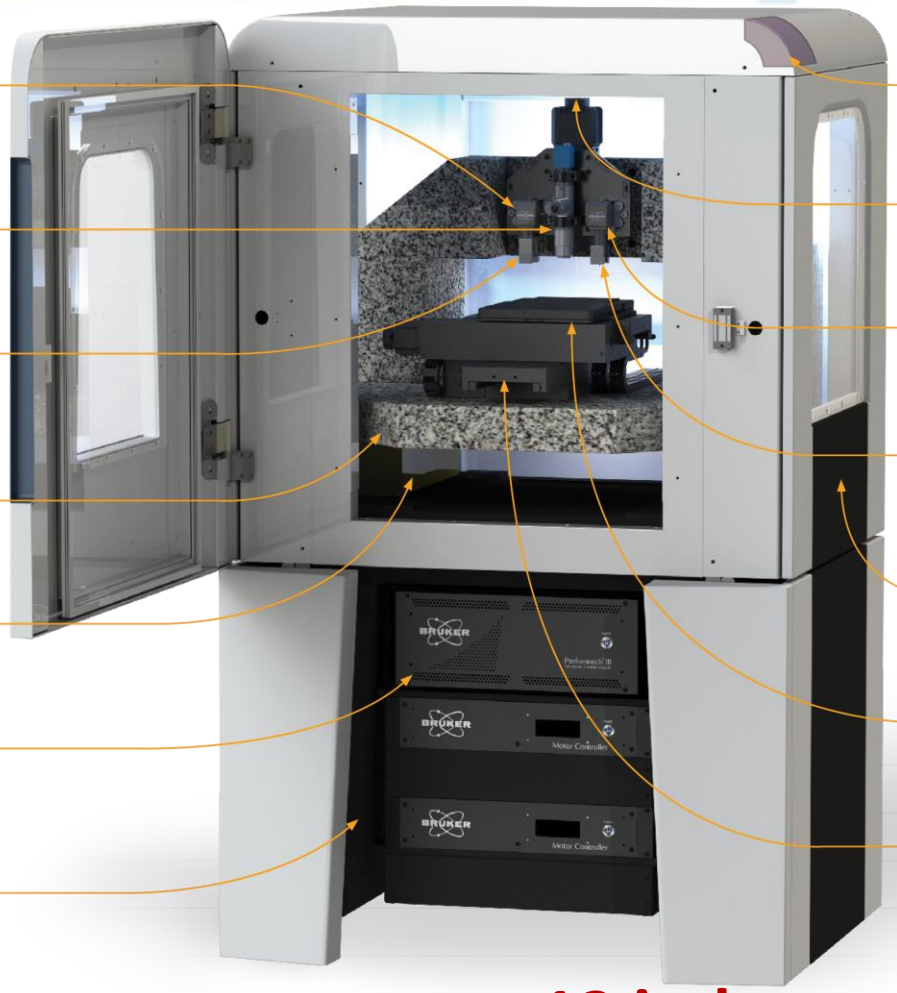


High Accuracy Test Positioning

Material Deformation Behavior



Hysitron TI 990 TriboIndenter



In-Situ SPM Imaging

Dual piezo scanners deliver high-resolution sample surface topography imaging and nanometer-precision test placement accuracy.

Sample Imaging

High-resolution, color optics enable easy sample navigation and coarse test positioning.

2D Capacitive Transducer

Exclusive low-noise 2D capacitive transducer technology enables quasistatic nanoindentation, nanoscratch, and nanowear characterization.

Test Stability

Metrology-grade granite framing assures superior instrument rigidity and test stability.

Vibration Isolation

Integrated active anti-vibration system isolates the instrument from the environment.

Performech III

High-speed feedback, low noise, and fast data acquisition rates provide industry-leading control over the testing process.

Noise Immunity

Vibration-dampening base delivers high-quality data in a broad range of environments.

Environmental Isolation

Multi-layered enclosure protects against thermal, acoustic, and air disturbances.

Chuck Imaging

Top-view sample chuck optics streamline sample navigation and system setup.

Property Mapping

XPM II ultrahigh-speed nanoindentation delivers high-resolution, quantitative mechanical property maps.

Dynamic Nanoindentation

nanoDMA IV enables viscoelastic characterization and a continuous measurement of properties as a function of depth, frequency, and time.

System Modularity

Customizable enclosure panels streamline system upgradability and technique integration.

Versatile Sample Chuck

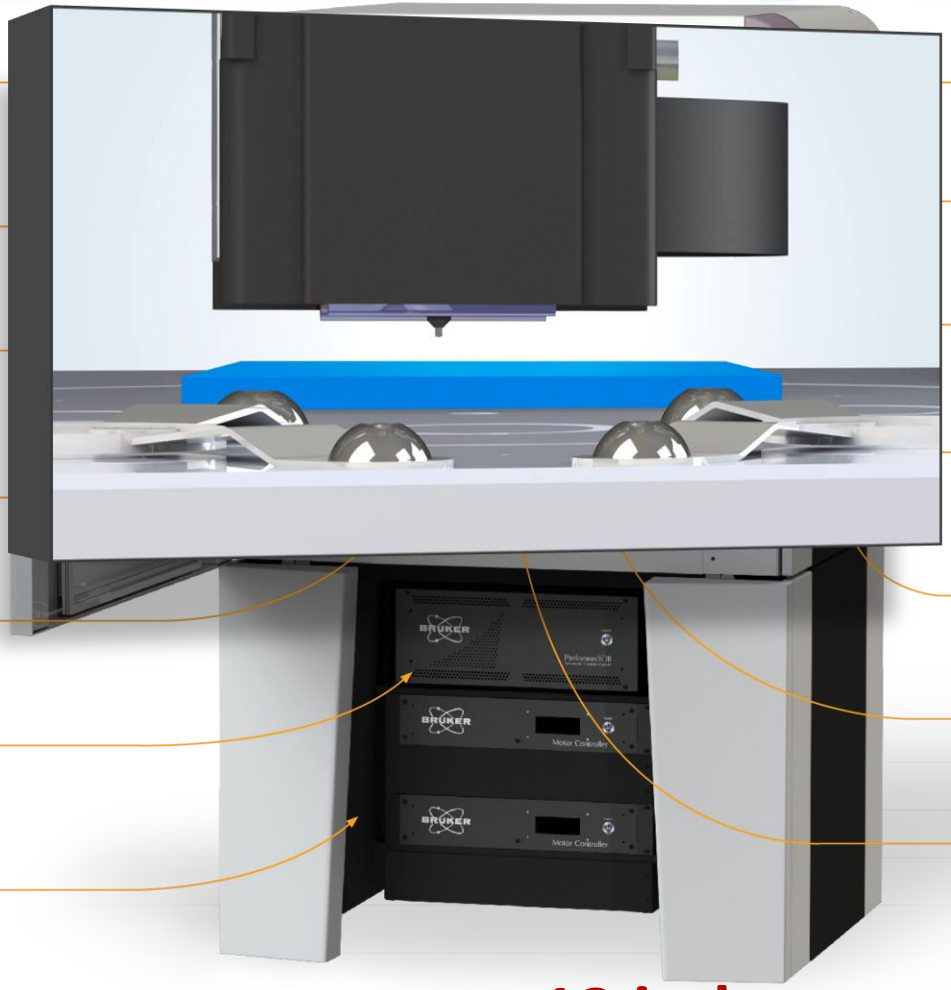
Rapid and reliable sample mounting options: magnetic, mechanical, and vacuum.

High-Precision Staging

Encoded motorized staging provides a large accessible test region and automated multi-sample testing.

12 indents per second!

Hysitron TI 990 TriboIndenter



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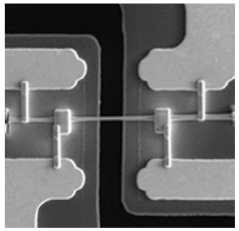
12 indents per second!

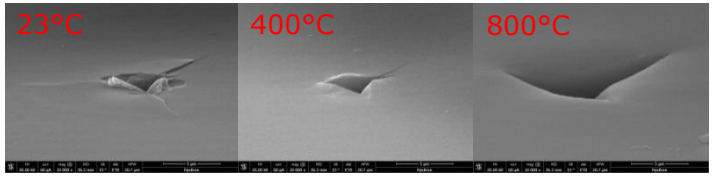
Additional in-situ testing techniques

- Mechanical + Electrical Biasing

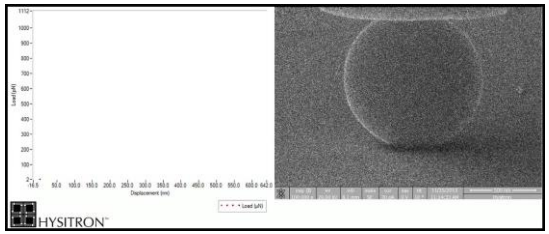


Electrical
Push-to-Pull (E-PTP)

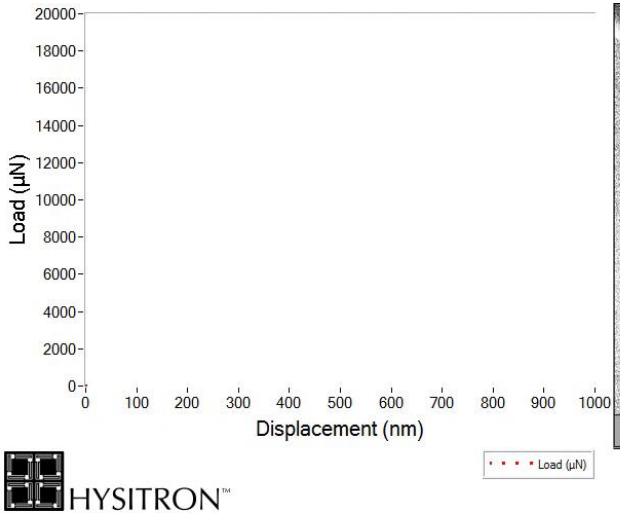
- Mechanical + Heating
  - Tip & Sample Heating up to 800°C
  - Environmental control

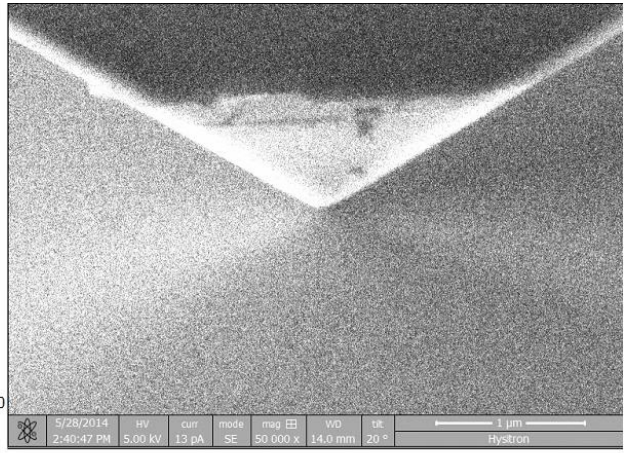


- Dynamic Loading
  - Fatigue Cycling or Continuous Stiffness Measurement During Testing

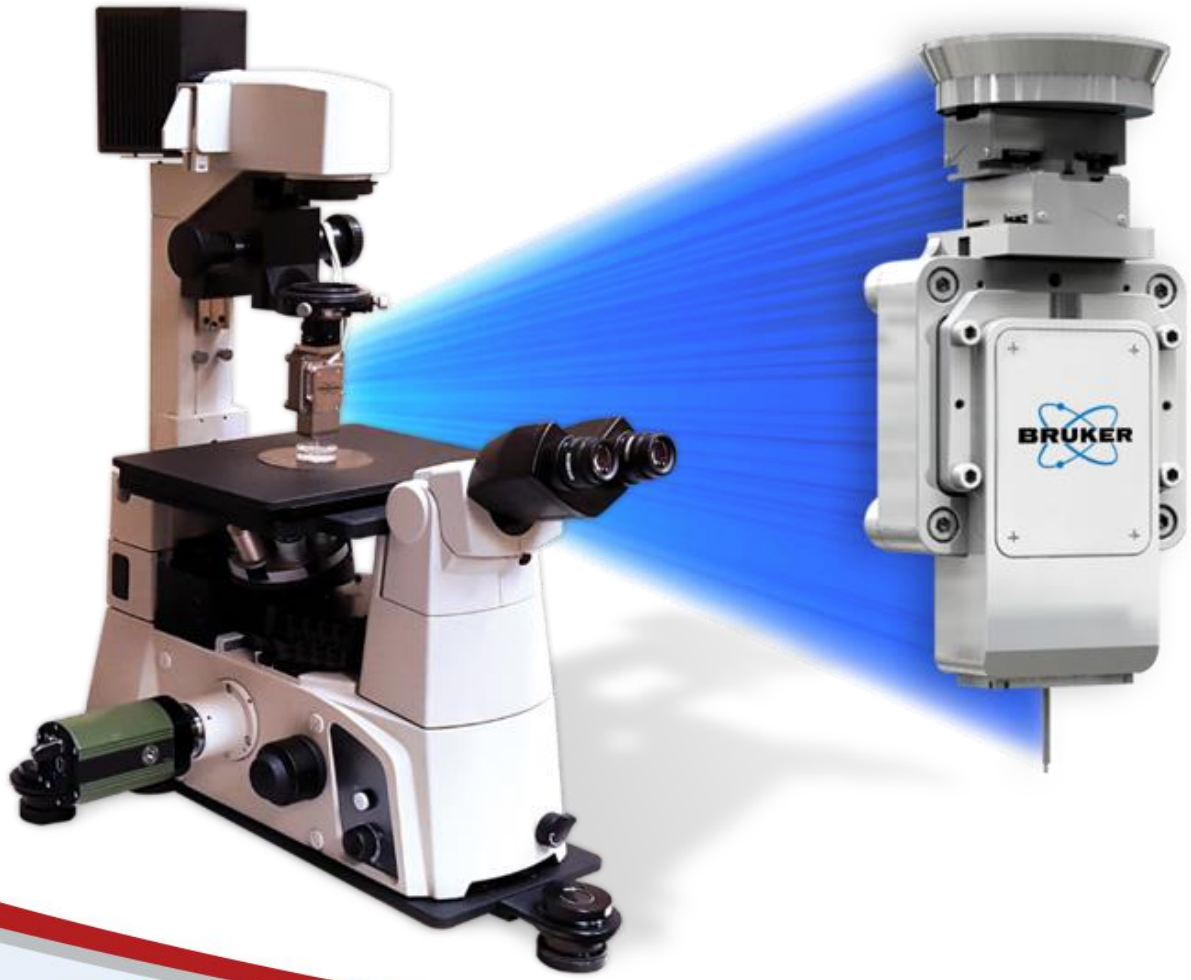


Nanoindenter for EM

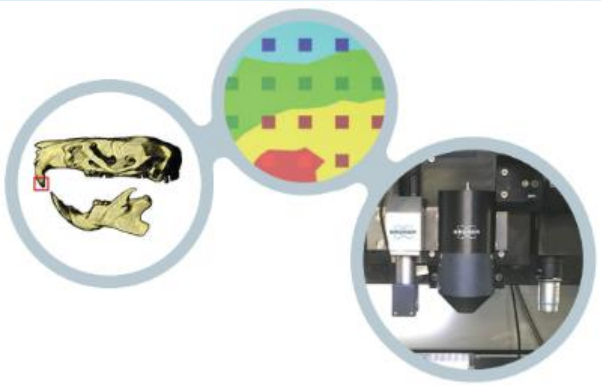




BioSoft



Transform Your Optical Microscope into a Powerful Biomaterials Test System



Life Science

Application Note #1500
Characterization of the Elastic Properties of Cartilage Tissue by Indentation

Application Note #1522
Raman and Indentation Mapping of a Rat Tooth

Application Note #1524
Highly Localized Characterization of Aortic Valve Tissue

Application Note #1523
Compression Test of a Living Cell

Application Note #1525
Nanoindentation on Marine Teeth: Studying Dentin and Enameloid in Dry and Hydrated Conditions

Application Note #1545
In-situ Nanoindenting Optimized for Mechanical Characterization of Soft Biomaterials

Application Note #1508
Indentation of Contact Lenses Using the Hysitron BioSoft In-Situ Indenter

Application Note #1525

Nanoindentation on Marine Teeth: Studying Dentin and Enameloid in Dry and Hydrated Conditions

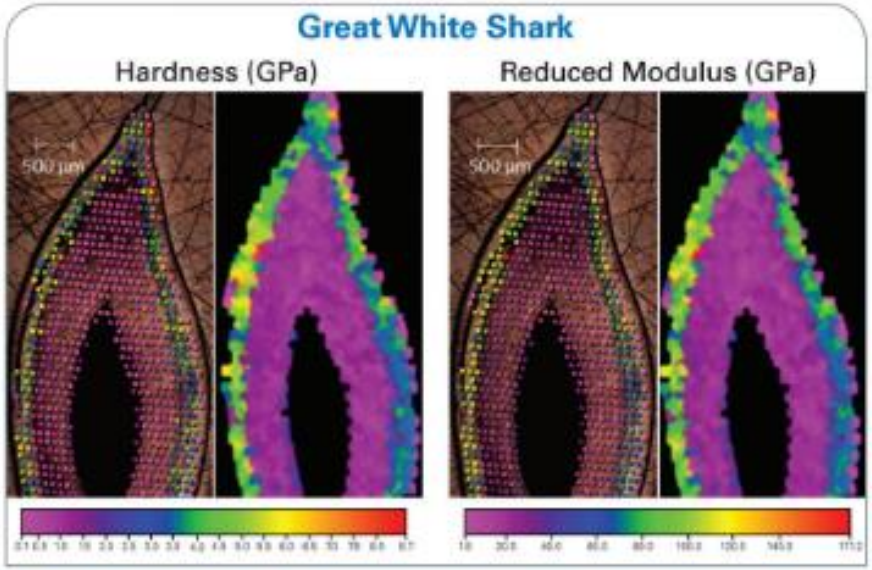


Figure 1. Hardness and reduced modulus surface plots from the series of 753 indents on the dry cross-sectioned GWS tooth sample.

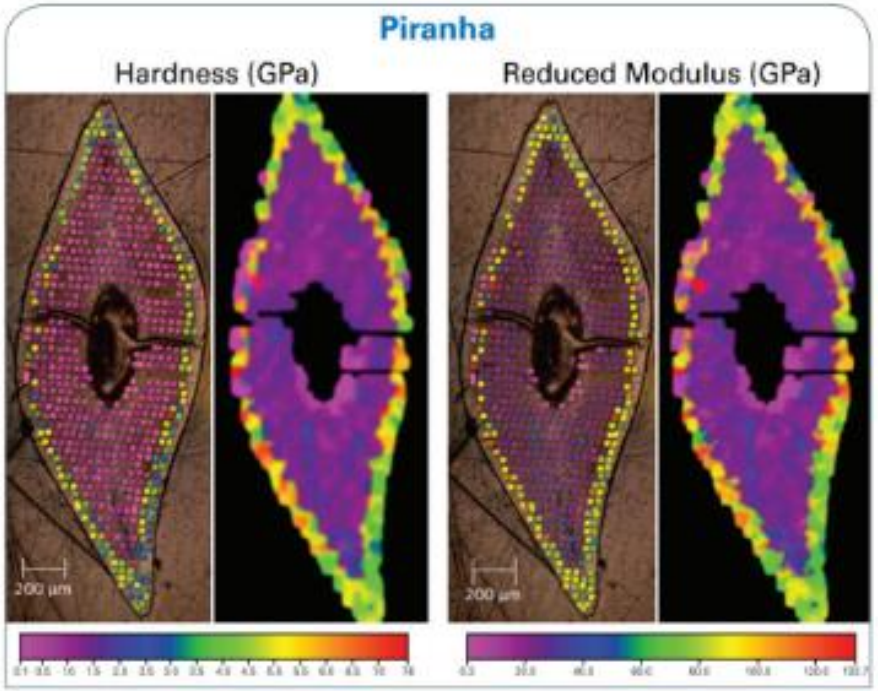


Figure 2. Hardness and reduced modulus surface plots from the series of 699 indents on the dry cross-sectioned Piranha tooth sample.

Application Note #1508

Indentation of Contact Lenses Using the Hysitron BioSoft In-Situ Indenter

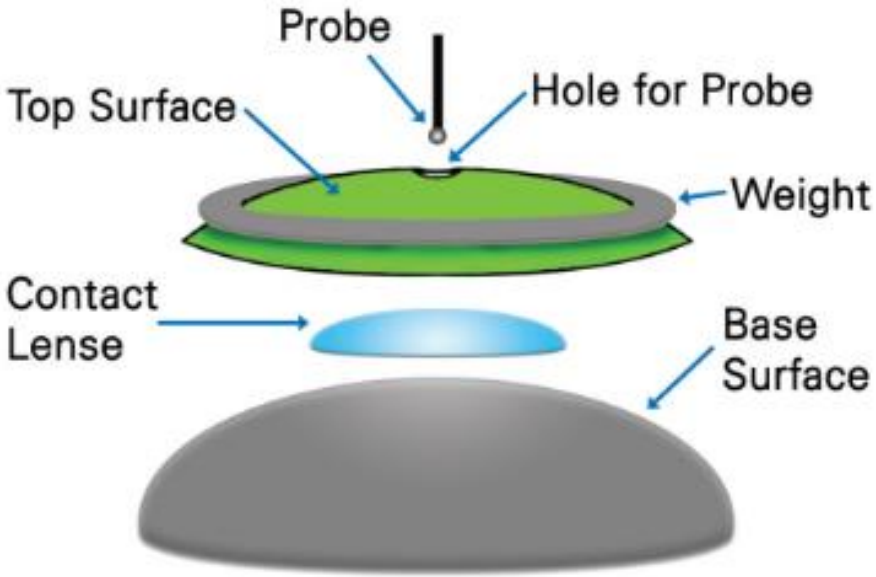


Figure 2. Mounting configuration for contact lenses. The apparatus was submerged in saline solution during testing.

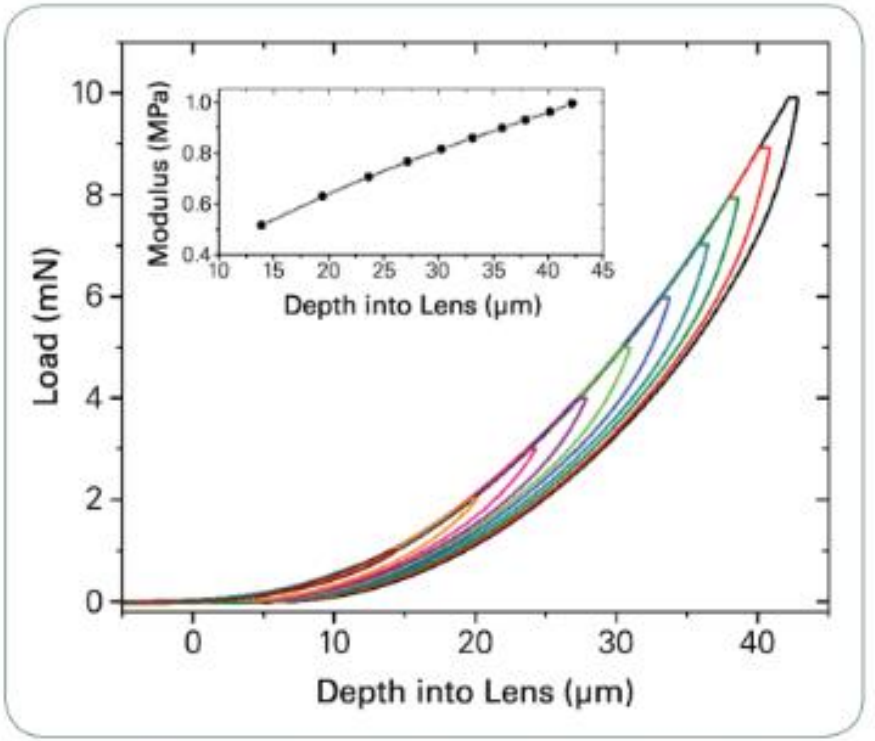
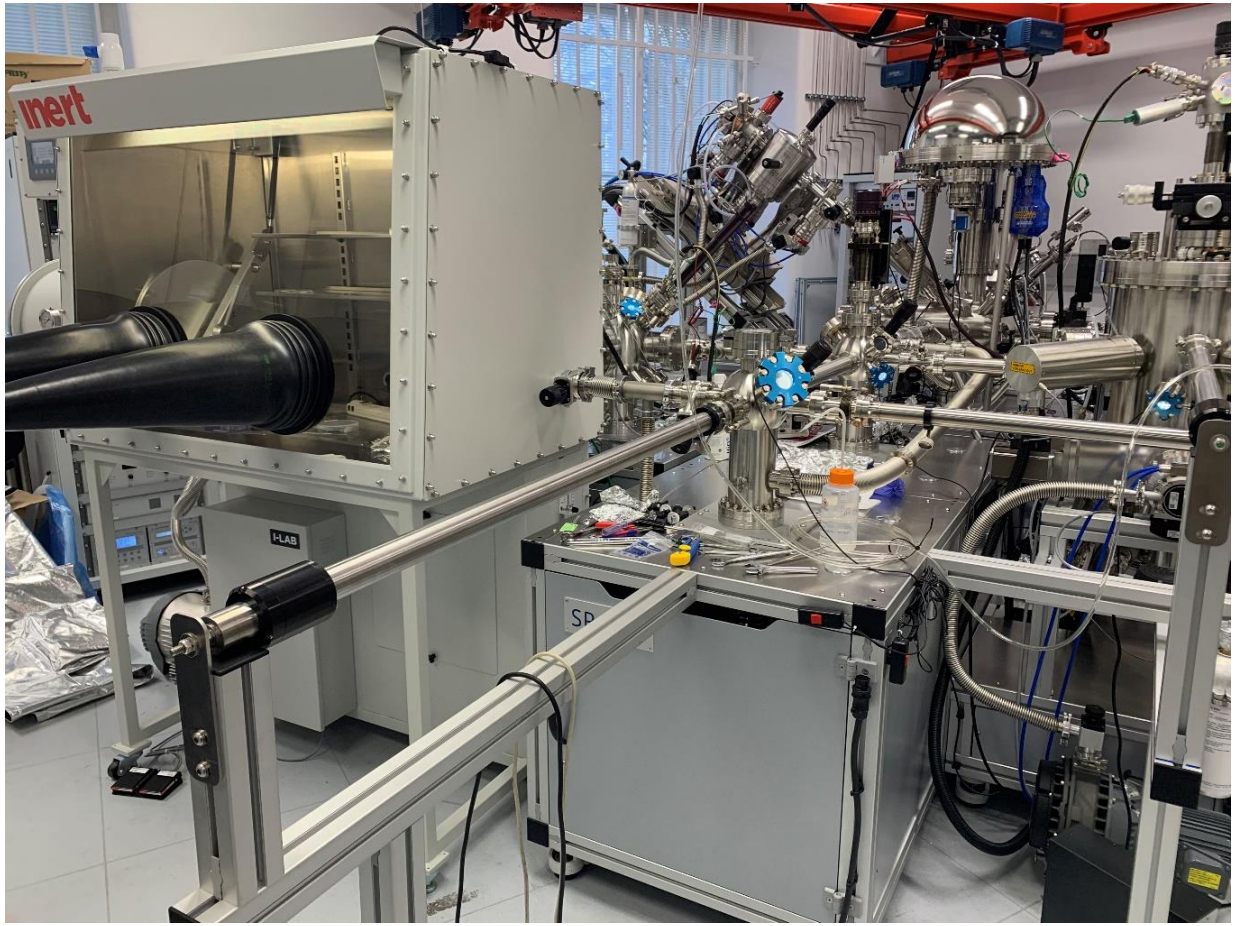


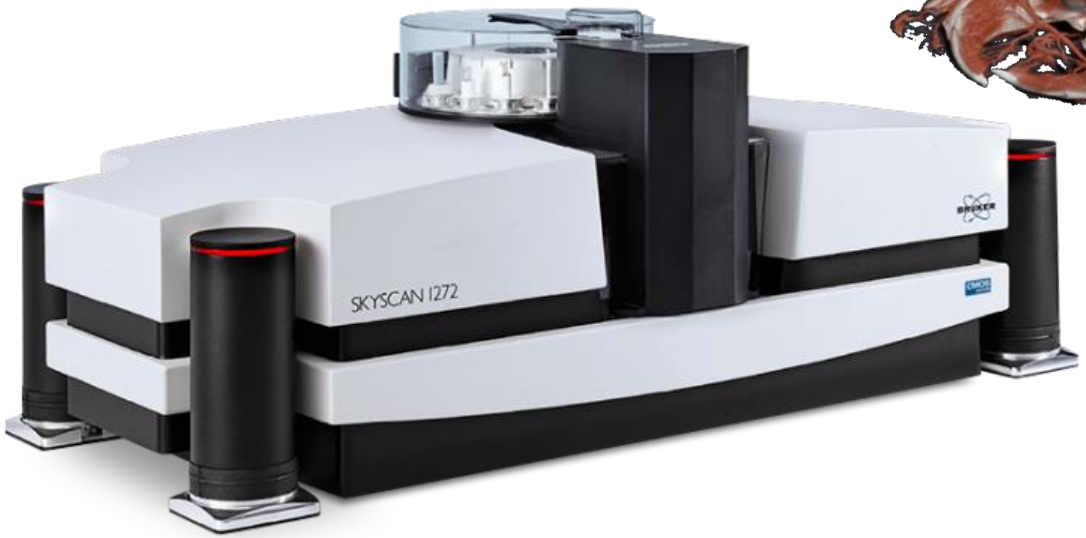
Figure 3. HEMA-based contact lens load vs. displacement for 500 μN/s loading to varying peak loads, showing excellent measurement repeatability. The inlay shows the effective elastic modulus increasing with depth.

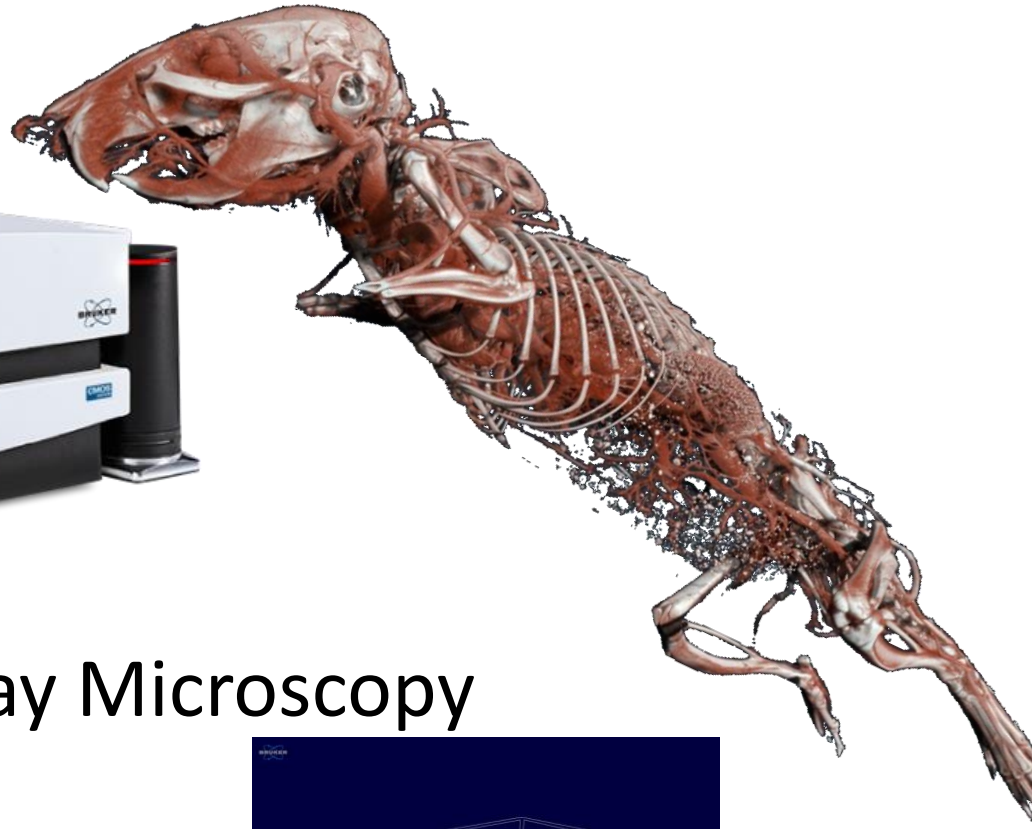
GloveBoxes from Inert

- Complete solution for your lab
  - AFM
  - NI
  - XPS
  - many more
- GMS, SPS,…

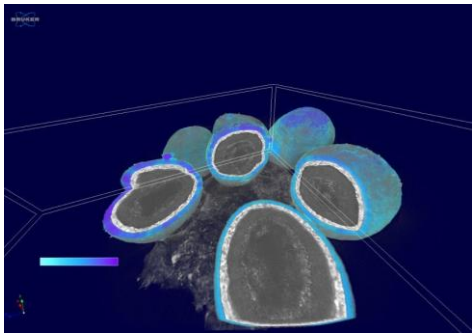


3D X-Ray Microscopy (XRM)





- High-resolution 3D X-ray Microscopy



EM detectors

- EDS – S(T)EM, TEM
- WDS
- EBSD
- XTrace2
- FlatQuad
- PI series

QUANTAX EBSD

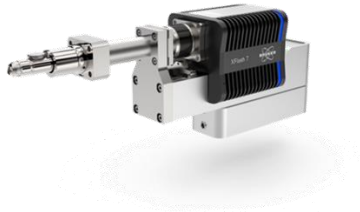
QUANTAX EBSD system with its popular OPTIMUS 2 detector head is the best available solution for analyzing nanomaterials in the SEM

→ READ MORE

QUANTAX EDS for SEM

The Most Advanced EDS for Your SEM, FIB and EPMA

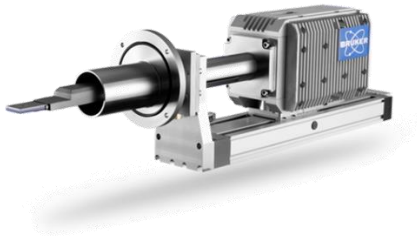
→ READ MORE



QUANTAX EDS for TEM

Energy Dispersive X-ray Spectrometer for STEM, TEM and T-SEM

→ READ MORE



QUANTAX FlatQUAD

Maximum Efficiency in X-ray Detection

→ READ MORE

QUANTAX Micro-XRF

Trace element sensitivity, thin film analysis and the elemental mapping of topographic samples, all with minimal sample preparation.

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QUANTAX WDS

High precision instrument for ultra-sensitive, high resolution X-ray microanalysis in the low energy range.

→ READ MORE

BioAFM


VERT HORZ
-0.07 -0.21
SUM=2.85
BRUKER


FastScan
BRUKER
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FastScan
with ScanAsyst

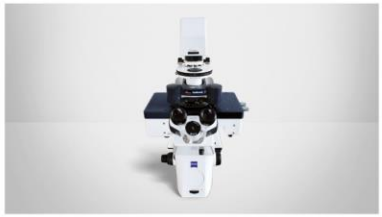

LASER APPROACHED
NanoWizard V


LASER APPROACHED
NanoRacer
NanoRacer
Scanning Stage
BRUKER

NEW **NanoWizard V BioScience**

Automated quantitative nano-mechanical imaging for long-term, self-regulating experiment series.

→ READ MORE



NanoWizard 4 XP BioScience

Extreme performance and ease of use for applications in Life Science and Soft Matter research ranging from single molecules to living cells and tissues.

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NanoRacer High-Speed AFM

True high-speed imaging at 50 frames per second and exceptional usability for following molecular dynamics in real-time

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NEW **CellHesion 300**

Automated platform for measuring cell-cell, cell-tissue, and cell-substrate interactions with single-molecule sensitivity.

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NanoWizard ULTRA Speed 2

High-speed imaging and super-resolution AFM on inverted microscopes, paired with unparalleled flexibility.

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NanoWizard Sense+

The perfect start to AFM, for applications in material and life sciences.

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NEW **ForceRobot 400**

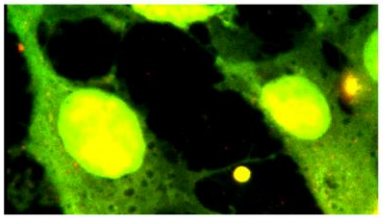
For single molecule applications. Automated force spectroscope with optional temperature control and fluidics system.

→ READ MORE

Dimension FastScan Bio

FastScan speeds and superior AFM ease of use for life science

→ READ MORE



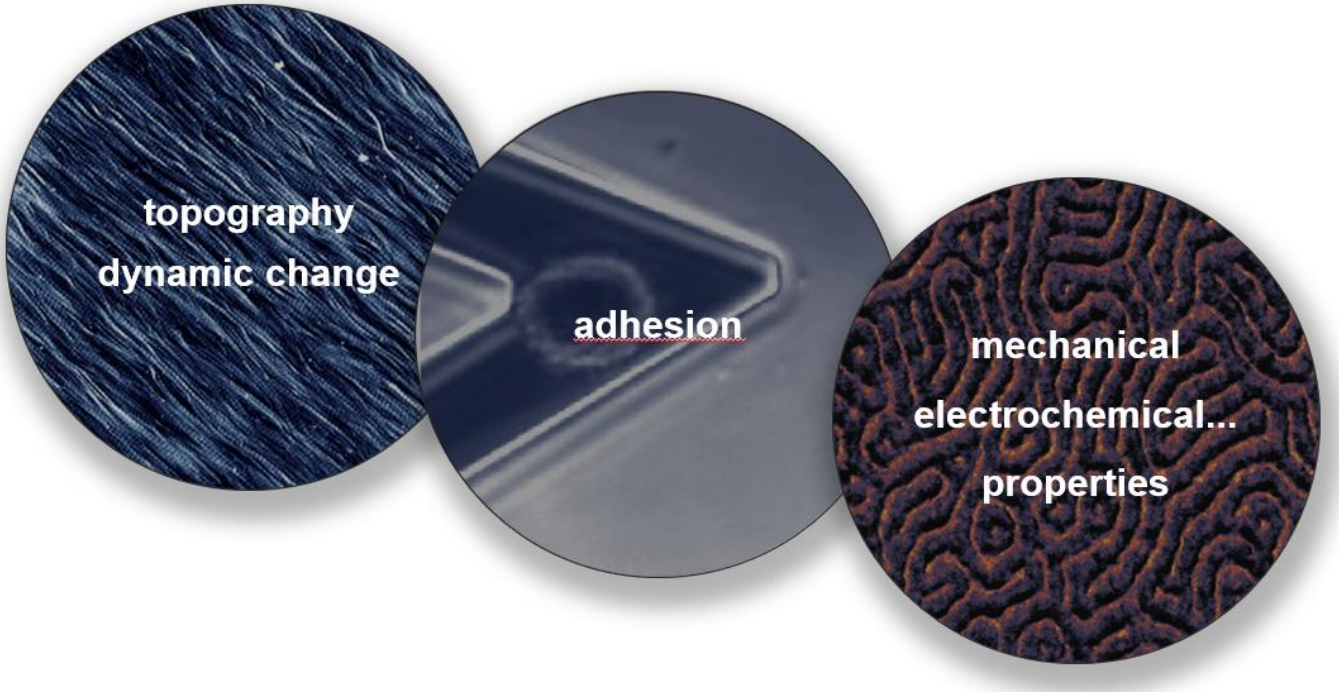
Optical Tweezers

Force-sensing optical tweezers and optical trapping

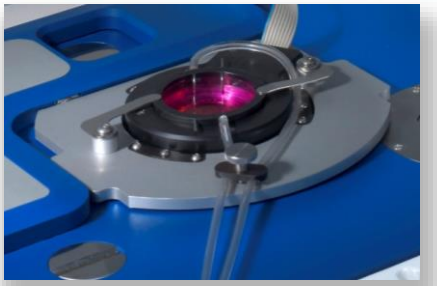
→ READ MORE

Benefits of AFM in Life Science

- Wide range of applications/modes → various sample properties



Benefits of AFM in Life Science

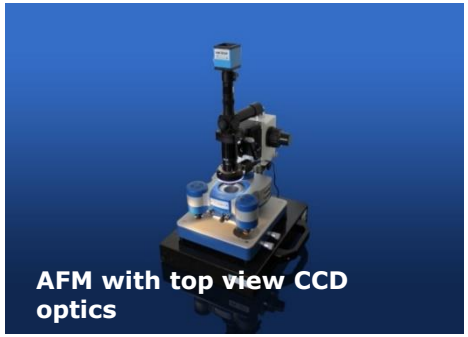


- **Near native sample conditions**
  - **in any liquid** (cells, proteins, DNA, hydrogels…)
  - no sample modifications/preparation artifacts
  - **controlled environment** (sample holders/accessories, temperature, CO_2)
- **Straightforward solution**
  - easy/ready to use, high quality data processing for everyone
- **Sophisticated Design**
  - **biocompatibility** (sterile working, safe working in liquid)
  - Tip scanner, optical access, ...
  - **Combination with advanced optical techniques, micropipettes, FluidFM**…
    - complementary information
- **Dynamic processes – within reach**
  - Up to 50 frames/s standalone
  - Up to 14 frames/s correlative

Correlative AFM in Life Science

Inverted microscope configuration

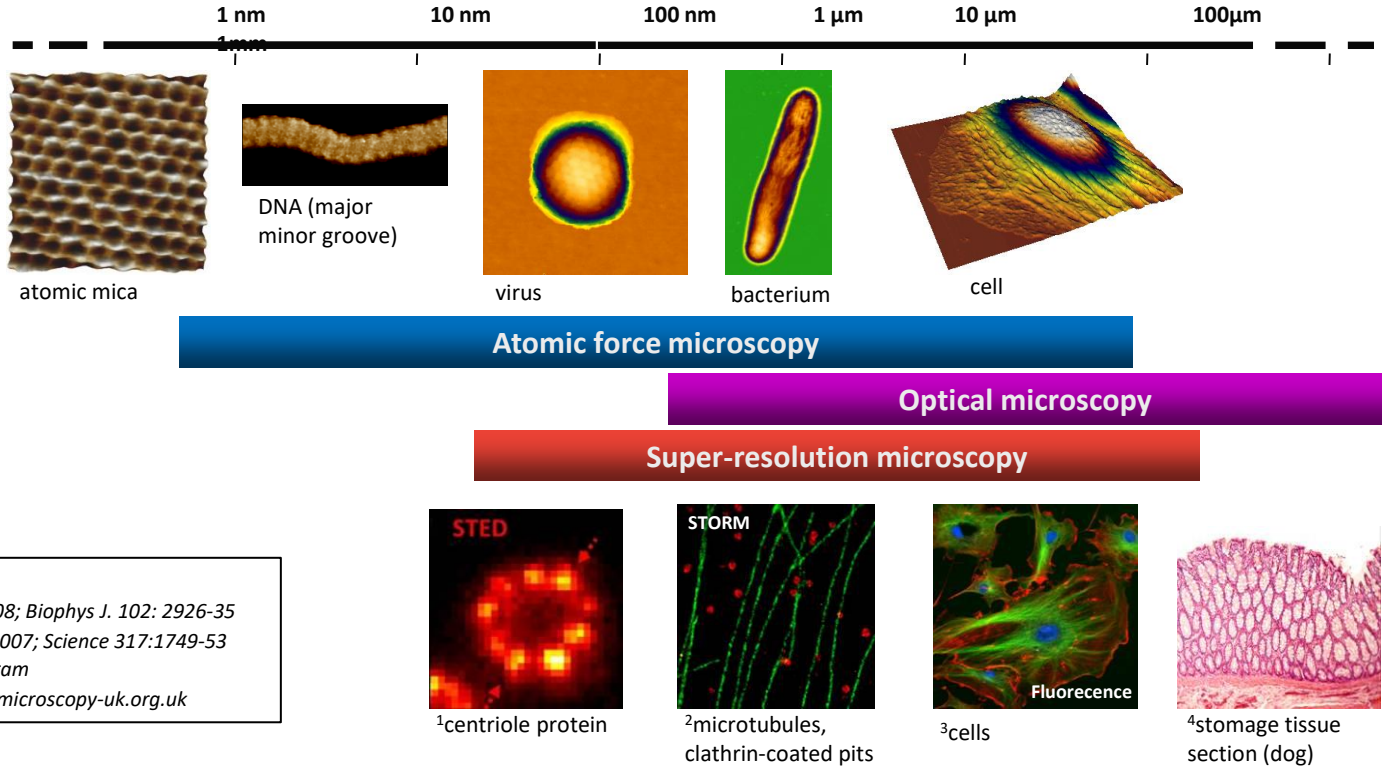
- Zeiss, Leica, Olympus, Nikon
- Confocal laser scanning microscopes
- TIRF, FLIM, FRET, FCS, STORM, STED,...
- Raman spectroscopy (TERS)



Upright configuration

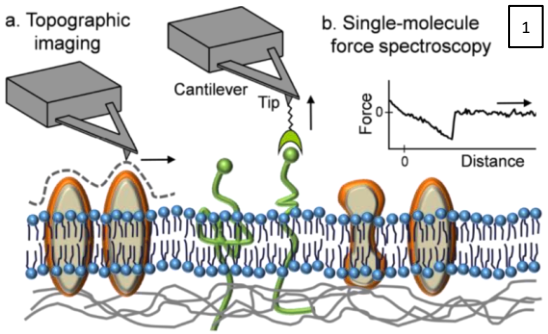
- Upright microscope combination (Zeiss, Olympus, JPK TopView)
- Raman
- Other optical spectroscopy

Correlative AFM in Life Science

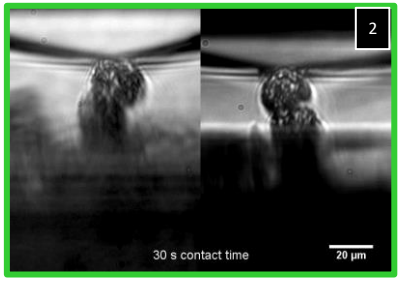


Pictures:
[1]Lau et al. 2008; Biophys J. 102: 2926-35
[2]Bates et al. 2007; Science 317:1749-53
[3]ImageJ program
[4]http://www.microscopy-uk.org.uk

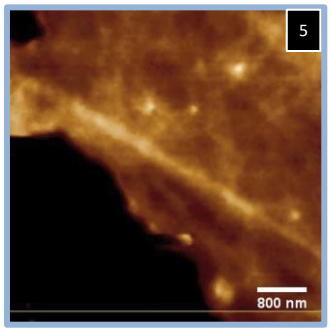
Application of AFM to study structure, forces and dynamics



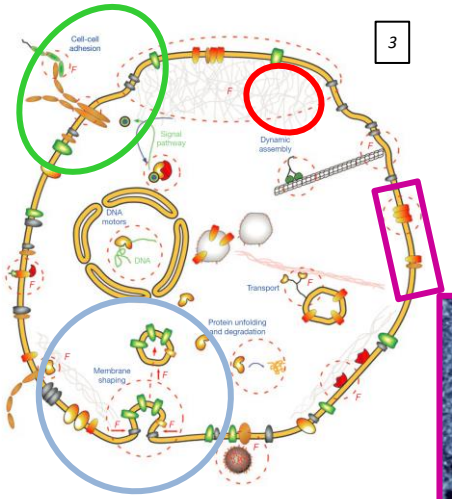
- Imaging topography and dynamic changes.
- Adhesion forces
- Nanomechanics

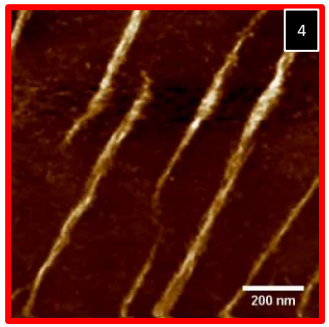


Studying Adhesion / Mechanics

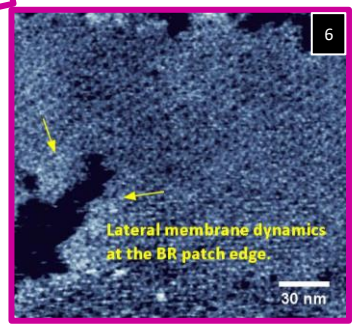


Cell Morphology / Membrane Processes





Matrix Protein Fibrillogenesis



Single Molecule Dynamics

[1] *Dufrêne YF, MBio 5(4) (2014) e01363-14*

[2] *Gonnermann C et al., Integr Biol 7 (2015) 356-363*

[3] *Dufrêne YF, Nat Methods 8 (2) (2011) 123-127*

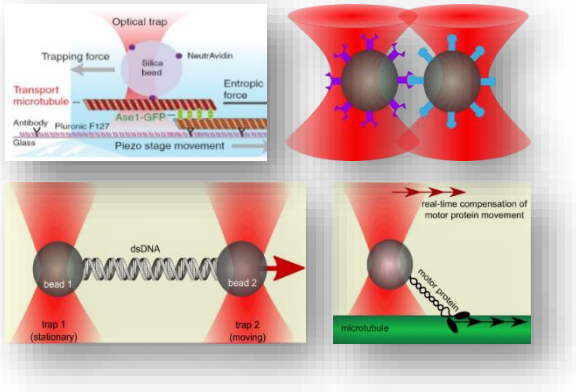
[4] *Stamov DR et al., Ultramicroscopy 149 (2015) 86-94*

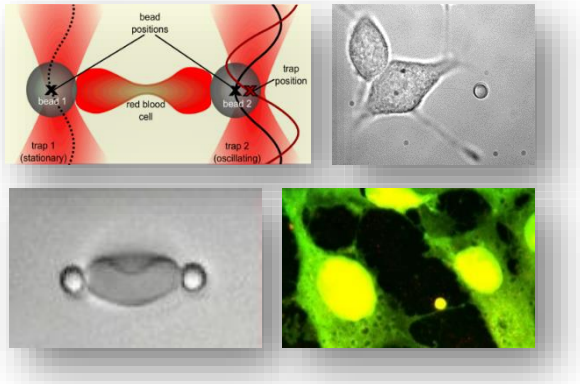
[5] *Sample courtesy of A. Hermann group, HU Berlin, DE*

[6] *Sample courtesy of D.J. Müller group, ETH Zürich, BSSE Basel, CH*

OT - NanoTracker 2

- Single-molecules:
  - DNA-mechanics (stretching), DNA-protein interactions.
  - Motor-proteins tracking and force generation.
  - Protein folding/unfolding studies, RNA-hairpins etc.
  - Enzyme-substrate, protein-ligand interactions.
- Living Cells:
  - Virus-cell, bacteria-cell, bacteria-bacteria interactions.
  - Cell mechanics, indentations, membrane tethers, membrane rafts
  - Cell immunology, especially combined with AFM.
  - In-cell manipulations and measurements, cell manipulations etc.
- Materials research:
  - Micro-rheology: properties of liquids, polymer networks, water-gels
  - Surface interactions: coated beads, polymer brushers etc.
  - Biopolymer mechanics (collagen fibers)
  - Emulsions: oil droplets, lipid liposomes etc.



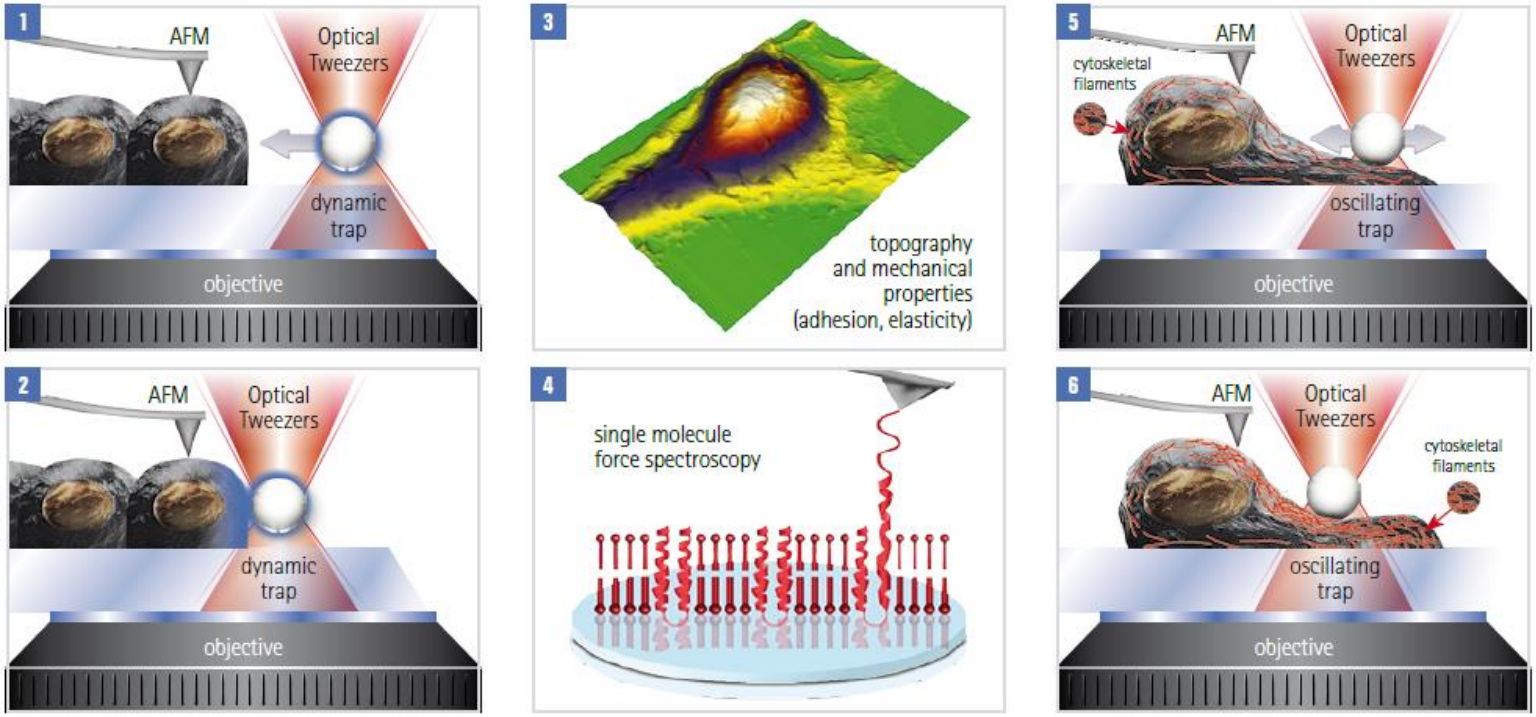


OT-AFM: the best of three worlds

Optical tweezers, AFM and Light Microscopy

OT-AFM: the best of three worlds

Optical tweezers, AFM and Light Microscopy



Latest partnership

TA Instruments

A leading manufacturer of instruments for thermal analysis, rheology, microcalorimetry, dilatometry, thermal conductivity, flash diffusivity, mechanical testing, dynamic mechanical analysis and rubber testing

- Binding affinity, specificity, and stoichiometry (ratio) to the molecular target
- Structure stability, and Solvent environment stability.
- Lead APIs, excipients, and impurities
- Native tissue, biomaterials, sub-components, complete devices

TA Instruments

Differential Scanning Calorimetry (DSC)

- Identification of the API or excipient
- Characterization of the API or excipient
- Polymorphism or polymorphic states
- Glass transition (T_g)
- Melting
- Heat of fusion

Temperature Range: -180°C to 725°C

Sorption Analysis (SA)

- Water sorption isotherms and kinetic
- Drying and dehydration
- Amorphous content
- Polymorphism
- Hydrate formation and dehydration

Humidity Control Range: 0% to 98% RH

Thermogravimetric Analysis (TGA)

- Thermal stability
- Oxidative stability

Evolved Gas Analysis (EGA)

- Impurity identification
- Composition analysis

Temperature Range: RT to 1500°C

Nano ITC

- Binding characterization
- Comparisons of the API or drug product to its target

Temperature Range: 2 °C to 80 °C

Affinity ITC

- Virus binding
- Cell binding
- Off-target interactions

Affinity Range: low-mM, to low-pM
Automation: 96-well plate compatible

Nano DSC

- Protein unfolding
- Nucleic acid melting/annealing
- Capsid stability

Temperature Range: -10 °C to 130 °C
Automation: 96-well plate compatible

TA Instruments

ElectroForce 3200

- Contact lenses
  - Friction
  - Lubricity
- Cartilage, Bone, Dentin/ Teeth
  - Strength
  - Stiffness
  - Durability
- Spinal Cord and Nerves
  - Strength
  - Stiffness
  - Response to injury

ElectroForce 3300

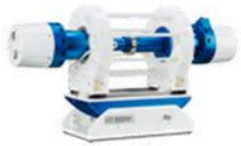
- Dental Implant
  - Axial Fatigue
- Spinal Implant
  - Axial Fatigue
  - Axial-Torsion Fatigue
- Muscle
  - Strength
  - Stiffness
  - Response to Stimulus
- Bone, Dentin/Teeth
  - Strength
  - Stiffness
  - Durability

ElectroForce 3500

- Hip Implants
  - Axial Fatigue
  - Axial-Torsion Fatigue
- Breast Implant
  - Axial Fatigue
- Bone, Tendon, Ligament
  - Strength
  - Stiffness
  - Durability

Multi-Specimen Fatigue

- IVC Filters
  - Axial-Radial Durability
- Other cardiovascular devices
  - Axial Durability
- Stent subsections (diamond surrogates)
  - Fatigue-to-Fracture
  - Fatigue Test-to-Success
- Pacemaker and Defibrillator Leads
  - Fatigue-to-Fracture
  - Fatigue Test-to-Success
- IVC Filters
  - Fatigue-to-Fracture



DuraPulse SGT

- Stent or Stent/Grafts
  - Pulsatile durability
  - Fatigue-to-Fracture
- IVC Filters
  - Radial durability
- Stents of Transcatheter Heart Valves (TAVR)
  - Pulsatile durability
  - Fatigue-to-Fracture

Thanks for your attention!

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