WITec
focus innovations

- Confocal Raman Imaging
- Atomic Force Microscopy
- Scanning Near-field Optical Microscopy

High-Resolution Optical and Scanning Probe Microscopy Systems

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Content

1.0

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- Photovoltaics & Semiconductors

AFM (Topography)

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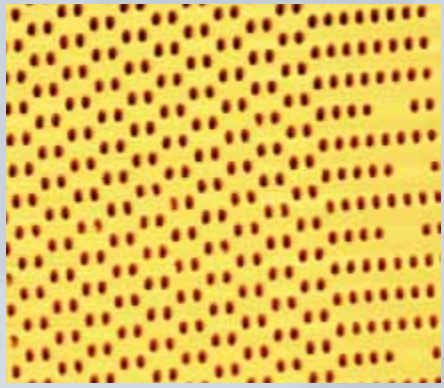
- Life Science
- Pharmaceutics, Cosmetics, Food Industry
- Materials Science
- Geoscience

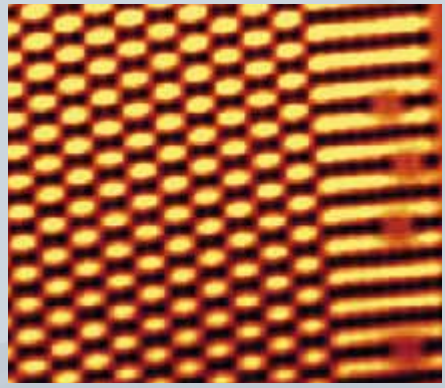
Forensics

Nanophotonics

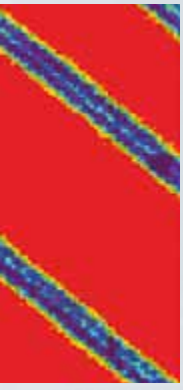
Coatings & Thin Films



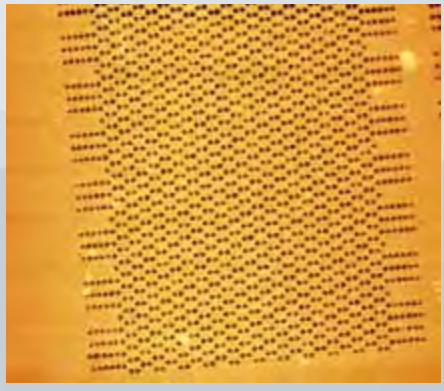
AFM (Topography)



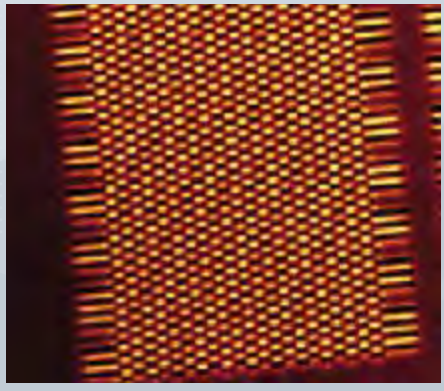
Raman (Intensity)



Polymer Science



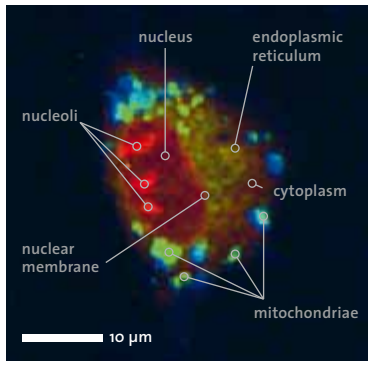
AFM (Topography)



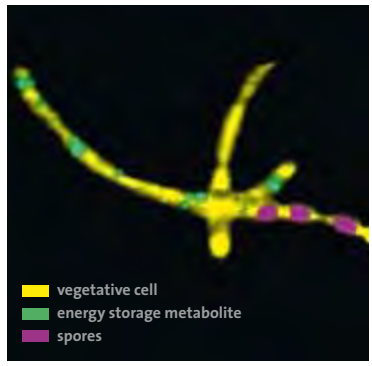
Raman (Intensity)

Life Science

- Chemical imaging without the need for fluorescent dyes
- Imaging of cells, tissues and bio-films
- Monitoring of metabolic activities
- High-resolution fluorescence imaging
- Nano-biomedical studies



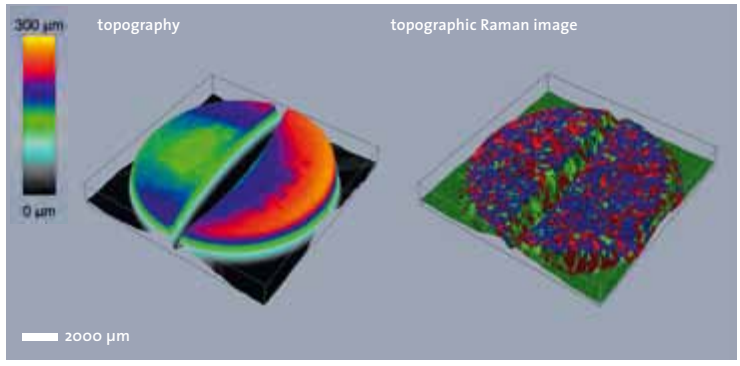
Raman image of a living cell



Raman image of Bacillus Cereus

Pharmaceutics, Cosmetics and the Food Industry

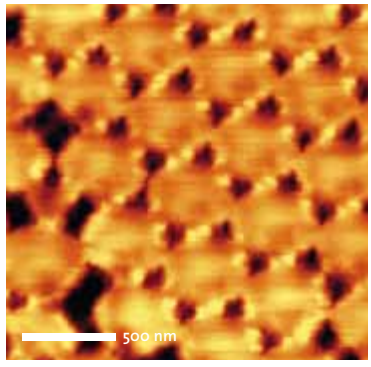
- Drug distribution and product homogeneity investigations
- Solid state and foreign particulates analysis
- Polymorph characterization
- Emulsions, tablets, drug-delivery coatings, core-shell systems



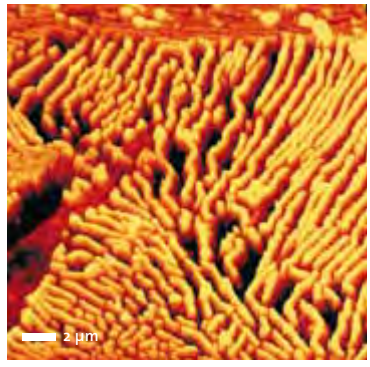
TrueSurface Microscopy applied to a pharmaceutical tablet

Materials Science

- Nanotechnology and nano-structured surface inspection
- Defect and residue analysis
- Surface modification
- Stress measurements



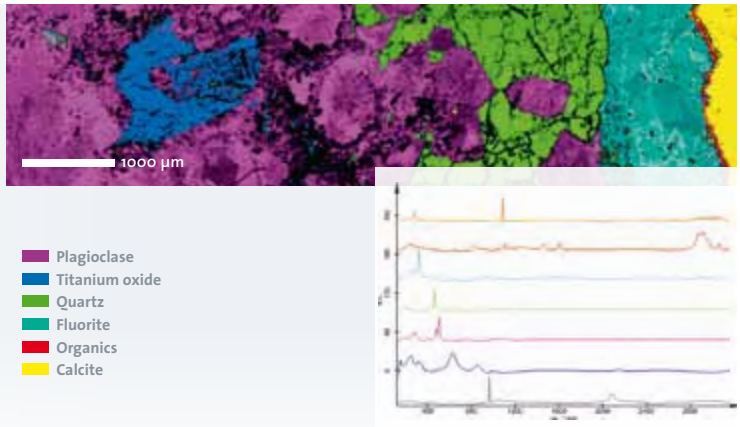
High-resolution SNOM image of a latex projection pattern



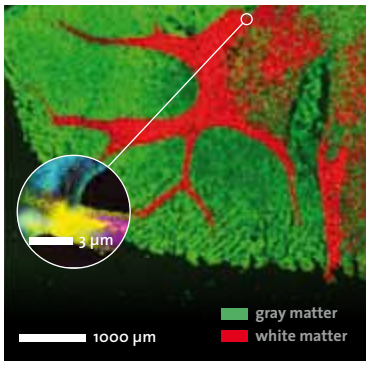
AFM topography image of a steel surface

Geoscience

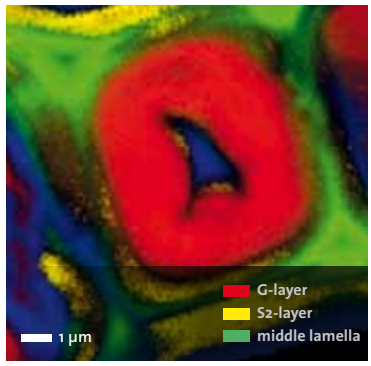
- Identification and distribution of minerals
- Characterization of organic and inorganic components
- Fluid inclusions
- Petrology
- Geo(micro)biology and astrobiology



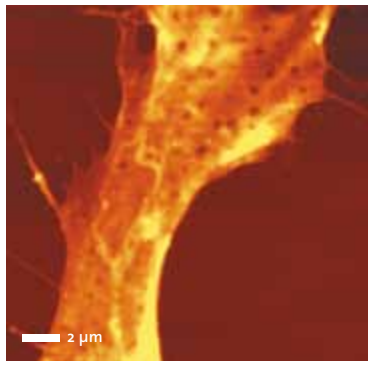
Large-area Raman image of a polished rock section with corresponding spectra



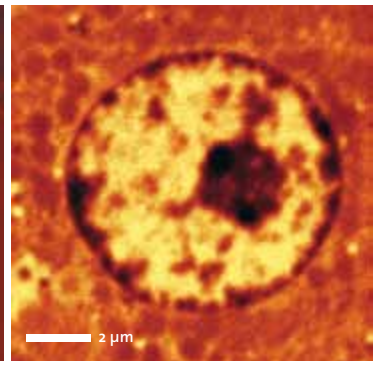
Large-area Raman image of the gray and white brain matter of a hamster brain along with a high-resolution zoom-in image at the border between gray and white brain matter



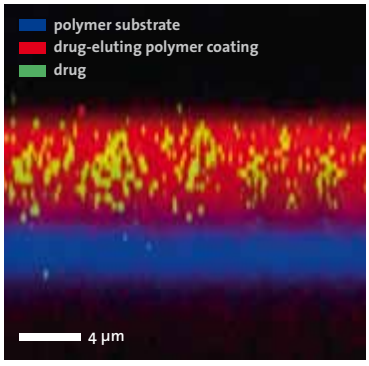
Raman image of a wood cell



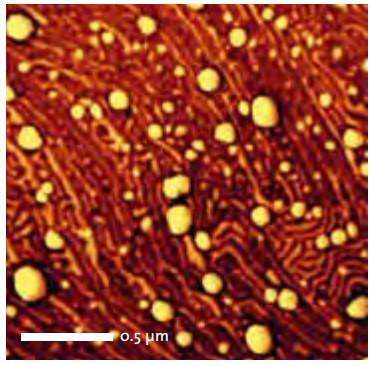
AFM image of a cell surface



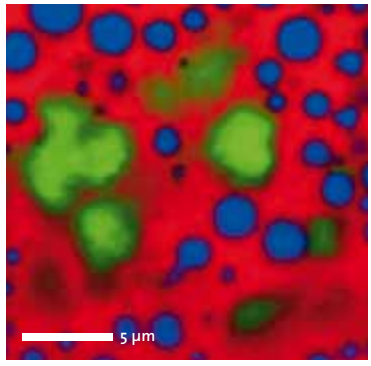
SNOM image of the nucleus of a rat hepatocyte



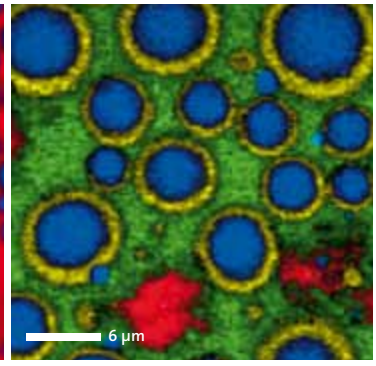
Drug-eluting stent
Confocal Raman depth-scan image



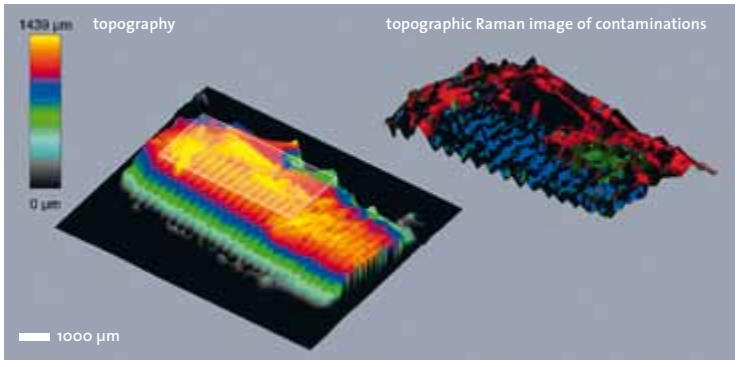
High-resolution AFM surface topography showing the polymer substrate structure with the embedded drug particle



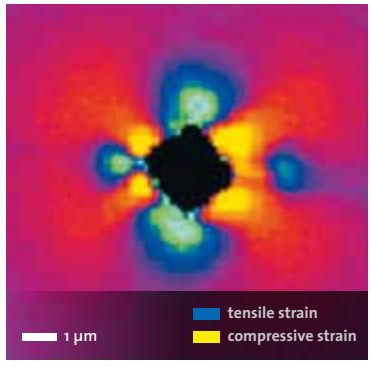
Emulsions: Dexpanthenol ointment
(Blue: Dexpanthenol in water,
red & green: ointment base)



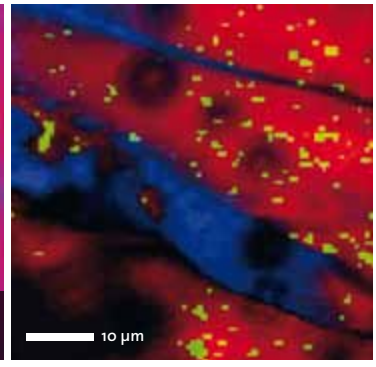
Emulsion used in food production
(Red + green: fatty matrix, blue:
aqueous phase, yellow: emulsifier PGPR)



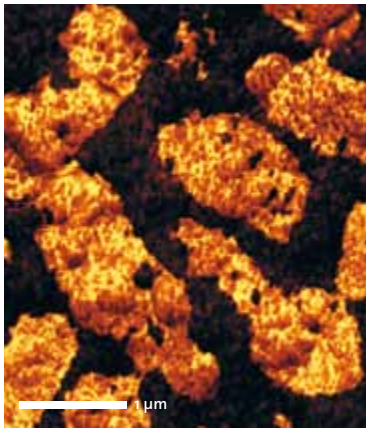
TrueSurface Microscopy investigation of a metal screw
Topography and Topographic Confocal Raman image of contamination on threads



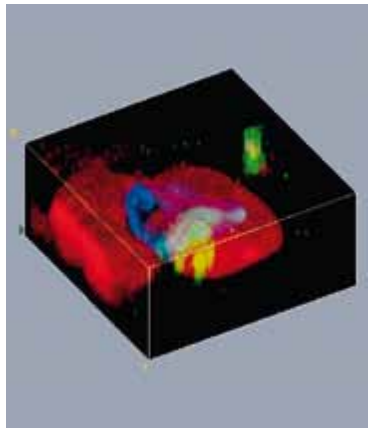
Material stress in silicon imaged via peak-shift analysis



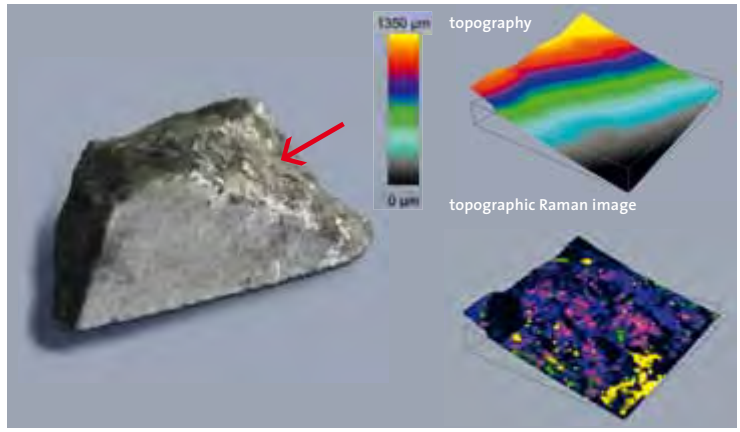
Confocal Raman image of a porous membrane, fibers (red), pores filled with oil (blue) and TiO_2 particles (green)



AFM image (Pulsed Force Mode)
of fossilized bacteria



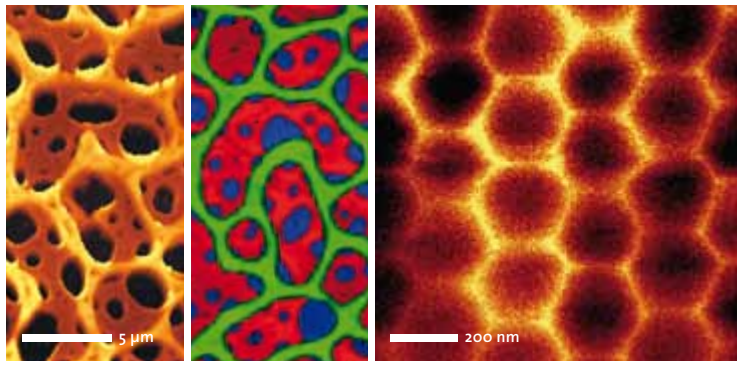
3D Raman image of a fluid inclusion in garnet



TrueSurface Microscopy measurement performed on a rough and inclined rock sample

Polymer Science

- Chemical constitution and compound distribution
- Crystallinity
- Polymer surface structure and properties
- Defect analysis and phase separations

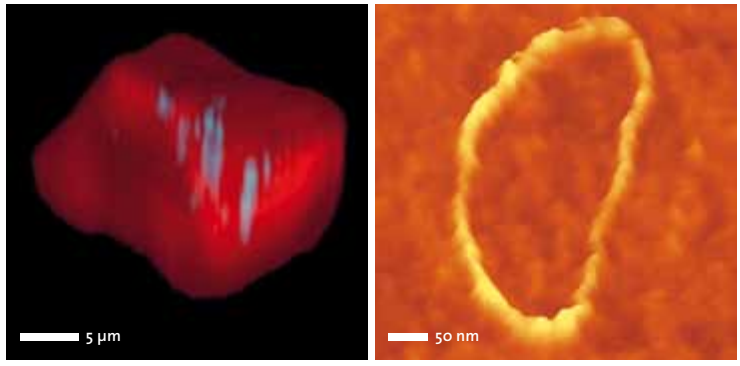


Confocal Raman and AFM topography image of a polymer blend on glass

AC-mode SNOM image of polystyrene spheres

Carbon Materials

- Nanotube properties characterization
- Graphene characterization and layer analysis
- Diamond films and inclusions

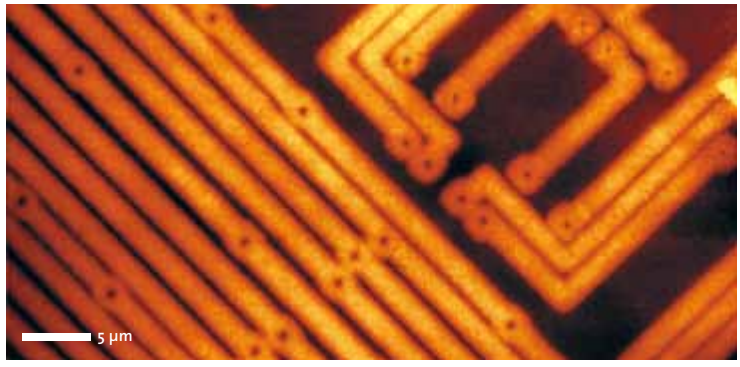


3D Raman image of a diamond inclusion (red) in quartz (not shown) with impurities (blue)

AFM image of a carbon nanotube on silicon substrate

Photovoltaics & Semiconductors

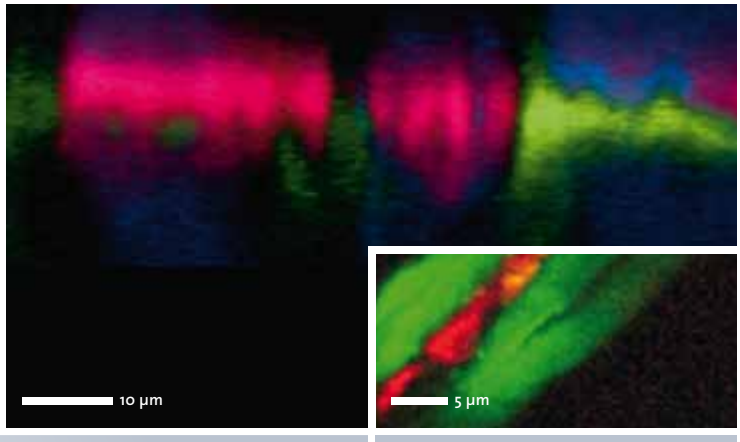
- Large-area wafer inspection
- Defect analysis
- Stress measurements
- Layering



AFM image of an integrated circuit

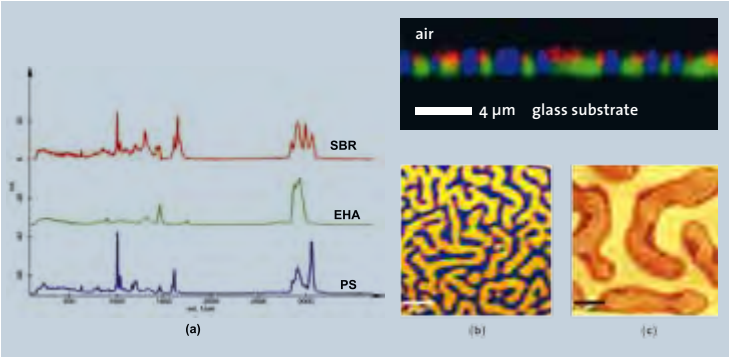
Forensics

- Fiber analysis
- Writing and printing on documents
- Residue characterization

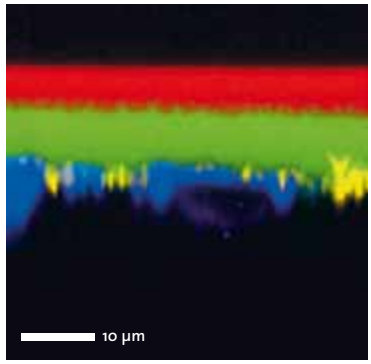


Order of ballpoint pen writing on paper determined by a depth profile (green: pen I, red: pen II).

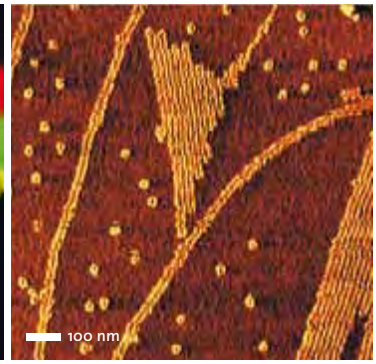
Raman image of a textile fiber



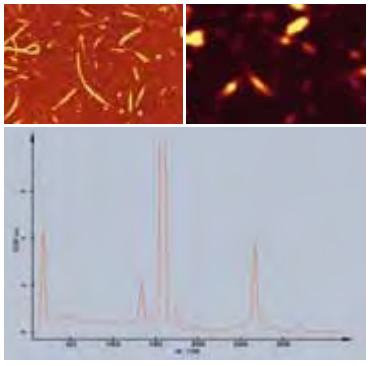
Three-component polymer blend (SBR, EHA, PS), Raman images (xy and xz scan) along with spectra and high-resolution AFM phase image



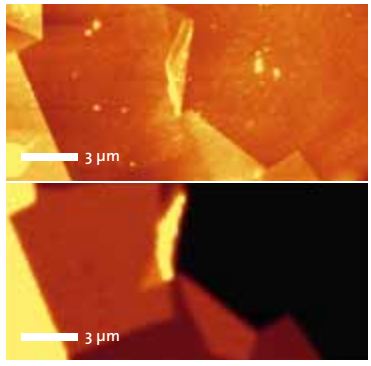
Confocal Raman depth profile of an adhesive polymeric layer on a paper substrate



AFM-phase image of long chain polymer molecules



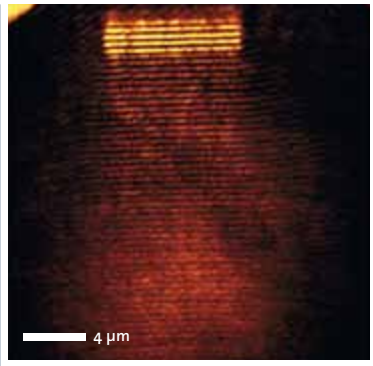
AFM and Raman images of carbon nanotubes deposited on a Si-substrate along with typical Raman spectrum of a carbon nanotube



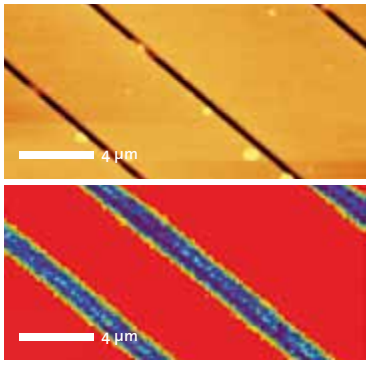
AFM (top) and Raman (bottom) images of a graphene flake

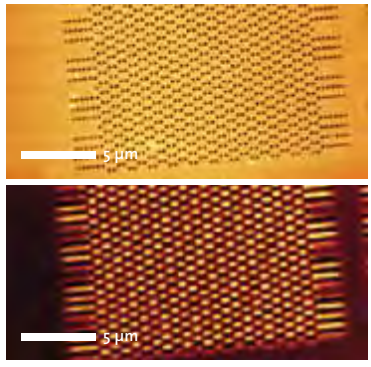
Nanophotonics

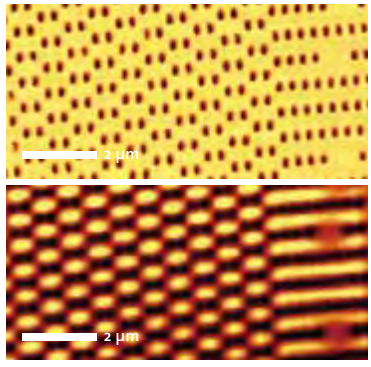
- Waveguides
- Imaging of surface plasmon waves
- Surface Enhanced Raman Imaging (SERS)



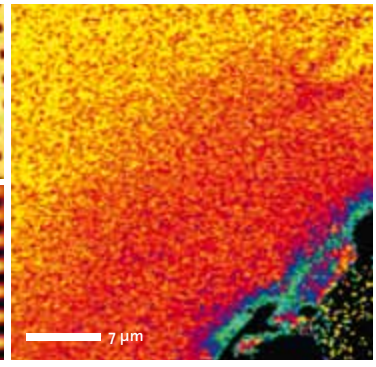
SNOM image of a surface plasmon-polariton wave launched on a nanostructured metal grid







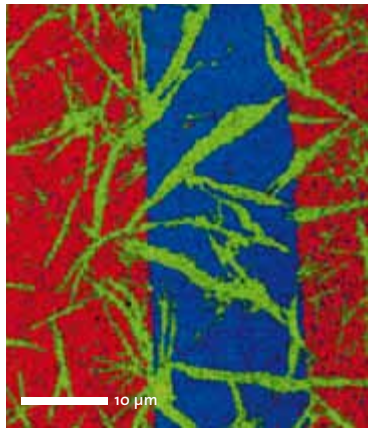
Raman and AFM images of the same sample area at three different positions on a wafer



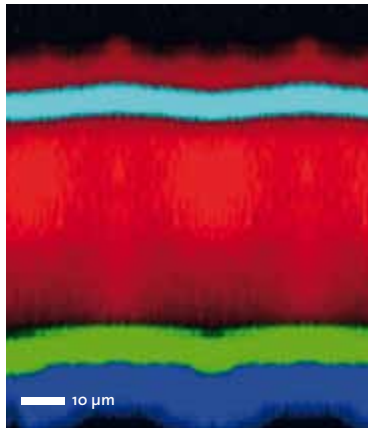
Stress map in Si around a laser-drilled hole on a Si solar cell device

Coatings & Thin Films

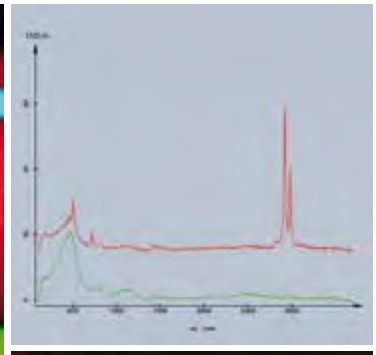
- Chemical constitution and layering
- Uniformity and thickness
- Surface structure and properties



Ultrafast Raman image of a 7.1 nm PMMA film (red) on glass (blue) with a 4.2 nm alkane contamination layer (green) on top.



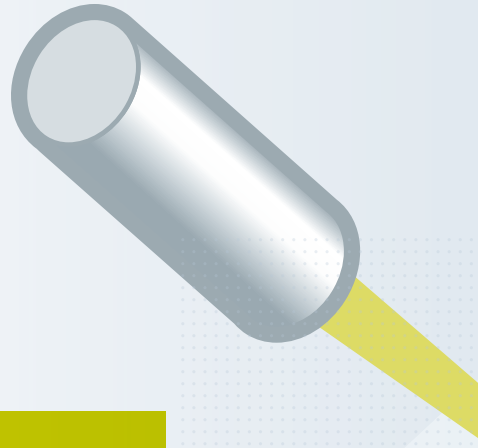
Raman image (depth profile) of the inner multi-layer coating of an orange juice container



Raman image of an oil coating (red) on the inner surface of a glass syringe

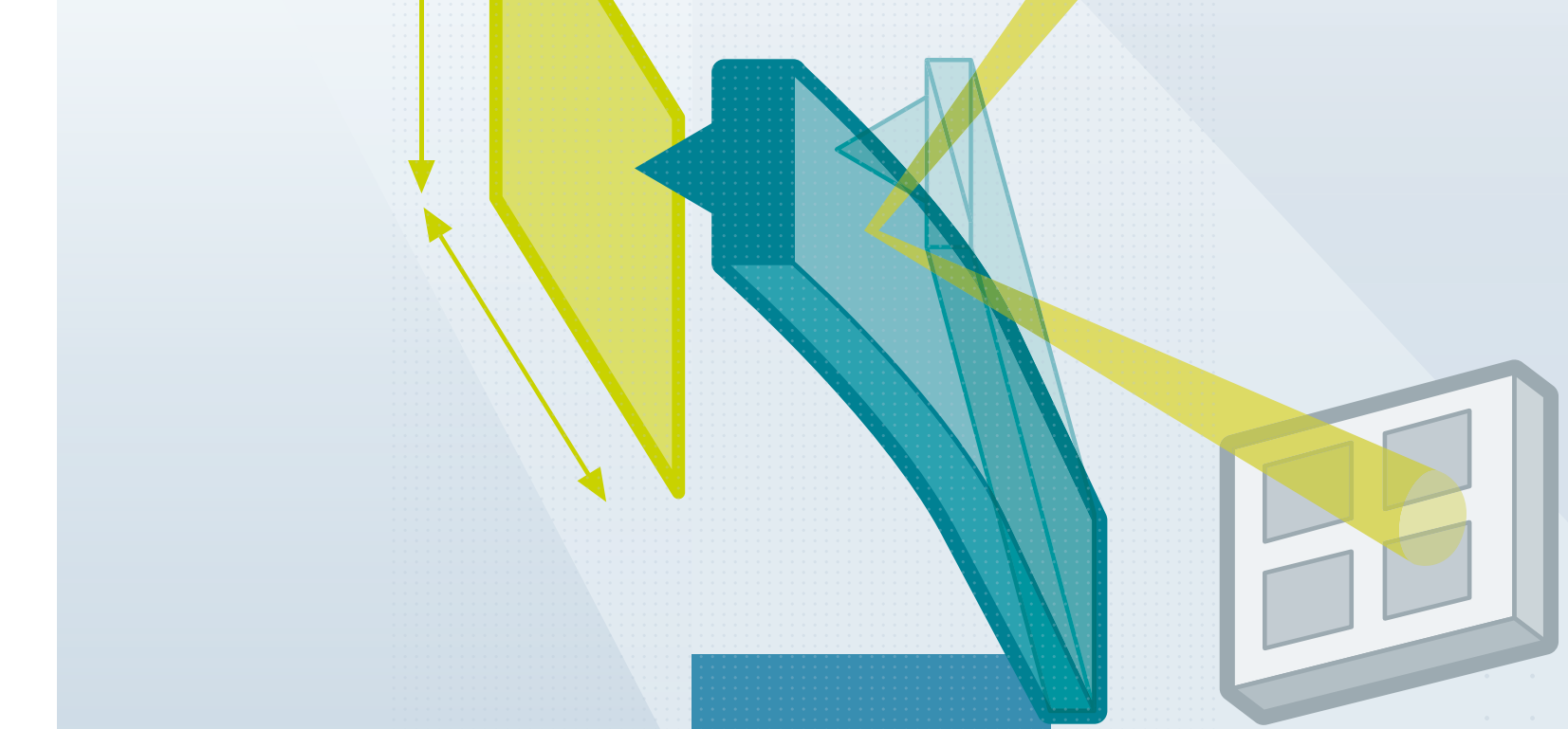
2.0

Confocal Raman Microscopy –
3D Chemical Imaging



Techniques

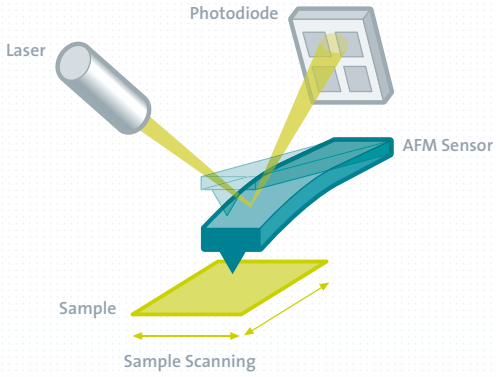
TrueSurface Microscopy



Atomic Force Microscopy (AFM) –
Nanoscale Surface Characterization

Scanning Near-field Optical Microscopy (SNOM) –
Optical Imaging Beyond the Diffraction Limit

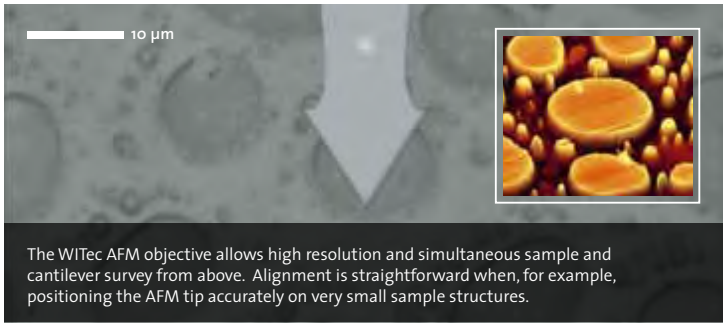
Nanoscale Surface Characterization – Atomic Force Microscopy (AFM)



Atomic Force Microscopy traces the topography of samples with extremely high resolution by recording the interaction forces between the surface and a sharp tip mounted on a cantilever.

The sample is scanned under the tip using a piezo-driven scanning-stage and the topography is displayed as an image. Atomic Force Microscopy provides spatial information parallel and perpendicular to the surface with resolution in the nm range.

In addition to topographic high-resolution information, local material properties such as adhesion and stiffness can be investigated by analyzing the tip-sample interaction forces.

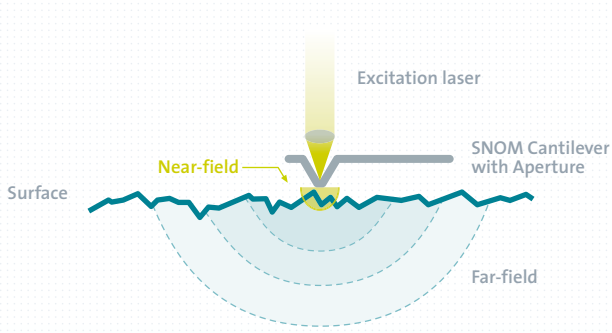


The WITec AFM objective allows high resolution and simultaneous sample and cantilever survey from above. Alignment is straightforward when, for example, positioning the AFM tip accurately on very small sample structures.

BENEFITS

- Surface topography imaging on the nanometer scale
- Nondestructive
- Minimal, if any, sample preparation
- Ease of use in air and liquids
- Various AFM modes available for e.g. advanced surface properties imaging

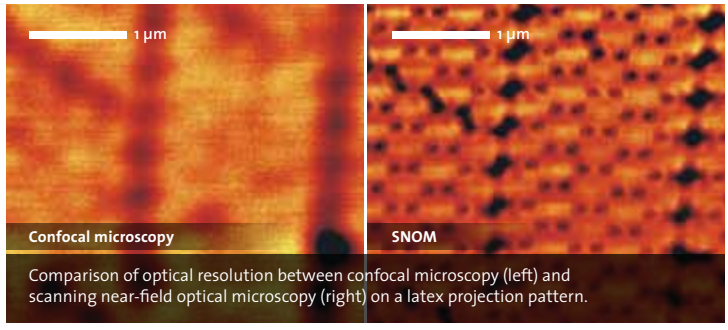
Optical Imaging Beyond the Diffraction Limit – Scanning Near-field Optical Microscopy (SNOM)



In Scanning Near-field Optical Microscopy, the excitation laser light is focused through an aperture with a diameter smaller than the excitation wavelength, resulting in an evanescent field (or near-field) on the far side of the aperture.

When the sample is scanned at a small distance below the aperture the optical resolution of transmitted or fluorescent light is limited only by the diameter of the aperture.
The surface of the sample is scanned under the aperture and the transmitted or reflected light is detected point by point and line by line in order to generate an optical image.

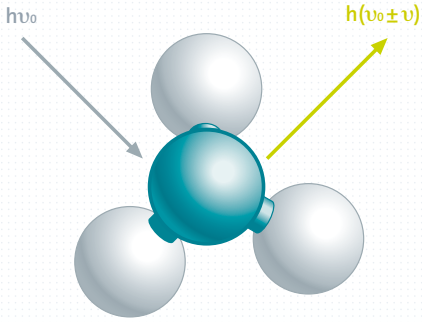
The aperture itself is located at the apex of a hollow pyramid on the micro-fabricated WITec SNOM cantilever. The optical resolution attainable is in the range of 50 – 100 nm.



Comparison of optical resolution between confocal microscopy (left) and scanning near-field optical microscopy (right) on a latex projection pattern.

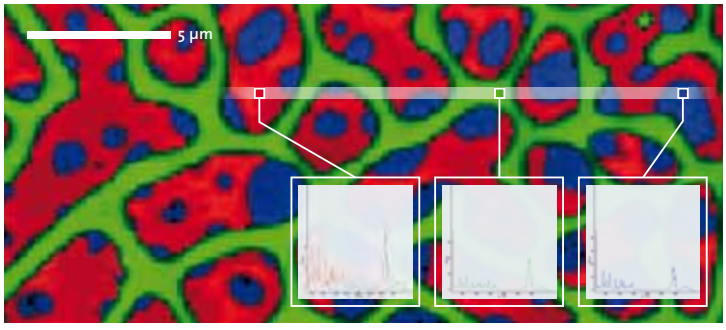
- Resolution beyond the optical diffraction limit
- Nondestructive
- Minimal, if any, sample preparation
- Ease of use in air and liquids

3D Chemical Imaging – Confocal Raman Microscopy



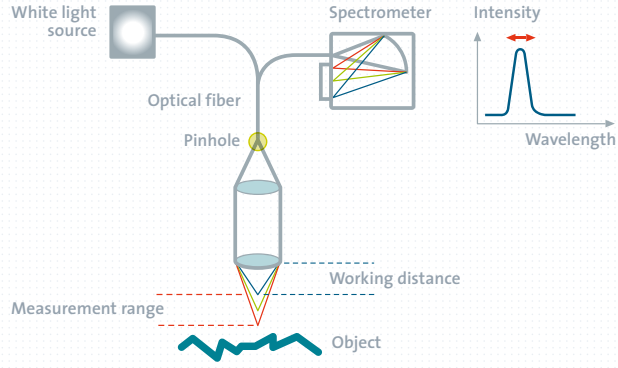
A Raman spectrum shows the energy shift of the excitation light (laser) as a result of inelastic scattering by the molecules in a sample. The excitation light excites or annihilates vibrations of the chemical bonds within the molecules. Different chemical species consist of different atoms and bonds, so each molecule can be easily identified by its unique Raman spectrum. As only molecular vibrations are excited (or annihilated), Raman spectroscopy is a nondestructive technique.

In Raman imaging the Raman spectra are collected with a high-throughput confocal microscope/Raman spectrometer combination. A high-sensitivity CCD camera connected to a powerful computer and software system is used to detect the Raman signal. With specialized software tools the imaging capabilities can be expanded even further. For example, it is possible to generate images by integrating over selected spectral areas, determining the peak width, peak position or by even more sophisticated procedures such as the fitting of complete spectra or cluster analysis.



- Imaging results may include: Information on the distribution of chemical compounds, amorphous/crystallinity-analysis and material stress characterization.
- Spatial resolution down to 200 nm
- 3D chemical imaging due to confocal setup
- Nondestructive
- Minimal, if any, sample preparation

TrueSurface™ Microscopy



The key element of this novel imaging mode is a topographic sensor that works using the principle of chromatic aberration. With this non-contact, purely optical profilometer technique it is possible to trace a sample's topography and follow it in a subsequent Raman measurement, thus remaining in focus throughout.

For profilometry a white light point-source is focused onto the sample with a hyperchromatic lens assembly: A lens system with a good point mapping capability, but a strong linear chromatic error. Every color has therefore a different focal distance. The light reflected from the sample is collected with the lens and focused through a pinhole into a spectrometer. As only one color is in focus at the sample surface, only this light can pass through the confocal pinhole. The detected wavelength is therefore related to the surface topography. Scanning the sample in the XY plane (up to 50 x 100 mm) reveals a topographic map of the sample. This map can then be followed in a subsequent Raman image so that the Raman laser is always kept in focus with the sample surface (or at any distance below the surface). The results are images revealing chemical and/or optical properties at the surface of the sample, even if the surface is rough or inclined.

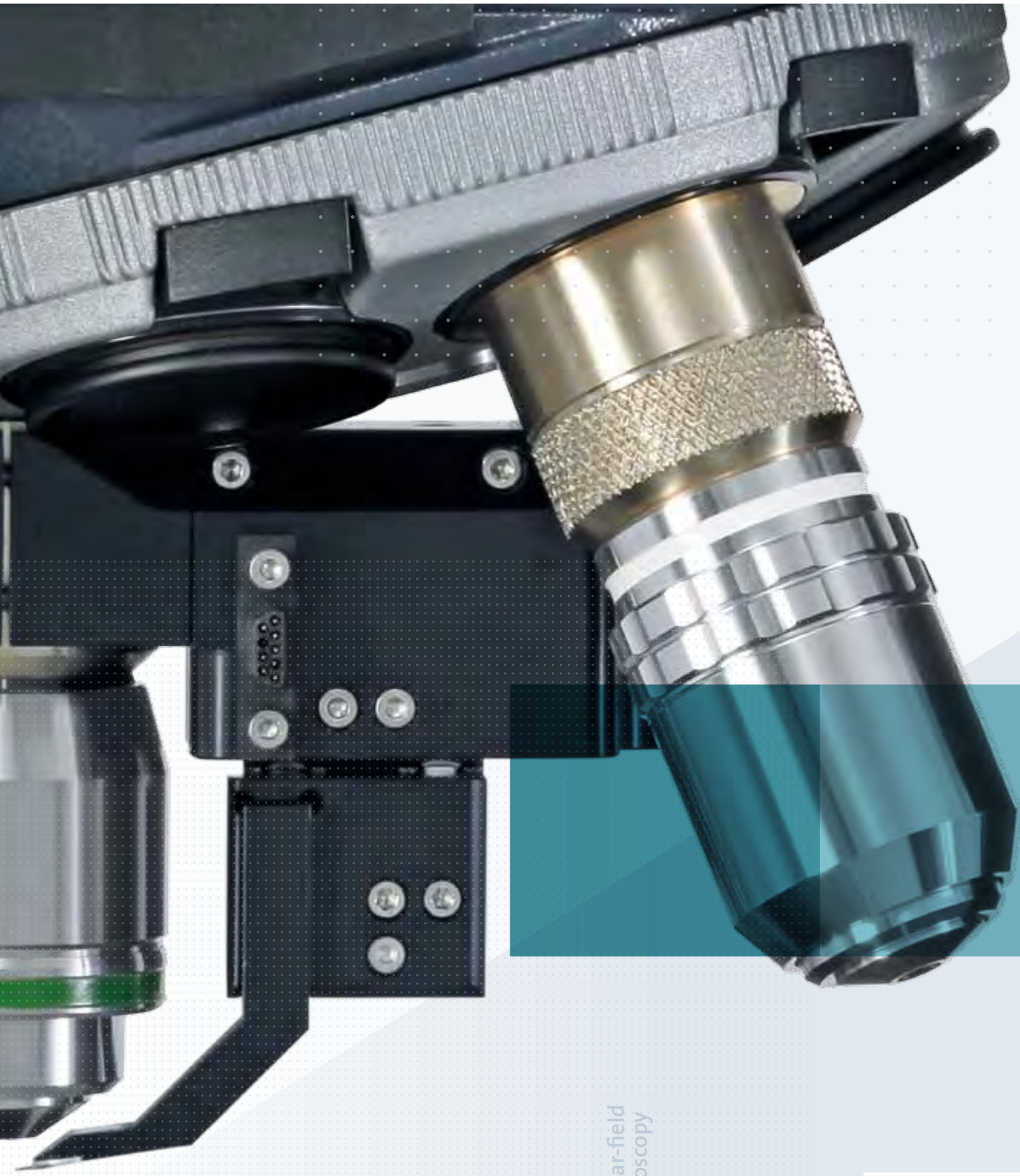
A topographic sensor is an ideal supplement to Atomic Force Microscopy (AFM). While AFM provides topographic information on small sample areas (< 100 µm) with ultra-high precision (< 1 nm) TrueSurface Microscopy can cover larger scan areas.

- TrueSurface Microscopy follows the surface topography with high precision, so that even rough or inclined samples always stay in focus.
- The topographic coordinates from the profilometer measurement are used to perfectly follow the sample surface in confocal Raman imaging mode.
- Combining large-area surface topography profiling with confocal Raman imaging and/or AFM allows for:
  - Topographic confocal Raman imaging
  - Topographic large-area surface imaging
  - Topographic spectroscopic Imaging

3.0

Systems

User-friendly tools for ambitious experiments

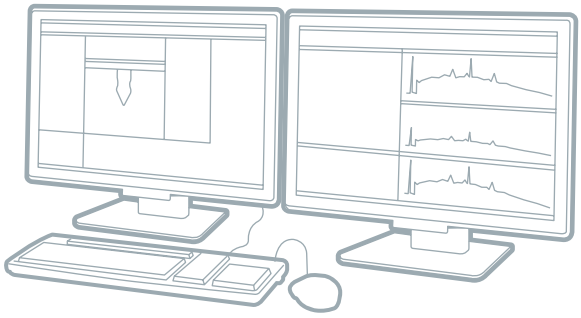


Atomic Force Microscopy

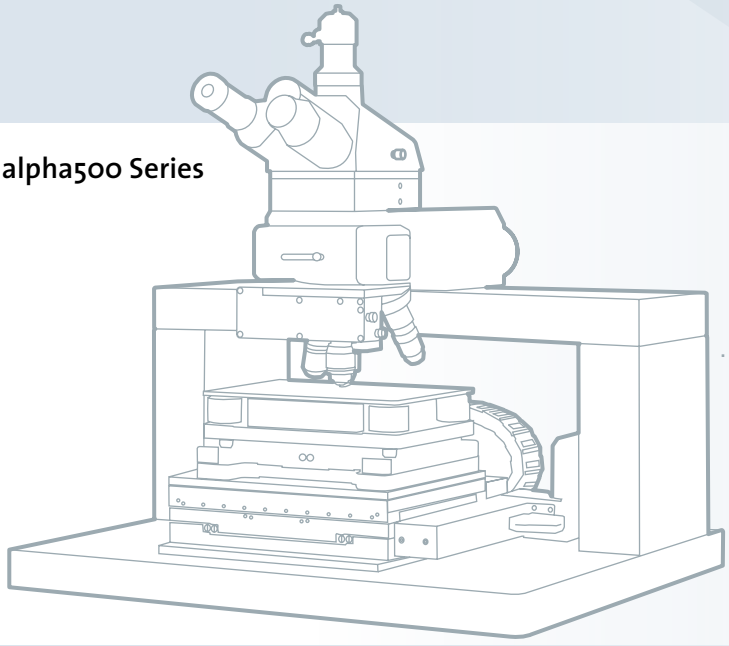
Scanning Near-field Optical Microscopy

The Microscopes

Outstanding Capabilities & Versatile Combinations



alpha500 Series



Microscope Control Software
- WITec Control

Data Evaluation Software
- WITec Project
- WITec Project Plus

Large Sample Setup: Stepper motor set for large-area confocal Raman imaging, automated measurements and depth profiling (100 x 150 x 10 mm)

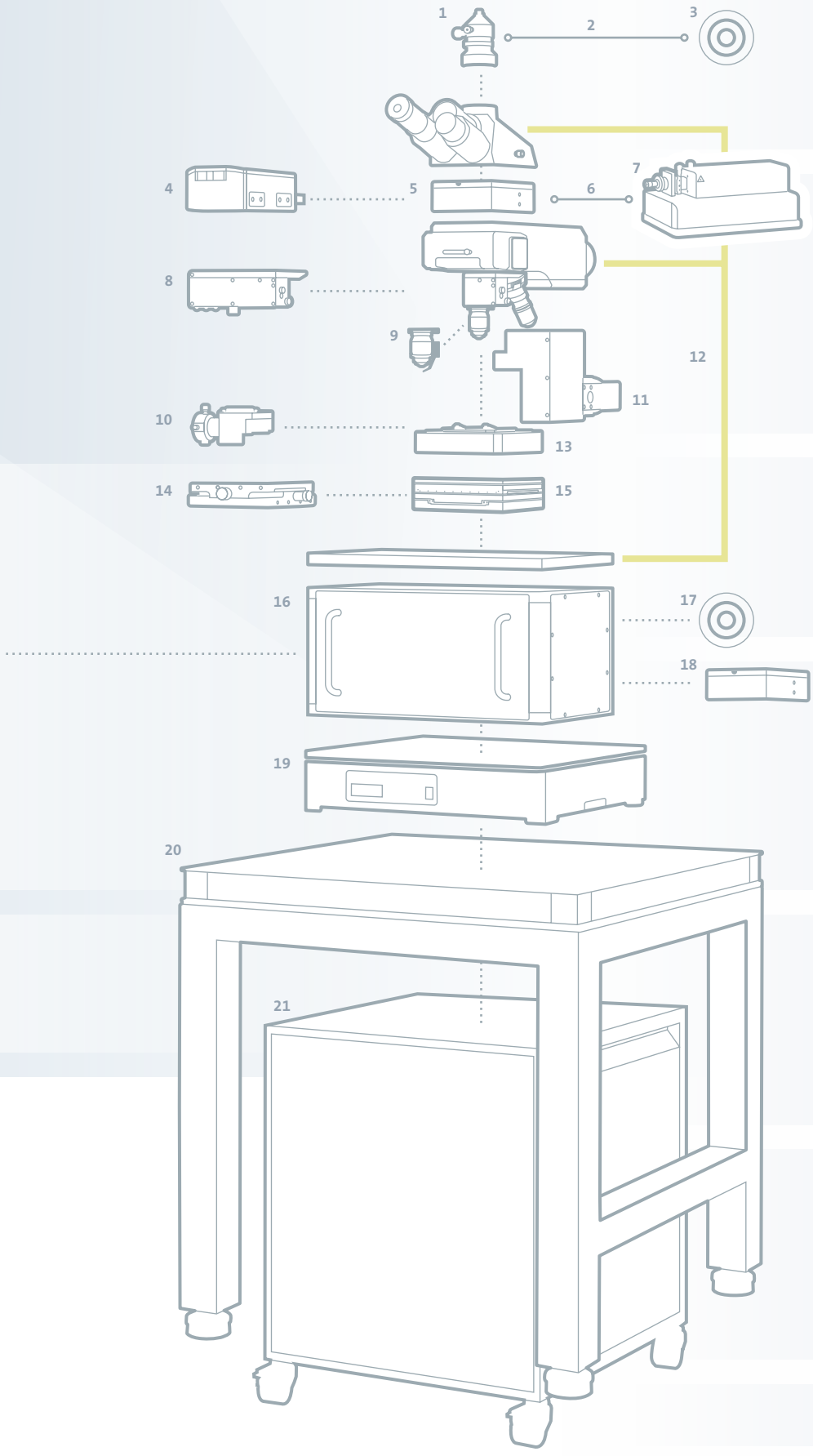
A research-grade optical microscope is the fundamental element of WITec's modular and flexible microscope series that can integrate virtually any scanning probe and optical microscopy technique. To achieve this flexibility, various components can be attached to this microscope base.

Focusing on innovations, WITec uses only state-of-the art, high quality, precise and optimized components. All WITec microscopes are built rock-solid and modular. Upgrades of the various models are possible at any time. It is possible, for example, to start with the alpha300 A and upgrade later to Confocal Raman Imaging (alpha300 R) or vice versa. Such modularity provides a universal tool for almost any optical or scanning probe microscopy application you may encounter. This philosophy leads to one of the best and most flexible pieces of equipment available for your experimental setup, enabling ground-breaking results and fundamentally new discoveries. With such a convenient and flexible instrument on hand, you can focus on your application.

BENEFITS

- Easy and cost-effective upgrade possibilities for unmatched flexibility or incremental additions to the experimental setup.
- A more comprehensive understanding of a sample in order to get the most out of the microscopic characterization.
- Access to the same sample area with different microscope techniques by simply rotating the microscope turret. No sample transfer necessary.
- A single software environment from one source for microscope control and data evaluation for the various combined microscope techniques guarantees a very high level of user-friendliness.

alpha300 Series – The WITec Building Blocks for High Resolution Optical and Scanning Probe Microscopy



1 **Detection Fiber Coupling Unit**
2 **Optical Fiber**
3 **Detectors**
- CCD (wavelength-optimized, back-illuminated)
- EMCCD (Ultrafast Raman)
- Deep Depletion (NIR Raman)
- InGaAs (Photoluminescence)
- Wavelength and/or application-optimized Raman spectrometer

4 **Wavelength-Optimized Three-in-One Laser Coupling Unit for SNOM and Raman**
5 **Wavelength-Optimized Laser Coupling and Filter Unit for SNOM and Raman**
6 **Optical Fiber**
7 **Lasers (355 – 785 nm), others upon request**

8 **AFM Beam Deflection Unit**
9 **SPM Objective for AFM and/or SNOM**
10 **SNOM Reflection Mode**
11 **Stepper motor for z movements** (focusing, depth profiling, 3D stacks)
12 **Research-grade Optical Microscope Base** with color video camera system and LED white-light illumination

13 **Piezo Scan-stage** 100 x 100 x 20 µm or 200 x 200 x 20 µm (AFM, SNOM, Raman Imaging), others optional
14 **Manual Microscope Stage (Raman, SNOM, AFM)**
15 **Motorized Microscope Stage** 25 x 25 mm (large-area confocal Raman imaging, automated measurements), Raman, AFM, other ranges upon request

16 **Inverted Microscope Base** for transmission SNOM and/or Raman incl. bottom view b/w video camera system
17 **SNOM Detectors**
- Single counting photomultiplier
- Single photon-counting avalanche photodiode

18 **Wavelength Optimized Laser Coupling** for excitation from below (SNOM, Raman)

19 **Active Vibration Isolation** (SNOM, AFM)

If your application requires any other components we are keen to discuss your individual requirements to get your experiment up and running. The modular design allows various other high-quality parts and detectors to be easily integrated.

20 **Rigid Support Frame**
21 **alphaControl**

Raman Microscopy

The WITec Raman microscope and imaging system combines an extremely sensitive confocal microscope with an ultrahigh-throughput spectroscopy system for unprecedented chemical sensitivity. A highly efficient combination of optical components such as filters, objectives and lenses used in conjunction with the most sensitive detectors available provide the highest spatial and spectral resolution.

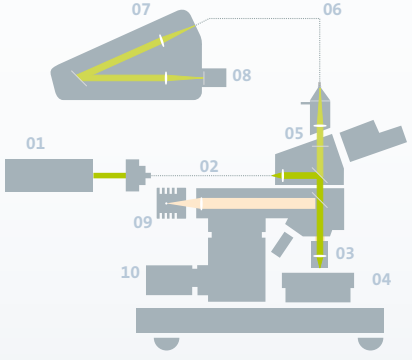
An optical system of such extreme sensitivity provides the advantages of reducing acquisition times for single Raman spectra down to well below 1 ms for ultrafast Raman imaging and the capability to perform time-resolved micro Raman spectroscopy with unprecedented time resolution.

Detecting signals from weak Raman scatterers or extremely low material concentrations or volumes along with the lowest excitation intensity levels is the unrivaled advantage of the WITec system for nondestructive analysis of precious and delicate samples. The typical micro Raman or Raman imaging experiment also benefits from this setup, which leads to a reduced overall experiment time and allows diffraction-limited spot sizes of as small as 200 nm.

The confocal setup of the microscopes also allows the compositional contrast of layered materials to be resolved by means of depth-profiling or 3D Raman imaging. For excitation, a variety of laser sources can be used in accordance with individual requirements. A video camera and white-light illumination system are integrated for high-resolution sample survey and alignment. All Raman spectra are collected and processed by the WITec Control and WITec Project Software, which also provide for post-processing and in-depth analysis of the spectral data.

RAMAN LAB ARRANGEMENT

BEAM PATH



01 Excitation laser
02 Optical fiber
03 Objectives
04 Scan table and/or stepper motor
05 Filter set
06 Optical fiber
07 Lens-based spectroscopy system UHTS 300
08 CCD detector
09 White-light illumination
10 Z-stage for focusing

KEY FEATURE

UHTS 300 Raman Spectrometer System

Ultrahigh-throughput spectrometer designed specifically for Raman microscopy and applications with low light intensities

In Raman microscopy, a high-throughput optical system is crucial in order to detect the low light intensities usually encountered. The ultrahigh-throughput of the UHTS 300 spectroscopy system enables up to 70 % transmission and is limited only by the efficiency of the grating.

With this spectrometer, the acquisition time for a single Raman spectrum can be below one millisecond per spectrum, which is essential in Raman microscopy where thousands of Raman spectra must be acquired.

The UHTS 300 features an extremely sensitive detector for the acquisition of the spectra. The thermoelectric-cooled, back-illuminated CCD detector chip is optimized for low Raman intensities (also available with deep depletion technology for enhanced NIR sensitivity or as an Electron Multiplying-CCD).

The UHTS 300 delivers exceptional spectral and imaging quality with the WITec Confocal Raman Microscopy Systems. Chemical information with a spatial resolution down to 200 nm laterally can be easily obtained with this highly sensitive instrumentation. The spectral resolution extends down to well below 1 wavenumber. A sensitivity of 0.02 wavenumbers for Raman peak shift has been demonstrated (Si, 532 nm excitation, 100 ms/spectrum integration time).

- **Lens-based, excitation wavelength optimized spectrometer**
- **Transmission:** 70 %
- **Focal Length:** 300 mm (500 mm optional)
  - One or two grating option
  - Type of grating customizable
- **Aperture Ratio:** f/4, microscope optimized (@532 nm excitation & 600/1800 l/mm grating)
- **Fiber entrance**
  - **Size:** 575 mm long, 345 mm wide, 140 mm high
- **CCD detector:**
  - Active Pixels 1024 x 127
  - Pixel Size 26 µm x 26 µm
  - Thermo-electric cooling (down to -70°C)
  - Peak QE of 95 %
  - Dynamic Range 16-bit
  - Spectroscopic EMCCD detector for Ultrafast and Ultrasensitive Confocal Raman Imaging (optional, active pixels 1600 x 200, pixel size 16 µm x 16 µm)

alpha300 M

alpha300 M

The alpha300 M is a high-end micro Raman system providing unprecedented throughput and sensitivity for in-situ chemical analysis of the most miniscule samples. As a member of the alpha300 microscope series, it offers full upgradability to high-speed Confocal Raman Imaging, Atomic Force Microscopy or Scanning Near-field Optical Microscopy, allowing the system to be altered to fulfill future requirements.

alpha300 M+

alpha300 M+

The alpha300 M+ features a 25 x 25 mm motorized scan-stage for sophisticated confocal Raman mapping. With a step size of 100 nm, diffraction-limited mapping is possible without compromise.

alpha300 R

alpha300 R

Being the first true Confocal Raman Imaging system capable of acquiring tens of thousands of spectra within minutes, the alpha300 R revolutionized the Raman spectroscopy market and established Raman Imaging as a standard technique. Ongoing development resulting from WITec's innovative spirit has kept the alpha300 R at the forefront of the Raman microscopy market and set the benchmark in terms of sensitivity, speed and imaging as well as spectral quality, spatial resolution, ease-of-use and compatibility with other measurement techniques.

In Confocal Raman Imaging a complete Raman spectrum is acquired at each image pixel and the images are calculated by isolating spectral characteristics (height, width, peak position, etc.) of these Raman spectra. Chemical properties of solid and liquid components can be analyzed with diffraction-limited resolution (~ 200 nm). No labeling or other sample preparation techniques are necessary. Due to an extremely accurate, feedback-controlled piezo-driven scan-stage, lateral resolution is not limited by any mechanical properties of the stage itself.

The depth profiling and 3D imaging capabilities of the alpha300 R are unparalleled and provide the ability to analyze the interior of transparent samples without microtome sectioning or freeze etching.

alpha300 & alpha500 | COMMON MODES & FEATURES

- Confocal micro Raman spectroscopy
- Single-point spectrum acquisition
- Single-point depth profiling
- Time series
- Wavelength-optimized UHTS300 spectrometer system

alpha300 M | MODES & FEATURES

- Convenient and precise manual sample positioning stage

alpha300 M+ | MODES & FEATURES

- Extremely accurate motorized scan-stage for large-area confocal Raman mapping

alpha300 R | MODES & FEATURES

- Raman Spectral Imaging
- Image stacks
- 3 D imaging and depth profiling
- Highly linear piezo-driven scan-stage with capacitive feedback control on all axes to eliminate hysteresis, creep and non-linearity with a scan range of 200 x 200 x 20 µm
- Exceptional accuracy over the entire travel and scan range (0.03 % linearity)

alpha300 R+

alpha500 R

alpha300 R+

The alpha300 R + incorporates a large-area motorized scan-stage for automated large and multi-area as well as multi-point measurements. In addition the piezo-driven scan-stage for high-resolution 3D imaging facilitates all features of the alpha300 R, providing a powerful instrument for a wide range of applications such as large sample analysis or automated screening.

alpha500

The alpha500 platform features a motorized sample-stage for large samples and customized multi-area/multi-point measurements. Each imaging mode can be run fully automatically, guaranteeing the most comprehensive surface inspection possibilities available for systematic and routine research tasks or high-level quality control.

For automated sample handling and analysis the alpha500 integrates a motorized sample-stage in addition to a high-resolution piezo scan-stage. The total travel range of the motorized sample-stage is 150 x 100 mm, allowing large samples to be analyzed automatically and effortlessly. It can be individually configured to handle a variety of samples such as wafers, well plates or others. Large-area scans, standardized routine measurement procedures or manually defined sequences can be precisely executed without any ongoing process control by an operator. This results in an improved utilization of the resources necessary for successful measurements and a lower cost of ownership. A high-definition auto-focus system for the optical modes guarantees the precision required for diffraction-limited optical resolution.

alpha300 R+ & alpha500 R | COMMON MODES & AUTOMATED FUNCTIONS

- Confocal micro Raman spectroscopy
- Single-point spectrum acquisition
- Single-point depth profiling
- Time series
- Wavelength-optimized UHTS300 spectrometer system
- Raman spectral imaging
- Image stacks
- 3 D imaging and depth profiling
- Highly linear piezo-driven scan-stage with capacitive feedback control on all axes to eliminate hysteresis, creep and non-linearity with a scan range of 200 x 200 x 20 µm
- Auto-focus (Confocal Microscopy/Confocal Raman Imaging)
- Automated travel of the positioning stage to user-defined coordinates on the sample
- Arbitrary user-defined number of measurement points selectable
- Automated execution of pre-defined measurement tasks

alpha300 R+ | MODES & FEATURES

- Extremely accurate motorized scan-stage for large-area confocal Raman mapping and automated measurements with a travel range of 20 x 25 mm

alpha500 | KEY FEATURES

- Extremely accurate motorized scan-stage for large-area confocal Raman mapping and automated measurements with a travel range of 150 x 100 mm
- Individual sample holder configurations implementable for flexible sample handling


Video camera system
Bright white light illumination
Beam deflection unit
WITec AFM objective
Highly precise motorized z-stage
High-resolution capacitive-feedback controlled piezo scan-stage
Active vibration isolation system

Atomic Force Microscopy (AFM)

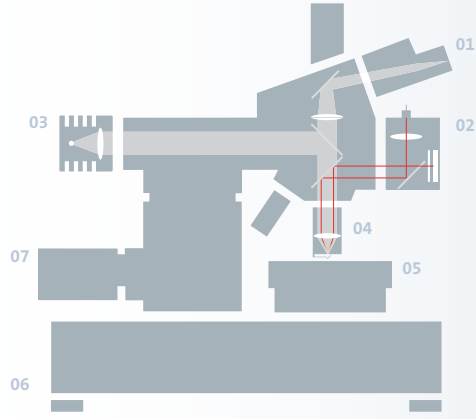
The WITec Atomic Force Microscope integrated into a research-grade optical microscope provides superior optical access, easy cantilever alignment and high-resolution sample survey.

Using optical pre-inspection with the aid of various optical illumination and detection techniques (e.g. bright field, dark field, polarization, fluorescence, etc.), the user can easily determine the point of interest for the AFM measurement. By simply rotating the microscope turret, the user can switch between optical and AFM modes quickly and accurately, maintaining the look and feel of optical microscopy in the AFM mode.

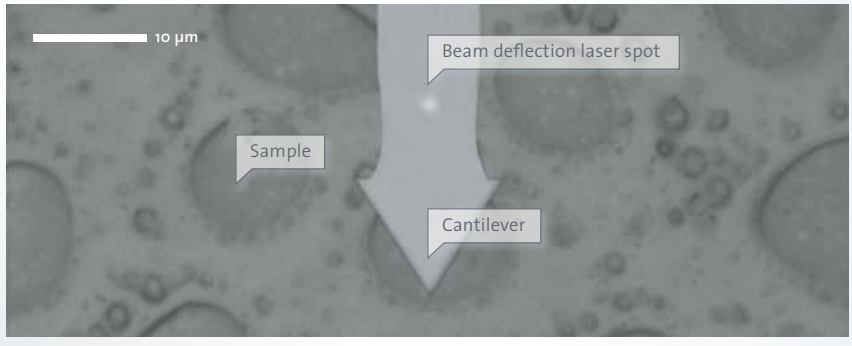
The optical mode combined with the advanced video camera system is the key to high-resolution sample survey and the quick selection of areas of interest.

BEAM PATH

01 Video camera system
02 Beam deflection unit
03 LED white light illumination
04 AFM objective with cantilever
05 Scan-stage
06 Active vibration-isolation table
07 Z-stage for focusing



SIMULTANEOUS CANTILEVER AND SAMPLE VIEW



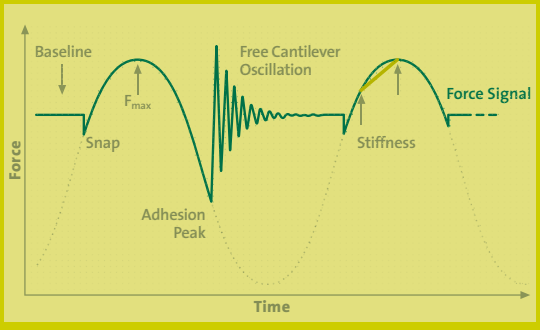
alpha300 A

The alpha300 A is a modular, user-friendly Atomic Force Microscope designed specifically for Materials Research, Nanotechnology, and Life Science. All standard AFM modes are supported, ensuring high flexibility throughout the full range of AFM applications.

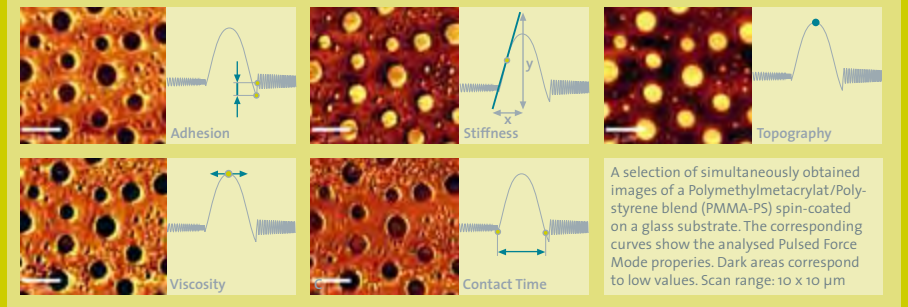
The WITec AFM objective used for the AFM mode provides a direct view of both sample and cantilever for easy and precise tip positioning. The alpha300 A system uses an extremely linear and precise capacitive-feedback controlled scan-stage featuring TrueScan™ for exceptional accuracy over the entire scan range of 100 x 100 x 20 µm.

PULSED FORCE MODE OVERVIEW

Imaging of Surface Properties



Pulsed Force Mode (PFM)



A selection of simultaneously obtained images of a Polymethylmetacrylat/Polystyrene blend (PMMA-PS) spin-coated on a glass substrate. The corresponding curves show the analysed Pulsed Force Mode properies. Dark areas correspond to low values. Scan range: 10 x 10 µm

Digital Pulsed Force Mode (DPFM)

Pulsed Force Mode (PFM)

Pulsed Force Mode (PFM) is a nonresonant, intermediate contact mode for Atomic Force Microscopy that allows the characterization of material properties such as adhesion and local stiffness along with the sample topography. Additionally, lateral forces are virtually eliminated. Therefore high-resolution mapping of delicate samples in air and fluids is easily attainable while maintaining a scanning speed comparable to contact-mode AFM. In contrast to most other intermediate contact techniques, the normal forces on the sample (introduced by the AFM tip) are controlled by the feedback loop. The PFM electronics introduce a sinusoidal modulation to the z-piezo of the AFM with an amplitude of 10-500 nm at a user-selectable frequency of between 100 Hz and 2 kHz: far below the resonant frequency of the cantilever. A complete force-distance cycle is carried out at this rate, resulting in the force signal as shown in the figure above.

The PFM is specifically suited for delicate and soft samples investigated in air or liquids at a high scanning speed. Digital Pulsed Force Mode (DPFM) is ideal for users with advanced surface properties characterization requirements, providing material properties analysis beyond adhesion and stiffness.

alpha300 A | FEATURES

- **Operating Modes**
  - Contact Mode/Lateral Force
  - Pulsed Force Mode
  - AC-Mode/Phase Imaging
  - Magnetic Force Mode
  - Nanolithography/Nanomanipulation
  - Temperature-controlled measurements
  - Air and liquid measurements
  - Virtually unrestricted experimental setup
- **Optical Microscope Capabilities**
  - Integrated high-resolution research-grade optical microscope
  - Easy and precise cantilever alignment
  - High-resolution sample survey
  - Color video camera system
  - Direct and simultaneous sample and cantilever viewing
- **Vibration Isolation**
  - Integrated active vibration-isolation table
  - Extremely low noise level
- **Linear Scan-Stage**
  - Sample scanning
  - Highly linear piezo-driven scan-stage
  - Capacitive feedback-control on all axes to eliminate hysteresis, creep and non-linearity
  - TrueScan™ Dynamic Position Control
  - Scan Range: 100 x 100 x 20 µm (200 x 200 x 20 µm optional)
  - Capacity for large samples
  - No image distortion
  - Exceptional accuracy over entire scan range
- **Beam-deflection Laser**
  - Low noise, highly focused optics for beam deflection laser
  - Low interference
  - Ultra-low laser noise

alpha500 A

The alpha500 A incorporates AFM capabilities within the automated system environment of the alpha500 platform.

Large samples with a size of up to 10 x 15 mm can be thus characterized automatically on the nanometer scale at many different sample positions. The automated tip approach allows software-controlled measurement procedures to be executed precisely on the nanometer scale.

KEY FEATURES

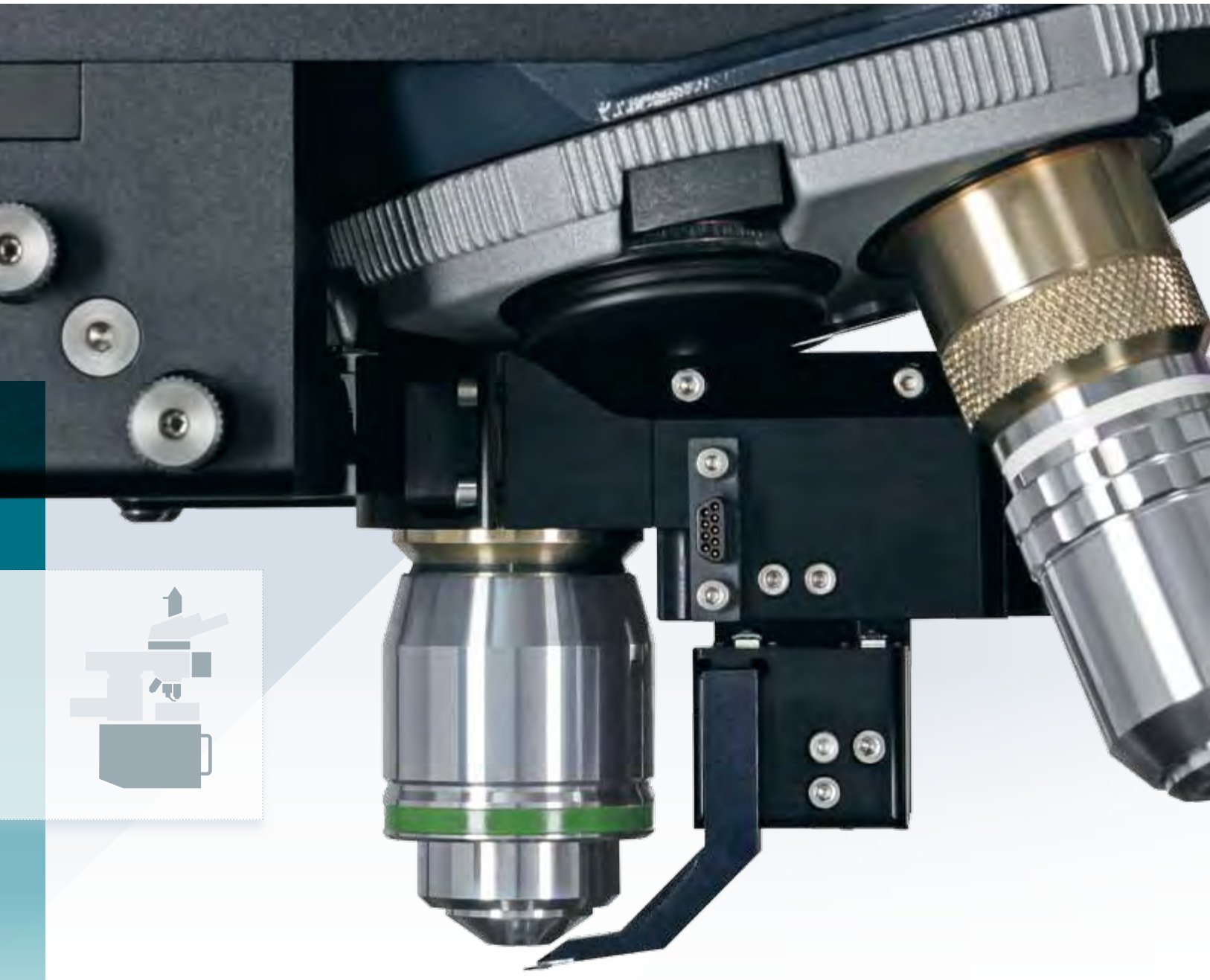
- High-resolution imaging of surface properties such as adhesion and stiffness along with the topography
- Especially suited for delicate and soft samples in air and liquids
- Lateral forces are virtually eliminated
- Fully programmable piezo modulation-frequency (131,072 points, 10 Hz-2 kHz)
- 16 Bit/5 MHz analog to digital converter
- Real-time hardware evaluation (DPFM)
- Storage of complete PFM curves over entire scan range (DPFM)
- Bidirectional linkage between imaged pixels and the corresponding stored force curves (DPFM)

Digital Pulsed Force Mode (DPFM)

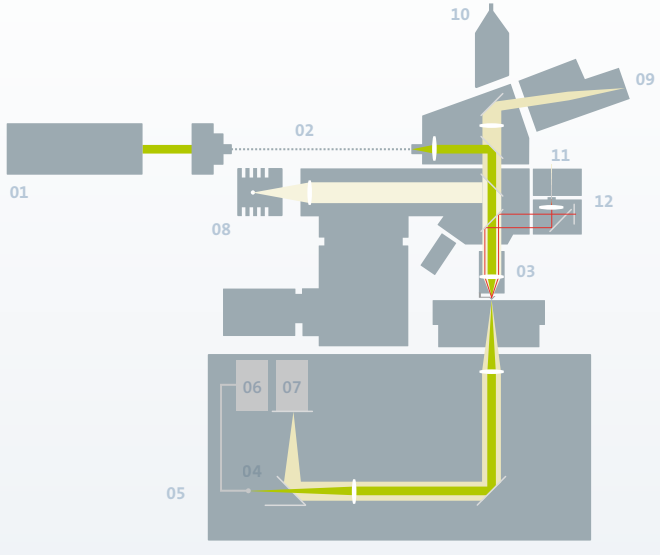
With DPFM a wide variety of sample properties can be extracted from force-distance curves; such as adhesion, stiffness, viscosity, energy dissipation, contact-time, long range forces, and many more. These properties can be analyzed and imaged simultaneously along with topography. Real-time processing of digitized force curves allows immediate online monitoring of the resulting image and facilitates the adjustment of the parameters for successful imaging results. Additionally, storage of the complete measurement provides unlimited access to all data through extensive post-processing data evaluation.

alpha500 A | FEATURES

Operating Modes	• Contact Mode/Lateral Force • Pulsed Force Mode • AC-Mode/Phase Imaging • Magnetic Force Mode • Nanolithography/Nanomanipulation • Temperature-controlled measurements • Air and liquid measurements • Virtually unrestricted experimental setup
Automated Functions	• Automated tip approach (AFM) • Automated travel of the positioning stage to user-defined coordinates on the sample • Arbitrary user-defined number of measurement points selectable • Automated execution of pre-defined measurement tasks
Automated Microscopy Stage	• Motorized sample-positioning stage • Travel range: 150 x 100 mm • Minimum step size: 100 nm • Individual sample holder configurations implementable for flexible sample handling • Highly-precise motorized z-stage for automated focusing and depth scanning • Highly linear piezo-driven scan-stage • Capacitive feedback-control on all three axes to eliminate hysteresis, creep, and non-linearity • TrueScan™ dynamic position control • Scan range: 100 x 100 x 20 µm (200 x 200 x 20 µm optional) • Exceptional accuracy over the entire travel and scan range (0.03 % linearity)
Vibration Isolation	• Integrated active vibration-isolation system • Highly stable rigid support frame to suppress ambient mechanical vibration • Extremely low noise levels
Beam-deflection laser (AFM Mode)	• Low-noise, highly focused optics for beam deflection laser • Low interference • Ultra-low-noise laser



BEAM PATH

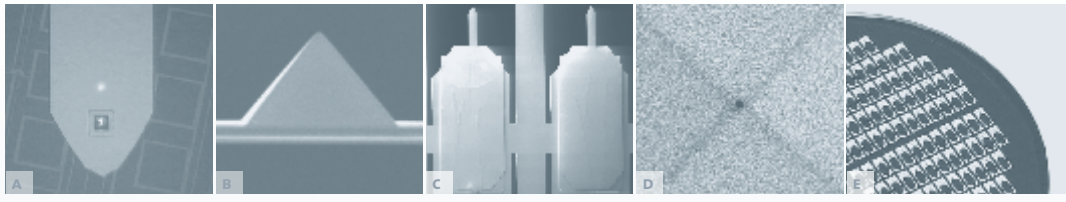


Scanning Near-field Optical Microscopy (SNOM)

Resolution in classical optical microscopy is limited by diffraction due to the wave nature of light. Therefore a resolution below approx. λ/2 is usually not possible. Scanning Near-field Optical Microscopy (SNOM) can easily overcome this diffraction limit and generate images with an optical resolution of typically between 60 and 100 nm. In addition, the technique requires only minimal sample preparation if any. With the featured WITec SNOM objective and the WITec cantilever SNOM sensors, imaging beyond the diffraction limit is accomplished quickly and effortlessly.

Typical applications are found in nanotechnology research and in particular the highly relevant fields of nano-photonics and nano-optics. In life science and materials research, SNOM allows the optical detection of the most miniscule surface structures of transparent as well as opaque samples. Using fluorescence techniques, even single-molecule detection can be easily achieved.

SNOM SENSORS



Cantilever SNOM Sensors

The alpha300 S uses unique, patented, high-quality micro-fabricated SNOM sensors, consisting of a silicon cantilever with a hollow aluminum pyramid as a tip. The SNOM aperture is at the apex of the pyramid. The laser light used for optical imaging is focused into the backside of the hollow tip and then onto the sample.

Due to the wide opening angle of the hollow pyramid, the transmission coefficient is much higher than that of fiber probes of the same diameter. An established and proven method of mass-production enables tips with apertures of varying size to be specified according to customers' individual requirements. Cantilever SNOM sensors are, unlike fiber tips, very robust and flexible in the z-direction and allow the beam deflection technique to precisely control the tip-sample distance.

All of these innovative characteristics make the handling of probes during near-field microscopy very easy and user-friendly for the most reliable optical imaging available beyond the diffraction limit.

- A Video camera top view of SNOM sensor and sample
- B Side view of cantilever pyramid
- C SEM image of SNOM sensors
- D EM image of aperture at the apex of the pyramid
- E SNOM cantilever wafer

01 Laser
02 Optical fiber
03 Cantilever SNOM sensor
04 Flip mirror
05 Optical fiber
06 Detector
07 Highly sensitive video camera
08 White light LED for Köhler illumination
09 Color video camera
10 Connector for signal pick-up in reflection
11 Fiber connector for beam deflection laser
12 Segmented photo diode

KEY FEATURE

Versatility & User-friendliness

The combination of Confocal Microscopy, SNOM and AFM in one instrument allows the use of confocal overview scans for quick and easy selection of the most appropriate sample area for the SNOM measurement. The SNOM mode can then be accessed instantly with a special SNOM objective holding the SNOM cantilever. While acquiring the SNOM image, the AFM topography is recorded simultaneously. This is another benefit of the cantilever sensors, enabling the well-established beam-deflection principle to be used for distance control. All standard optical modes such as transmission, reflection or fluorescence are available as well as all standard AFM modes. Various automated measurement procedures such as a high speed automatic cantilever approach and adjustment controlled by the intuitive software, make the operation of the system straightforward. For SNOM and confocal excitation, a variety of laser sources can be used for maximum experimental flexibility. To detect the scattered light, either a single-photon counting photomultiplier or a single-photon counting avalanche photodiode detector can be used, both guarded by a high-speed overload protection system. A highly sensitive spectrometer is also available.

alpha300 S

The alpha300 S is a user-friendly Scanning Near-field Optical Microscope (SNOM) that combines the advantages of SNOM, Confocal Microscopy and Atomic Force Microscopy in a single instrument. Switching between the different modes can easily be done by rotating the objective turret. The alpha300 S uses unique microfabricated SNOM Cantilever Sensors for optical microscopy with spatial resolution beyond the diffraction limit.

The WITec Scanning Near-field Optical Microscope alpha300 S operates using a unique near-field objective. It is mounted in the objective turret and provides access to SNOM or AFM. The microfabricated SNOM sensors are held magnetically at the end of the objective's arm, enabling simultaneous observation of the cantilever and sample. For quick cantilever alignment, the arm can be moved in all three dimensions by an integrated highly-precise inertial drive. The movements are controlled by the WITec Control software, which also provides convenient alignment routines. The objective not only focuses the excitation laser beam, but also the beam-deflection laser for distance control. Highly focused, ultra-stable optics guarantee low-noise measurements without interference from the two laser systems. Using standard AFM cantilevers, the alpha300 S includes full AFM capability.

TECHNICAL DATA

Operating Modes

- **Near-field microscopy:** transmission, reflection, fluorescence, collection, polarization, lithography, air and liquid measurements, temperature-controlled
- **Confocal microscopy:** transmission, reflection, fluorescence, Raman, polarization, lithography, air and liquid measurements, temperature-controlled
- **Atomic Force Microscopy:** contact, lateral force, Pulsed Force and AC-Mode, MFM, Nanolithography/Nanomanipulation, air and liquid measurements, temperature-controlled

Probes

- Micro-fabricated Cantilever SNOM Sensors, aperture size typically < 90 nm, others optional
- Standard AFM cantilever sensors

Beam-deflection distance control for SNOM and AFM

- Low noise, highly focused optics for beam deflection laser
- No interference with excitation laser
- Ultra-low laser noise

Optical System

- Integrated research-grade upright microscope
- Integrated inverted microscope
- Motorized focusing stage
- Color video camera system
- Highly sensitive b/w video camera system
- Direct and simultaneous sample and cantilever observation
- Easy and precise automatic cantilever alignment
- Automatic approach and beam path alignment
- Optical Resolution: Near-field mode 90 nm, depending on aperture size; Confocal mode typically 200 nm, diffraction-limited
- Optical beam delivery and signal pickup via optical fibers

Linear Scan-Stage

- **Sample scanning** Highly linear piezo-driven feedback-controlled scan-stage
- Capacitive feedback-control on all axes to eliminate hysteresis, creep and non-linearity
- TrueScan™ dynamic position control
- Scan range: 100 x 100 x 20 µm (200 x 200 x 20 µm optional)
- Capacity for large samples
- No image distortion
- Exceptional accuracy over entire scan range

Detectors

- Single photon counting Photomultiplier Tube (PMT)
- Single photon counting Avalanche Photodiode (APD), (optional)
- Automatic high-speed overload protection
- Spectroscopy extension (optional)

Excitation Lasers

- Multiple laser sources easily interchangeable
- Various lasers available, to best fulfill individual excitation equirements
- Flexible setup through optical fiber connections

4.0

Raman AFM

SNOM Raman AFM

Modularity & Combinations

The modular and flexible design of the WITec alpha300 and alpha500 microscope series guarantees easy and cost-effective upgrade and extension possibilities. By combining different techniques, a more comprehensive understanding of samples can be attained. Thus not only chemical information, but also structural and topographic information can be acquired at the same time and on the same sample area using only one instrument.

WITec's modular product line incorporates nearly all scanning probe and optical microscopy techniques to meet your individual requirements. Each WITec microscope model can always be equipped with the functionality of another variation of the alpha300 or alpha500 family either as a built-in feature or as a later upgrade.

The WITec hardware and software environment is used for all new features or upgrades, securing the best possible compatibility and ease of use.

The WITec FPM objective allows switching between FPM and optical mode by simply rotating the turret.

01 **SPM mode:** The SPM cantilever is held at the end of the objective's arm. The arm can be aligned with an attached highly-precise inertial drive.

02 **Optical modes:** Rotating the turret provides access to the optical modes allowing high-resolution confocal optical and chemical imaging to be perfectly linked with AFM or SNOM measurements without touching or transferring the sample.

01

02

Raman AFM

By combining the materials analysis capability of confocal Raman imaging with the ultra-high topographic and lateral resolution of an AFM, the chemical properties of the sample can be easily linked with the surface structure.

These two complementary techniques are available in a single instrument for more flexible and comprehensive sample characterization.

alpha300 AR

The well-established Raman-AFM combination alpha300 AR was the first integrated Raman AFM system on the market and sets the benchmark for combined instrument configurations.

The alpha300 AR incorporates the features of the Raman microscopy system alpha300 R for chemical imaging along with the Atomic Force Microscopy (alpha300 A) for a more comprehensive understanding of the samples.

alpha300 AR+

For extended scan ranges (up to 25 x 20 mm) or automated measurement tasks, the alpha300 AR+ combines all features of the alpha300 R+ and alpha300 A.

SNOM Raman AFM

alpha500 AR

The alpha500 AR was the first instrument on the market to combine Confocal Raman Imaging and Atomic Force Microcopy in an automated system for large samples. Both modes can be run fully automatically, guaranteeing the most comprehensive surface inspection possibilities for systematic and routine research tasks or high-level quality control with a maximum scan range of 50 x 100 mm.

alpha300 SR

For the user with challenging experimental requirements, the alpha300 SR facilitates Raman characterization and imaging in combination with Scanning Near-field Optical Microscopy for optical imaging with resolution beyond the diffraction limit.
It combines all features of the alpha300 S and alpha300 R.

alpha300 SR+

The alpha300 SR+ combines all features of the alpha300 R+ and alpha300 S for large-area Raman imaging and high-resolution optical imaging on selected sample positions.

5.0

Controller & Software

WITec Control

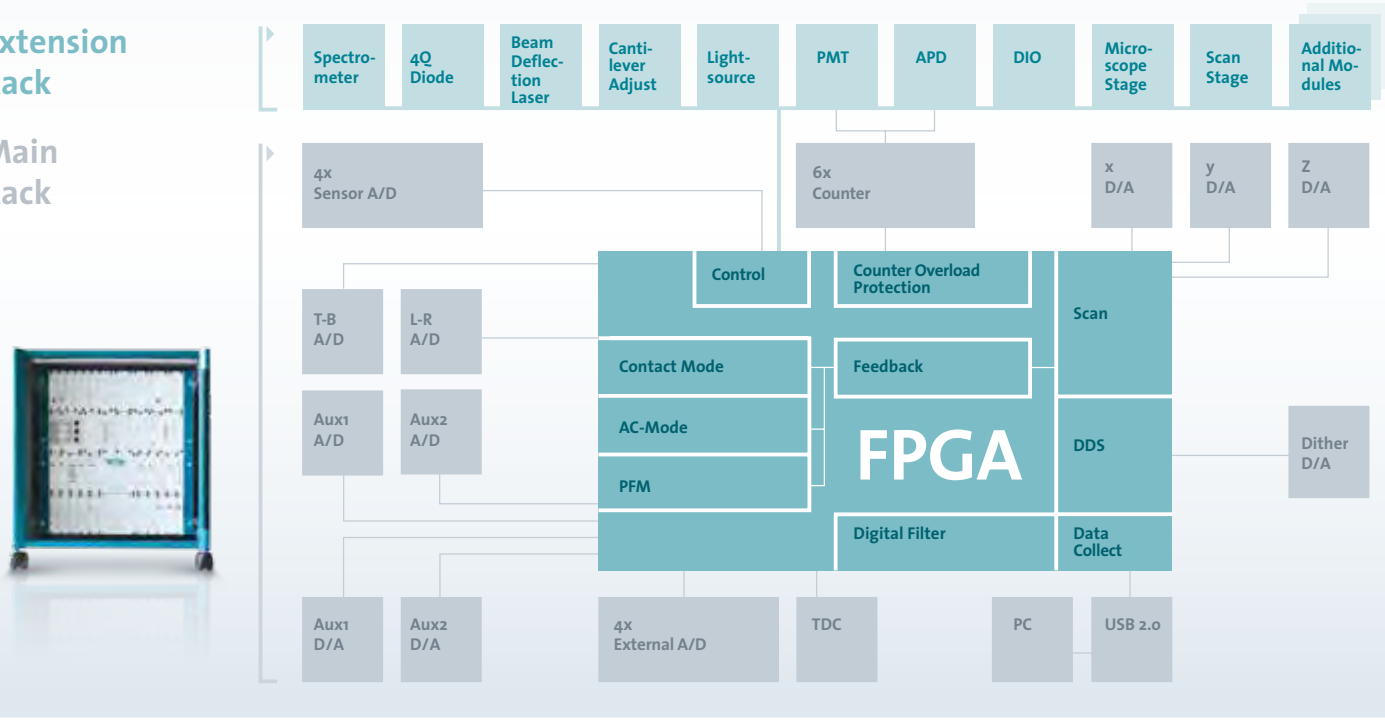
WITec Project

Witec Project Plus

Digital Controller for Scanning Probe Microscopy
alphaControl

alphaControl is a digital microscope controller based on a System-on-a-Chip concept. The digital component of the system is entirely realized within one Field Programmable Gate Array (FPGA). This results in speed, flexibility, accuracy, expandability and precise timing.

High-resolution scanning probe and optical microscopy requires multiple tasks such as scanning, feedback control, data acquisition, communication with the host computer, etc., to be performed simultaneously. The patented alphaControl FPGA-based architecture uses a star topology, which allows true parallel execution of such multiple tasks without conflicts, bottlenecks or decreases in performance, guaranteeing the autonomy of all modules as well as real-time data processing. This enables higher data throughput and unrivaled speed and system architecture stability. The separation of analog and digital circuitry reduces noise to extremely low levels and significantly enhances data and image quality. New functionality can be implemented at any time by simply reprogramming the FPGA. This flexibility – a cornerstone of the WITec product philosophy – is also reflected in the modular design of the alphaControl, consisting of a main rack housing the FPGA and its attached devices, and an extension rack for power supplies along with microscope and motor control units.



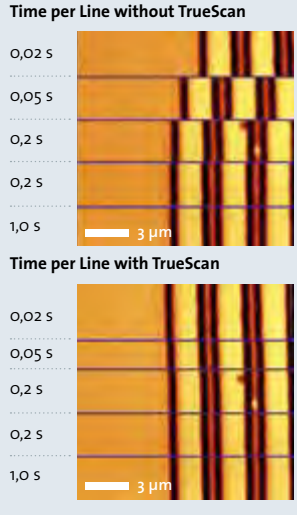
KEY FEATURES

- TrueScan™
- Automated high-speed cantilever approach
- High-speed frequency scan
- Automated light intensity adjustment
- High-speed overload protection for photon-counting detectors
- Two built-in fully digital lock-in amplifiers (real amplitude and real phase up to 500 KHz)
- Fully digital feedback-control
- High-speed USB 2.0 interface (continuous data stream of 20 MByte/s to and 10 MByte/s from host computer)
- Effective 19bit scan DACs
- Real-time rotation matrix and real-time translation for XYZ scans
- Precise timing
- Complete access to internal signals
- Expandable

KEY FEATURES

TrueScan™

TrueScan™ is an integrated scan engine including dynamic position error correction, continuous scanning without time gaps and script-based nanolithography. While a closed-loop scan system eliminates static position errors, TrueScan™ additionally incorporates dynamic position error correction capabilities. Extremely precise synchronization of scan motion with internal and external measurement tasks is achieved by triggers with sub-pixel time resolution.



Instrument Control and Data Evaluation Software
WITec Control, WITec Project and Witec Project Plus

The WITec Control and WITec Project Software platform is a powerful tool for sophisticated image-data acquisition, evaluation, post-processing as well as image generation for SNOM, AFM, Pulsed Force Mode AFM and Confocal Raman Microscopy. Its software architecture and graphical user interface enables an integrated and consolidated functionality incorporating the various techniques and measurement modes, thus reflecting the modularity of the WITec microscope family.

KEY FEATURES

- One software environment for all alpha300/500 microscope techniques, and measurement modes
- Unique features for unmatched chemical, structural and optical imaging at the highest resolution
- Lifetime flexibility due to modular architecture
- Intuitive and easy-to-use graphical user interface optimized for microscopy
- Accelerates workflow for experiments
- Less time-consuming due to unrivaled processing speed

WITec microscope family with alphaControl

WITec Control
- Control experiment and instrument settings
- Acquisition of image and/or spectroscopy data
- On- and offline data analysis and image processing

WITec Project
- Offline data and image processing
- Licensed for an unlimited number of users

WITec Project Plus
- Advanced offline data and image processing
- Chemometric post-processing features and superior data analysis tools: Cluster Analysis, Principal Component Analysis, Spectral demixing, Advanced Spectral Fitting, Image Correlation, and many more
- Single user license

WITec Control

WITec Control is the software that operates the alpha300 and alpha500 series and defines the experimental settings. The intuitive user interface changes automatically depending on the measurement mode and includes specialized routines and step-by-step sequences. The unique concept of a single Control Window enables quick access to a variety of parameters without resulting in the clutter of multiple windows. It lists all available parameters and provides detailed access to measurement tasks, settings and signals while its tree structure facilitates and accelerates the location of parameters. Information concerning important system parameters is clearly displayed in status windows. WITec Control additionally includes all features of the WITec Project data-evaluation package for on- and offline data evaluation and post-processing.

WITec Project

WITec Project is the stand-alone software tool for data evaluation and post-processing of the imaging data acquired with WITec Control. WITec's multi-user-friendly licensing concept allows the installation of WITec Project on an arbitrary number of computer workstations without additional individual licensing.

WITec Project Plus

WITec Project Plus is an add-on single-user software package for advanced chemometric and microscopic data evaluation. A variety of intelligent algorithms for multivariate data analysis of hyperspectral Raman data files allow the computerized unveiling of hidden structures automatically. Superior microscopic data analysis tools permit specialized, expert-level evaluation tools for advanced users.

6.0

Accessories & Extensions

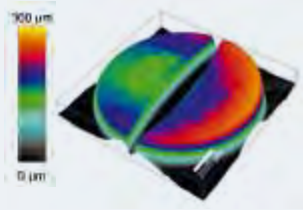

Raman Spectral
Database
Heating &
Multi Laser Coupler
TrueSurface Microscopy
TrueSurface

TrueSurface™ Microscopy

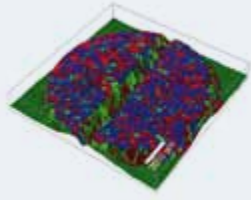
Confocal Microscopy Along with Large-area Optical Profiling

WITec's new TrueSurface™ Microscopy option (patent pending) allows confocal Raman imaging guided by surface topography. Confocal microscopy is often desirable and highly effective due to its suppression of out-of-focus light but can be challenging when analyzing large or rough surfaces because only those points that are in focus contribute to the image. TrueSurface Microscopy follows the surface topography with high precision, so that even rough or inclined samples always stay in focus. To achieve this unique capability, the WITec alpha500 series can be equipped with a highly precise sensor for optical profilometry. This sensor is used to perform a contactless measurement of the surface topography with sub-micron height resolution. The topographic coordinates from the profilometer measurement are used to perfectly follow the sample surface in confocal Raman imaging mode. The result is an image revealing chemical properties at the surface of the sample, even if the surface is rough or inclined.

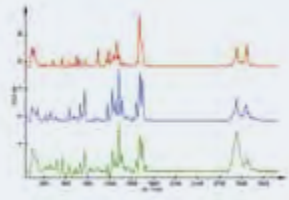
APPLICATIONS



Height profile of a pharmaceutical tablet. (12 x 12 mm)



Topographic confocal Raman image along the tablet's true surface.



Corresponding Raman spectra, Red + Blue: API, Green: Excipient

FEATURES & BENEFITS

- Extension for the WITec alpha500 series that combines Large-area surface topography profiling with confocal Raman imaging:
  - · Topographic confocal Raman imaging
  - · Topographic large-area Surface imaging
  - · Topographic spectroscopic imaging
- Unique combination (patent pending) delivers innovative application possibilities for new research techniques
- Ease-of-use through full integration with the alphaControl hardware and WITec Project software environment
- Scan speed up to 2000 pixels/s for rapid data acquisition
- Spatial resolution of 10 - 25 µm laterally and < 100 nm vertically to reveal an expanse of miniscule surface structures
- Light source: High intensity LED for highest throughput, accuracy and longevity
- Measuring distance: 10 mm – 16 mm providing wide-ranging sample size flexibility
- Multi-sensors easily configurable to meet virtually any application

WORKING PRINCIPLE

Confocal Raman imaging on large samples (mm-size) delivers an optical cross-section through the sample. If the sample is not transparent, only the intersection of focal plane and sample surface will give a Raman signal. Depending on the objective used, the focal plane might have a thickness of less than 1 µm.

The TrueSurface Microscopy mode enables the precise tracing of the surface while acquiring Raman imaging data, resulting in a true surface Raman image.

Multi Laser Coupler

Excitation Wavelength Selection with a Flick of the Thumb

The WITec multi-wavelength laser coupling unit advances the ease-of-use of alpha300 and alpha500 microscope systems equipped with more than one laser. Switching between various laser sources is performed by simply rotating the integrated filter wheel. The alignment and calibration of the laser beam path is perfectly maintained for accurate and flexible Raman imaging. Each excitation wavelength features a high-quality and wavelength-optimized filter set, enabling the highest throughput and greatly contributing to the exceptional speed and sensitivity of WITec's systems. Experiments specifically requiring a variety of lasers, for example, to eliminate fluorescence can benefit from such a multi-laser setup.

BENEFITS

- Maximum ease-of-use and simplicity provided by the integrated filter wheel for switching between lasers with a simple rotation.
- Flexible and versatile beam delivery via optical fiber: Lasers can be mounted as stand-alone units, preventing thermal or vibrational effects from influencing the measurements.
- Highest optical throughput due to wavelength-optimized filters and beam-splitters.
- Ensures long-term stability of calibration and beam path alignment.
- Compatibility with all existing WITec microscopes guaranteed.

SPECIFICATIONS & FEATURES

- Standard laser wavelengths: 355 nm, 488 nm, 532 nm, 633 nm, 785 nm (others upon request).
- Equipped with up to three Raman filter sets (filter assembly with laser bandpass filter, dichroic beam splitter and Raman edge filter for each laser wavelength).
- Four-position turret including open position for unblocked white-light microscopy.
- Extendable for laser-power measurements and polarization experiments.

Enclosure & Rigid Support Frame

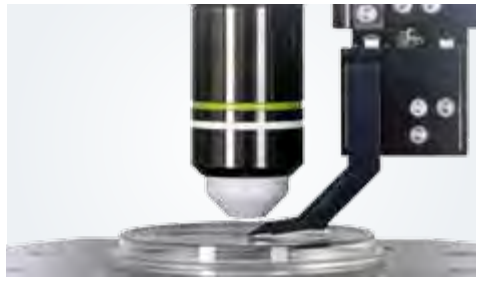
For maximum reduction of environmental interference such as acoustic or vibrational noise, the WITec support frame and enclosure system is ideally suited to achieving exceptional imaging results. The enclosure can be configured as an air-tight option to allow control of the gas-phase during the experiment. Equipped with an interlock, safety regulations (e.g. laser class I requirements) can be easily accommodated.

Nano-Lithography

Advanced nanotechnology often requires accurate and reliable nano-manipulation or nano-lithography tools for individual surface structuring. The WITec DaVinci nanolithography package allows these kinds of experiments in AFM as well as in optical modes with an integrated laser shutter control.

Imaging in Liquids

Imaging in liquids can be easily performed by using a water immersion objective in optical mode or the liquid imaging extension for AFM and SNOM modes. A specialized cantilever holder and inertial drive allows operation in fluids (e.g. in Petri dishes)



AC Mode for SNOM

The acoustic AC mode for the WITec microscope systems allows state-of-the-art resonant intermittent contact AFM and SNOM imaging specifically suited for soft and delicate samples. Acoustic AC mode enhances the imaging capabilities of contact mode AFM on such samples, eliminating lateral forces and delivering optimized resolution.

Heating & Cooling Stages

For experiments requiring an accurate temperature control, the alpha300 and alpha500 series can be equipped with a standard heating stage (room temperature up to 200 °C) or specialized heating and cooling stages (from -193°C up to 600°C).

Raman Spectral Database & Library

Identification of unknown chemical species in a sample by means of the measured Raman spectra can be achieved by using the powerful Raman spectral database, which is offered as an optional add-on to the WITec Project software suite.

Fiber-based Raman Probe

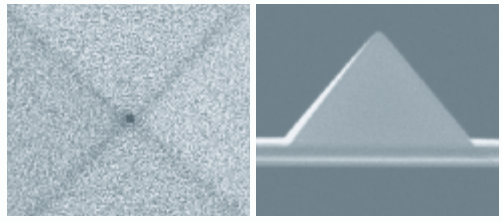
Samples which are not suitable for microscopic characterizations (size, localization, etc.) can be easily investigated with the fiber-based Raman probe option for the WITec UHTS300. Fully integrated within WITec's hardware and software environment, it takes advantage of the optimized sensitivity and allows easy correlation of the macroscopic data with microspectral findings.

Objectives

A wide range of objectives for various microscopic techniques are available to meet virtually any experimental requirement.

AFM & SNOM Cantilevers

WITec provides several types of high-quality AFM-Cantilevers for various AFM imaging modes. WITec is the only company capable of producing highly reliable SNOM cantilever sensors with apertures ranging from 50 nm to 100 nm. Each SNOM cantilever is individually tested before shipment.



Lasers

Excitation laser sources for SNOM and Raman imaging can be individually chosen and jointly attached to the microscope via reliable and customized optical fiber coupling. The influence of laser vibration or heat dissipation is therefore eliminated and ensures the lowest degree of drift during the experiment. Laser wavelengths range from 325 nm to 785 nm to fulfill a variety of experimental excitation requirements. Switching between different lasers is a matter of simply rotating a wheel in the coupling unit.

Photoluminescence

For the detection of photoluminescence spectra, an InGaAs detector can be easily attached to the spectroscopic setup. Raman experiments can be extended to acquire additional information in the near-infrared photoluminescence regime.

LabVIEW™ Interface

The optional LabVIEW™ interface provides access for WITecControl in order to design and control individual measurement procedures with LabVIEW™.

Time-Correlated Single-Photon Counting (TCSPC) Module

A time-correlated single-photon counting module for the alpha300 and alpha500 series makes possible several spatial and time-resolved measurement techniques such as fluorescence lifetime imaging or electro- and photoluminescence decay imaging.

7.0

WITec

Since its founding in 1997, WITec has established itself as a market leader in the field of nano-analytical microscope systems (Raman, AFM, SNOM). As reflected in WITec's maxim "Focus Innovations", our success is based on constantly introducing new technologies and a commitment to maintaining customer satisfaction through high-quality, flexible and innovative products.

WITec began with the introduction of the first Scanning Near-field Optical Microscope featuring easy-to-use cantilever SNOM sensors for reliable optical imaging beyond the diffraction limit. In addition, the Pulsed Force Mode accessory AFM module for imaging of local stiffness and adhesion along with topography was successfully introduced to the AFM community. With the release of the first Confocal Raman Imaging system in 1999, WITec outperformed the existing Raman mapping techniques in terms of sensitivity, speed and lateral resolution, pioneering Raman spectroscopy as a tool for true 3D chemical imaging. The modular design of WITec microscopes allows the integration of Confocal Raman and Scanning Probe Microscopy in one system. This innovation initiated the current boom in combined Raman/SPM systems.

In 2010 TrueSurface Microscopy was successfully introduced to the market. It facilitates the Raman imaging process on large, rough or inclined samples.

RECENT AWARDS

2008
- R&D 100 for the alpha500

2011
- PITTCON Editors Gold Award for TrueSurface Microscopy
- R&D 100 for TrueSurface Microscopy
- Microscopy Today Innovation Award for TrueSurface Microscopy

2012
- Photonics Prism Award Finalist (TrueSurface Microscopy)

WITec MILESTONES

1997
- SNOM System with unique Cantilever SNOM Sensors
- Pulsed Force Mode

1999
- Confocal Raman Microscope (WITec CRM 200) for fast 3D Raman imaging

2003
- WITec Mercury 100 Atomic Force Microscope
- Digital Pulsed Force Mode
- World's first integrated Raman/AFM combination

2006
- Modular alpha300 series with FPGA based control unit alphaControl

2008
- alpha500 series for large-area and automated multi-point measurements

2010
- TrueSurface Microscopy for confocal microscopy along with large-area optical profiling

To be continued ...

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		Bright Field Microscopy	Dark Field Microscopy	Phase Contrast Microscopy	Confocal Microscopy (Imaging)	Confocal Fluorescence Microscopy	Micro Raman (single point)	Raman Mapping	Confocal Raman Imaging	Ultrafast Raman Imaging	Inverted Beam Path	AFM	SNOM	Automated Multi-Area, Multi-point Measurements	TrueSurface Microscopy	
Raman	alpha300 M	+	↗	↗	↗	↗	+	↗	↗	↗	↗	↗	↗	↗	↗*	
	alpha300 M+	+	↗	↗	+	+	+	+	↗	↗	↗	↗	↗	↗	↗*	
	alpha300 R	+	↗	↗	+	+	+	↗	+	↗	↗	↗	↗	↗	↗*	
	alpha300 R+	+	↗	↗	+	+	+	+	+	↗	↗	↗	↗	+	↗*	
	alpha500 R	+	↗	↗	+	+	+	+	+	↗	O	↗	O	+	↗	
AFM	alpha300 A	+	↗	O	↗	↗	↗	↗	↗	↗	↗	+	↗	↗	↗*	
	alpha500 A	+	↗	O	↗	↗	↗	↗	↗	↗	↗	+	O	+	↗	
Raman/AFM	alpha300 RA	+	↗	O	+	+	+	↗	+	↗	↗	+	↗	↗	↗*	
	alpha300 RA+	+	↗	O	+	+	+	+	+	↗	↗	+	↗	+	↗*	
	alpha500 RA	+	↗	O	+	+	+	+	+	↗	O	+	O	+	↗	
SNOM	alpha300 S	+	↗	↗	+	↗	↗	↗	↗	↗	+	+	+	↗	O	
Raman/SNOM	alpha300 SR	+	↗	O	+	+	+	↗	+	↗	+	+	+	↗	O	
	alpha300 SR+	+	↗	O	+	+	+	+	+	↗	+	+	+	+	O	

↗ upgradeable
\+ included
O not applicable
* additional upgrade to alpha500 base required

- 3D Chemical Imaging
- Optical Imaging Beyond the Diffraction Limit
- Nanoscale Imaging Accessories
- Nanoscale Surface Characterization

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