



QUALITY ASSURANCE DOWN TO THE SMALLEST DETAIL.

That something special about Quality Analysis: in our organisation you will find the right experts and the right analysis methods for all materials and every requirement.

Our service areas:

- Industrial computed tomography
- Industrial metrology
- Technical cleanliness verification
- Materialography
- Chemical analytics

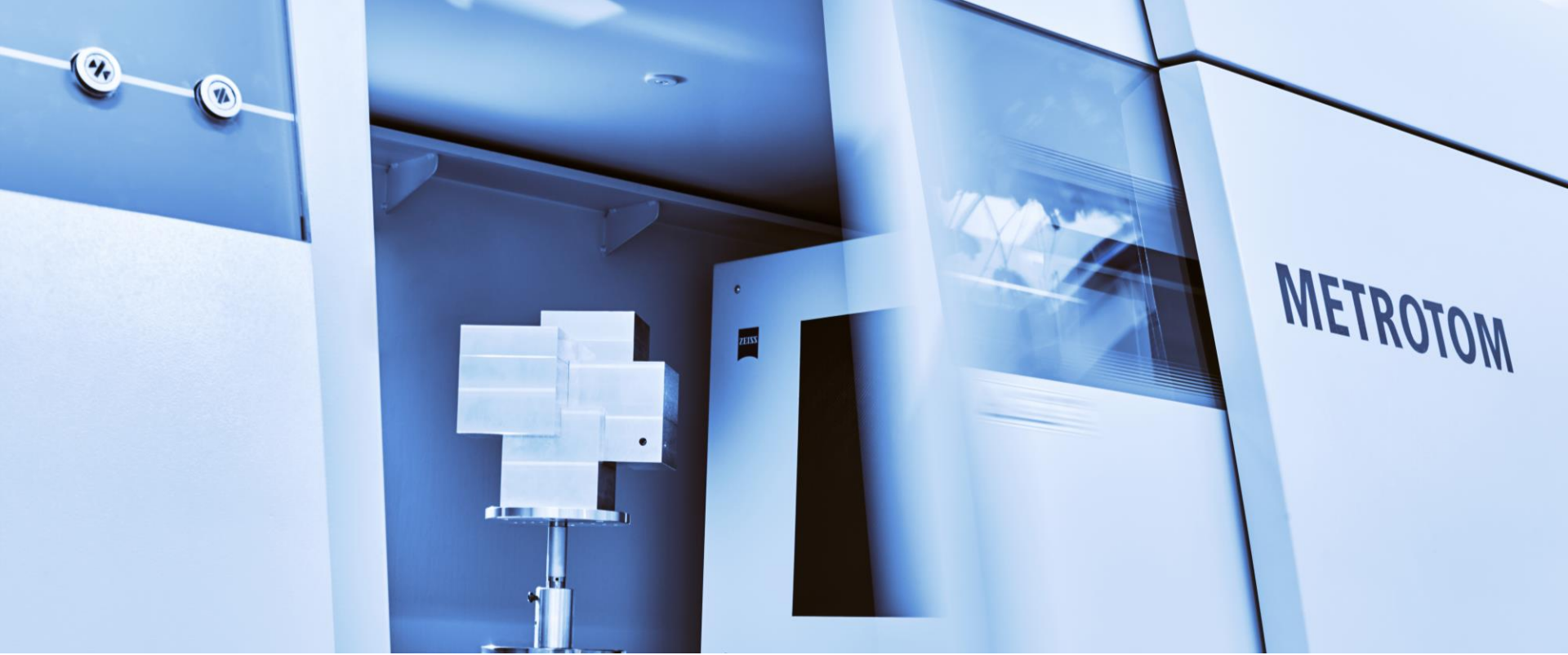


WHAT'S NEW?

Residual dirt analysis for electrostatic sensitive components (ESDS parts) in ESD protection zone

- ESD protection zone (EPA, electrostatic protected area) permanently integrated areas or mobile mountable
- Device complies with the requirements of the standard DIN EN 61340-5-1 (VDE 0300-5-1), which describes the general requirements for the protection of electronic components
- ESD control elements, such as work surface, LED magnifier light, wristband, floor covering, chair and clothing have been qualified by an external test laboratory
- Regular internal verification with own calibrated measuring instrument
- Trained and instructed personnel
- Continuous environmental monitoring (temperature und relative humidity)
- Personnel access to ESD protection zone only after discharge capability test (PGT, personnel grounding tester)





INDUSTRIAL COMPUTED TOMOGRAPHY

A NON-DESTRUCTIVE LOOK INSIDE THE COMPONENT.

With the aid of industrial computed tomography, we measure and analyse the internal and external characteristics of your components and provide information about porosities, defects, cracks, wall thicknesses, assembly states or make nominal-actual comparisons.

- Fast, reliable measurement results thanks to high machine capacity and extensive human resources
- Accredited measuring rooms with more than 1,000 m²
- Modern, flexible range of equipment: Varian, Zeiss and GE
- Data evaluation using VG StudioMax 3.2 and GOM Inspect Professional
- Very small and large components in all materials

With extensive experience and sound expertise, our experts obtain the best from every analysis so that you can rely on excellent measurement results.



WHAT'S NEW?

With our new high-resolution 3D X-ray microscope **GE nantom m** we can now undertake CT scans in the micrometre and nanometre range.

With a minimum resolution of $0.2 \mu\text{m}$ we can depict material and component characteristics with even higher resolution and close the gap to materials microscopy.

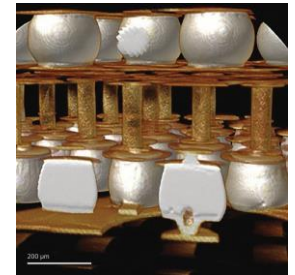
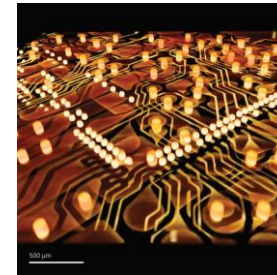
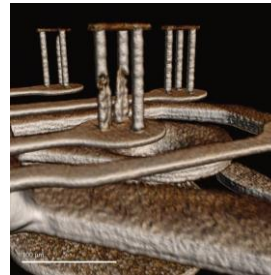
Application examples:

- High-resolution safety and quality checks on **lithium-ion batteries**
- Analysis of **coatings and material characteristics**
- Structure and damage analysis on **electronic components and semiconductors**
- Detailed analysis of shape, size and volume of powder particles from **additive manufacturing**



+ TECHNICAL DATA VERSA 520 +

- Minimum achievable voxel size: $<300 \text{ nm}$
- Voltage: 180 kV
- Maximum electron source power: 15 W
- Sample size: $\varnothing 240 \text{ mm}$, Height: 250 mm
- Sample weight: 3 kg
- 5-axis technology with 360° round table



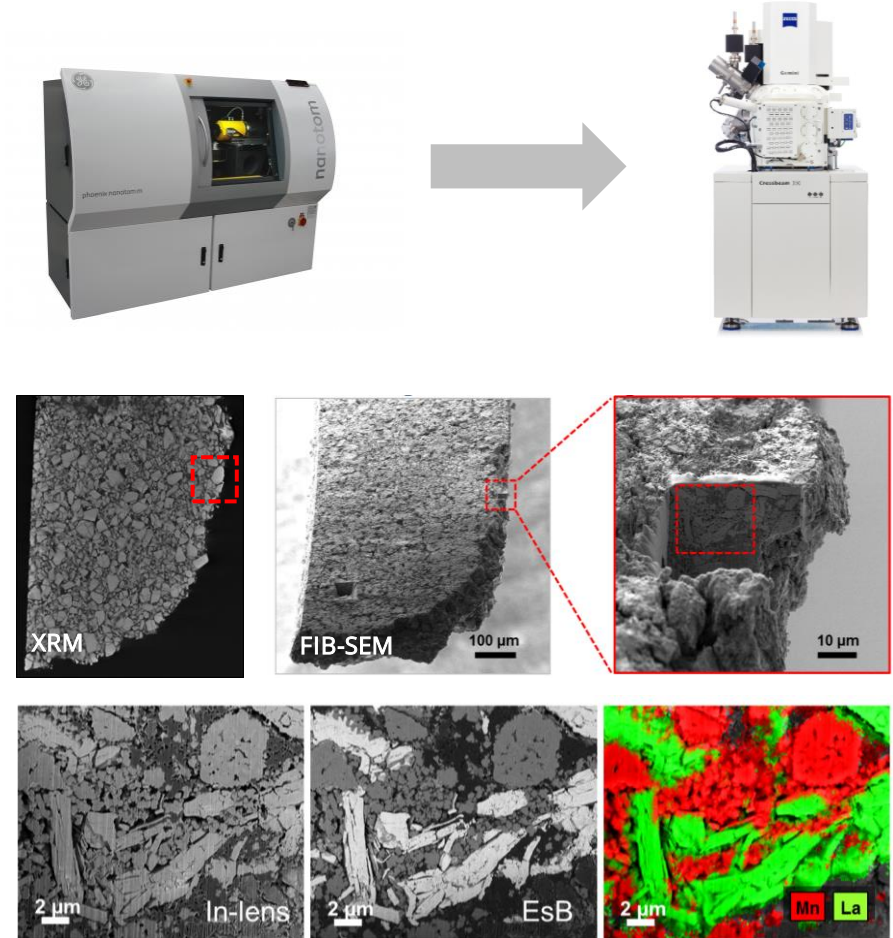
Source: Carl Zeiss AG

WHAT'S NEW?

Correlative workflow: NANO-CT and FIB-SEM

Material research increasingly requires multi-stage analyses or the combination of various analysis methods from the same field of interest.

Let us take the example of a **lithium-ion battery**: in the X-ray microscope (XRM) we obtain various 2D and 3D views of the battery and can non-destructively investigate the distribution of the active cathode material at the particle level. The distribution, homogeneity and density of the active material are important parameters for determining the performance of the battery. In the correlative workflow we now have the possibility of further analysing conspicuous areas with even higher resolution. In the crossbeam, we can specifically prepare and analyse the areas detected. By means of various detectors we can also, for instance, depict material contrasts and analyse them using qualitative mapping.



Source: Carl Zeiss AG; General Electric Deutschland Holding GmbH Hochschule Aalen, Institut für Materialforschung; Christian Weisenberger, Andreas Kopp, Timo Bernthaler, Gerhard Schneider

WHAT'S NEW?

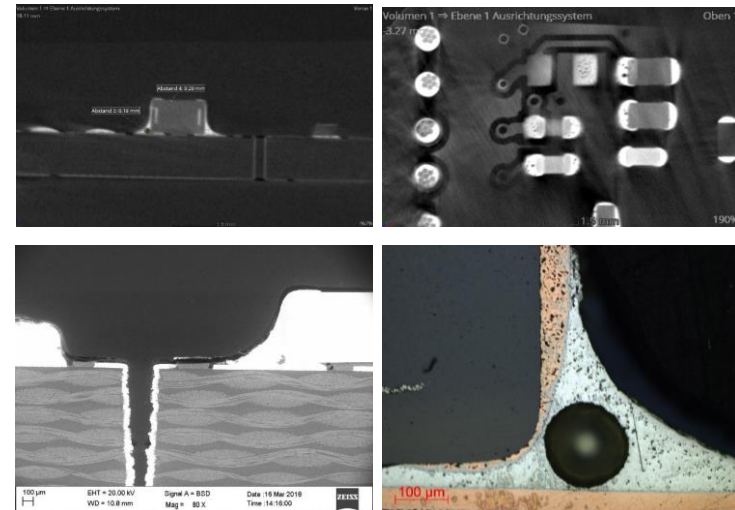
Stress Testing & Analytics

Detection and analysis of material change and component behavior through targeted stress simulations, such as.

- Thermal stress: thermal shock, climate change or temperature change
- Stressing under defined environmental conditions (environmental simulation)
- Corrosion change test
- Salt spray test

Through the targeted application of component stress simulations, we can detect and analyse changes in the shape of components or defect patterns such as cracks, fractures, inclusions or assembly conditions in downstream analysis. We offer a **wide range of non-destructive and destructive analysis options** for this purpose.

Especially for electronic components, such as printed circuit boards, but also plastic or ceramic components, the comprehensive analysis offers a better understanding of the damage processes and the damage behavior on the component.





METROTOM



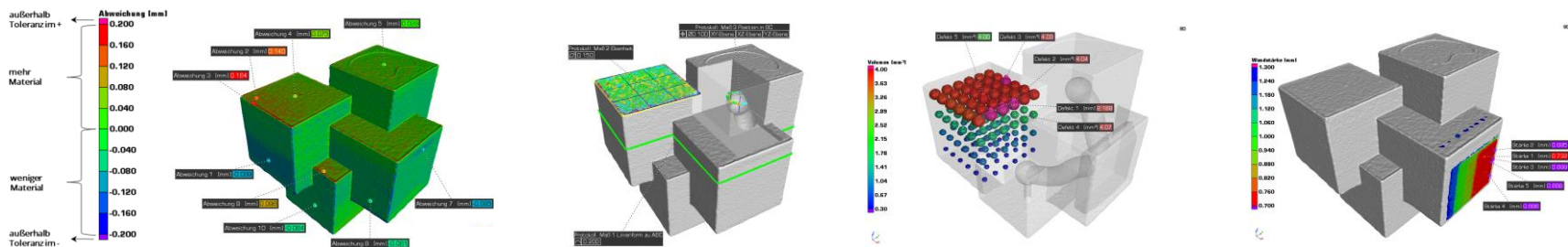
METROTOM

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3D COMPUTED TOMOGRAPHY.

Non-destructive analysis of complex internal and external geometries

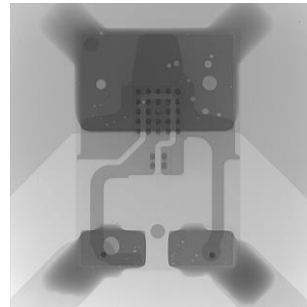
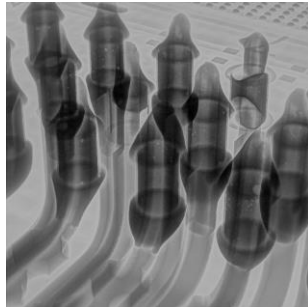
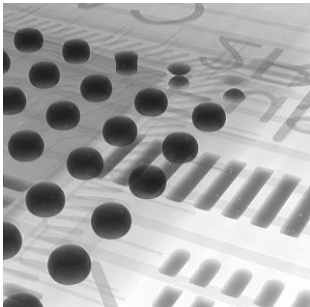
- High-resolution depiction of the 3D volume with the ability to detect detail down to $0.3\ \mu\text{m}$
- Metrological evaluation of standard geometries and freeform surfaces
- Geometry comparison, e.g. nominal-actual comparison
- Versatile volume-based analysis options, e.g. defect analysis, porosity and inclusion analysis, assembly checking, foam structure analysis
- Components made of various materials with diameter of up to 550 mm and height of up to 1200 mm



2D X-RAY INSPECTION.

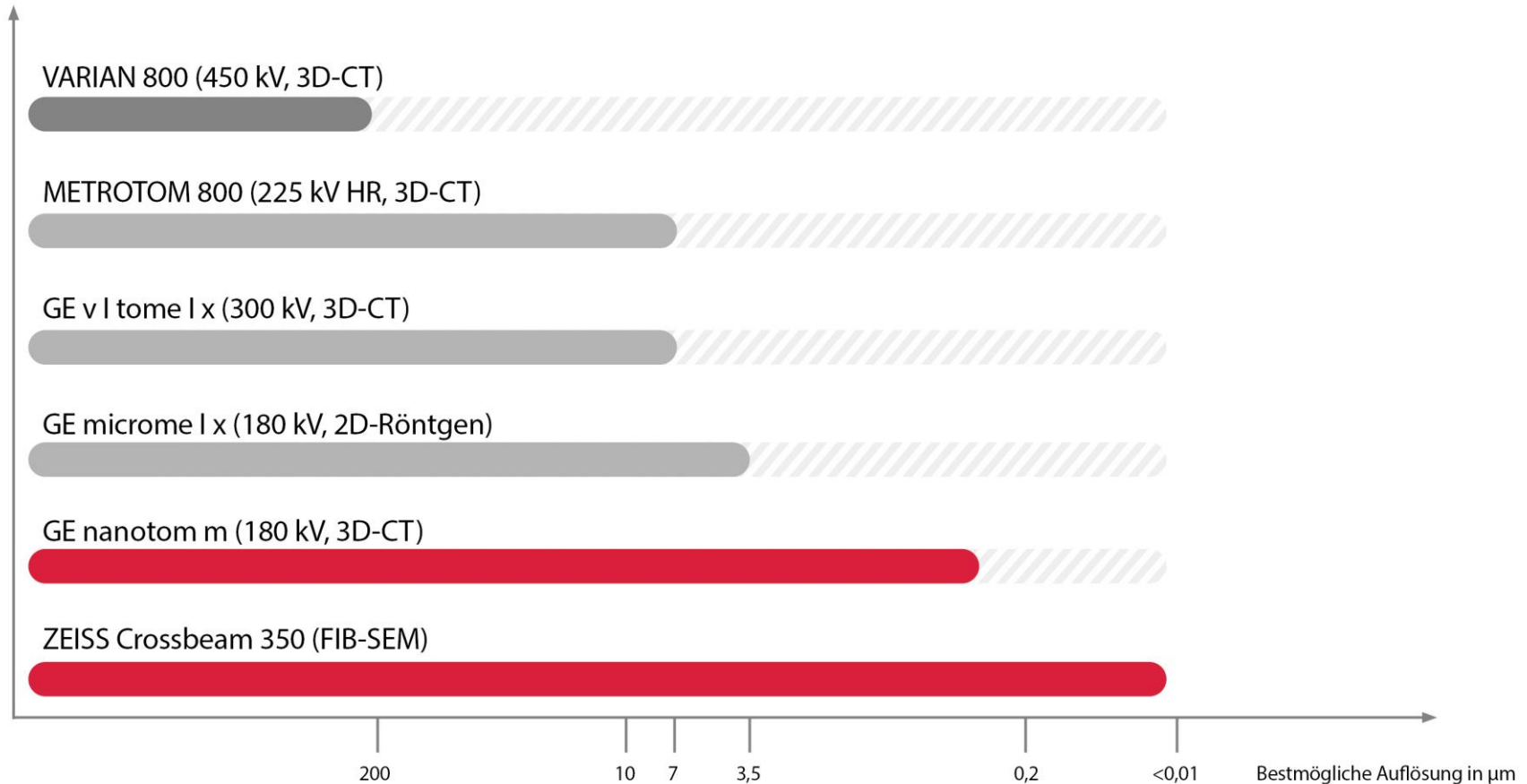
2D X-ray inspection for accurate detection of defects in realtime

- High-resolution 2D X-ray images with the ability to detect detail down to $0.5\ \mu\text{m}$
- Qualified, certified personnel in accordance with DIN EN ISO 9712 as well as IPC-A 600 and IPC-A 610
- Area-based analysis options by means of planar CT
- Preliminary inspection for 3D computed tomography and microscopic material analyses
- Non-destructive inspection of high-quality integrated circuit packaging, for example for the inspection of soldered joints or semiconductors



TECHNICAL EQUIPMENT.

With our versatile CT systems, we have the ability to perform CT examinations down to the micro- and nanometer range.



TECHNICAL EQUIPMENT.

Broad range of services for widely varying customer requirements

Comprehensive analysis options in the area of 2D X-ray inspection and 3D computed tomography independent of the component size and material



GE nanotom m

180 kV



GE microme|x

180 kV
(2D-Röntgen)



ZEISS Metrotom 800

225 kV



GE v|tome|x

300 kV



Varian Actis 800

450 kV



Quelle: Carl Zeiss AG, General Electric Deutschland Holding GmbH



INDUSTRIAL METROLOGY

YOU HAVE THE MEASURING TASK, WE HAVE THE APPROPRIATE MEASURING METHOD.

Whether **TACTILE**, **OPTICAL** or using **CT**: to suit your measuring task, we check for dimensional accuracy and surface quality using the appropriate method or we combine various methods. For cost-effective measurement and analysis results on time:

- Fast, reliable measurement results thanks to high machine capacity and extensive human resources
- Accredited measuring rooms with more than 1,000 m²
- Modern, flexible range of equipment: Zeiss, Mitutoyo and GOM
- Very small and large components in all materials

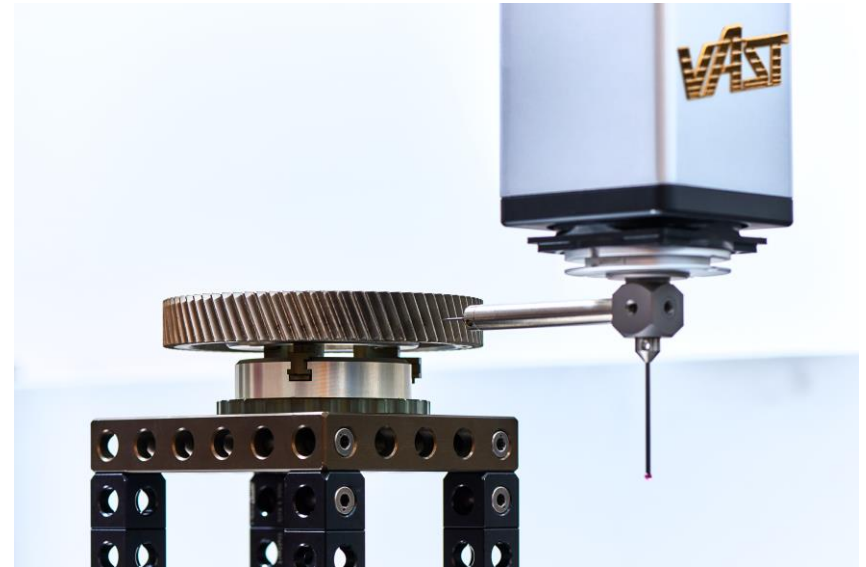
You profit from all the advantages of the related method. With extensive experience and sound expertise, our experts obtain the best from every analysis method so that you can rely on excellent measurement results.



TACTILE METROLOGY.

Checking quickly and precisely from the individual dimension to serial measurements

- Highly precise measurement of standard geometries, freeform surfaces, shape and position, surfaces and contours
- Surface comparison, e.g. nominal-actual comparison
- Very high dimensional accuracy for precision fits and gearwheel measurement
- Measuring volume up to $x = 1200$, $y = 3000$, $z = 1000$ mm
- Initial sampling in accordance with VDA and PPAP



Mitutoyo Crysta-Apex	ZEISS O-Inspect	ZEISS Contura	ZEISS Accura	Mitutoyo Euro-CApex	ZEISS Contura	ZEISS Prismo Naviagtor	ZEISS Accura	ZEISS Prismo Naviagtor	Mitutoyo Crysta-Apex	ZEISS Accura
X = 505 Y = 705 Z = 405	X = 800 Y = 600 Z = 300	X = 700 Y = 1000 Z = 600	X = 900 Y = 1200 Z = 800	X = 900 Y = 1600 Z = 600	X = 1000 Y = 1200 Z = 600	X = 1200 Y = 1800 Z = 1000	X = 1200 Y = 1800 Z = 1000	X = 1200 Y = 2400 Z = 1000	X = 1200 Y = 2000 Z = 1000	X = 1200 Y = 3000 Z = 1000

Source: Carl Zeiss AG, Mitutoyo Deutschland, GmbH

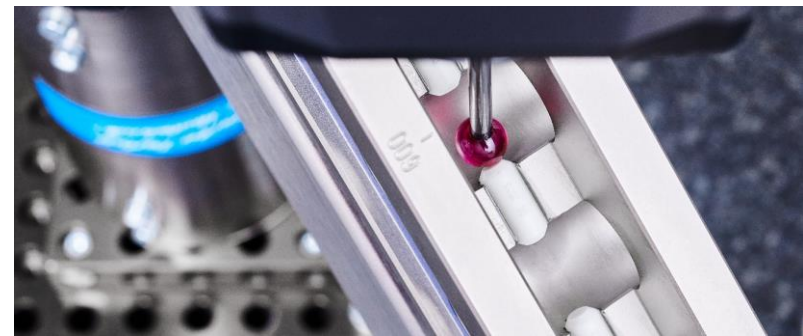
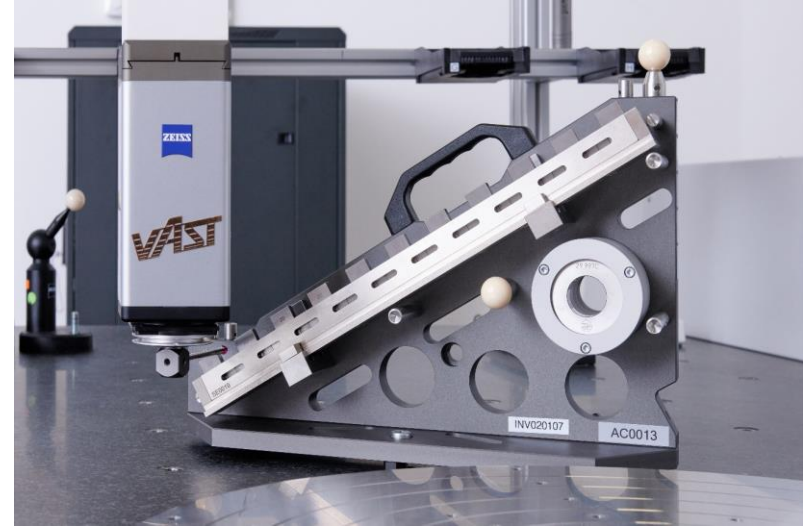
CMM-ACCEPTANCE CHECK

We check the accuracy of our coordinate measuring machines at regular intervals according to DIN EN ISO 10360 and VDI/VDE 261.

This check is carried out with a 1540 mm step gauge block for the X/Y/Z axes and with a universal test body (CMM Check). The basis of the CMM-Check is a flexurally rigid base body on which high-precision, calibrated dimensional standards and form standards are mounted, such as setting rings, ceramic balls, mating standards and two gauge blocks. This allows properties such as probing behavior or scanning properties of the measuring head, length deviations or four-axis deviations to be recorded for our CMM with rotary table.

Both standards are metrologically traceable and are monitored by an external accredited testing laboratory. Due to the regular interim tests, we can always guarantee the measuring equipment capability and suitability of our systems, analogous to the accreditation according to DIN EN ISO/IEC 17025:2018.

We also offer the calibration and testing of coordinate measuring machines as a service at your site. Our experts will be happy to inform you about this: 07022 2796-832



OPTICAL METROLOGY.

3D digitalisation for the fast acquisition of all external geometries

- Measurement of standard geometries and freeform surfaces
- Complete component analysis and early trend analysis during series production
- Surface comparison, e.g. nominal-actual comparison
- 3D digitalisation and reverse engineering
- For mobile applications, independent of component sizes



ZEISS
O-Inspect



GOM ATOS Q
(8M)



GOM ATOS 5
(12M)

X = 800
Y = 600
Z = 300

100 x 70 x 60 mm²
170 x 130 x 130 mm²
270 x 200 x 200 mm²
350 x 260 x 260 mm²
500 x 370 x 320 mm²

320 x 240 x 240 mm²
700 x 530 x 520 mm²
1000 x 750 x 750 mm²

Source: Carl Zeiss AG, GOM GmbH

3D COMPUTED TOMOGRAPHY.

Non-destructive analysis of complex internal and external geometries

- Measurement of standard geometries and freeform surfaces
- Surface comparison, e.g. nominal-actual comparison
- Versatile volume-based analysis options, e.g. defect analysis, porosity and inclusion analysis, assembly checking, foam structure analysis
- Components made of various materials with diameter of up to 550 mm and height of up to 1200 mm



Varian Actis 800

450 kV



GE v|tome|x

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GE microme|x

180 kV
(2D-Röntgen)



GE nanotom m

180 kV

Source: Carl Zeiss AG, General Electric Deutschland Holding GmbH

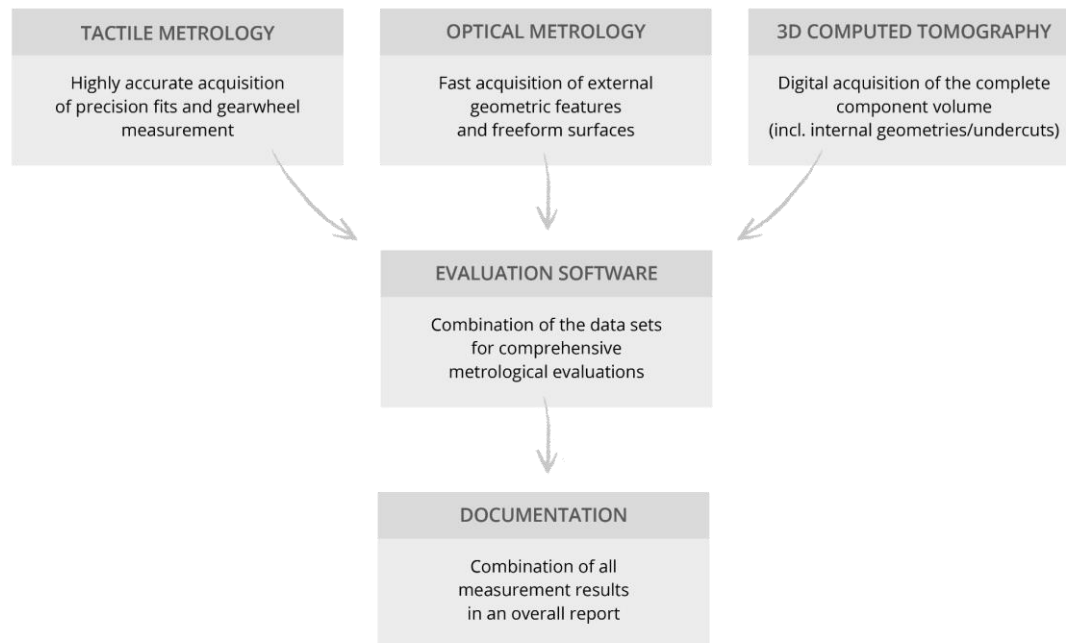


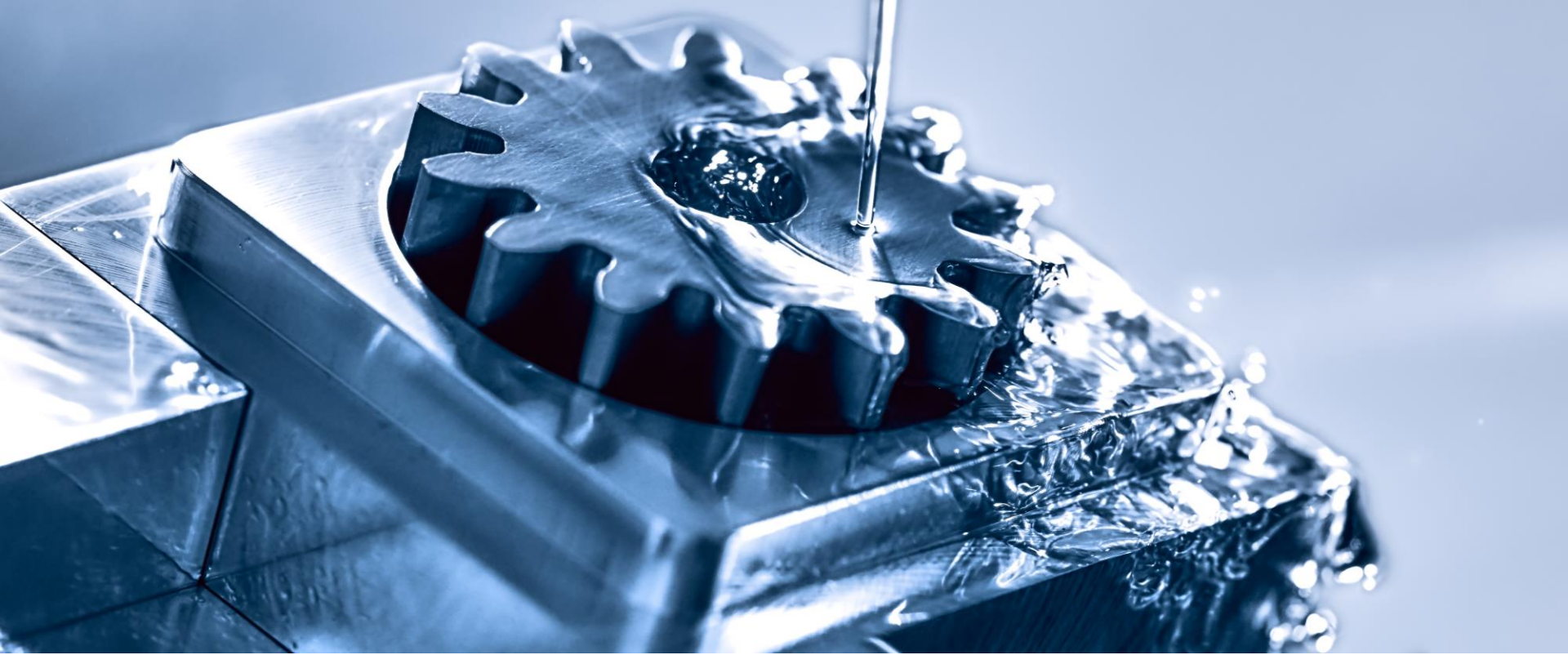
METROLOGY³.

METROLOGY³: COMBINED METHODS FOR PRECISE RESULTS.

Rely on **exact, precise and efficient measurement results**: for data acquisition we combine tactile and optical metrology, as well as 3D computed tomography, as necessary. As such we exploit the specific strengths of the measurement methods used for your measuring task. For the highly precise checking of initial samples, workpieces, series production components and more.

In a comprehensive overall report you receive all measurement results clearly presented as well as access to the complete measurement results – the perfect basis for your product and process development, process monitoring and requalification.





TECHNICAL CLEANLINESS VERIFICATION

QUALITY ADVANTAGE BY MEANS OF TECHNICAL CLEANLINESS VERIFICATION.

Huge technical advances mean that consistent compliance with cleanliness requirements is no longer just a voluntary exercise, instead it has become mandatory. Our multi-faceted cleanliness analyses help you to guarantee the function, durability and quality, as well as the trouble-free manufacture of your products.

- Accredited test laboratory with more than 400 m²
- Extraction and analysis methods for the residual dirt analysis
- Competitive advantage of correlative particle analysis
- Qualitative and quantitative investigation of contaminating films on surfaces
- Very small and large components in all materials



WHAT'S NEW?

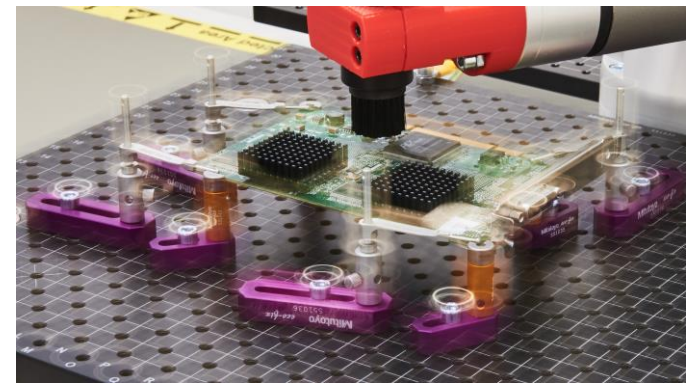
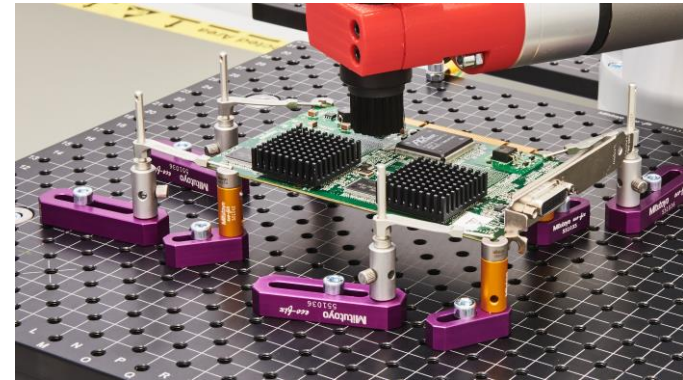
With our new **particle suction extraction system**, we now have the ability to remove dry and loose adhesive particles from large surfaces or specific control areas by suction. The components will not be wetted and can be returned to the application afterwards. The microscopic particle analysis is then performed according to the standards of the QA fluid analysis.

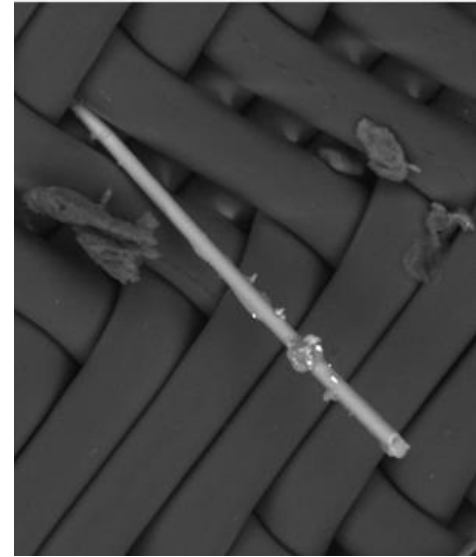
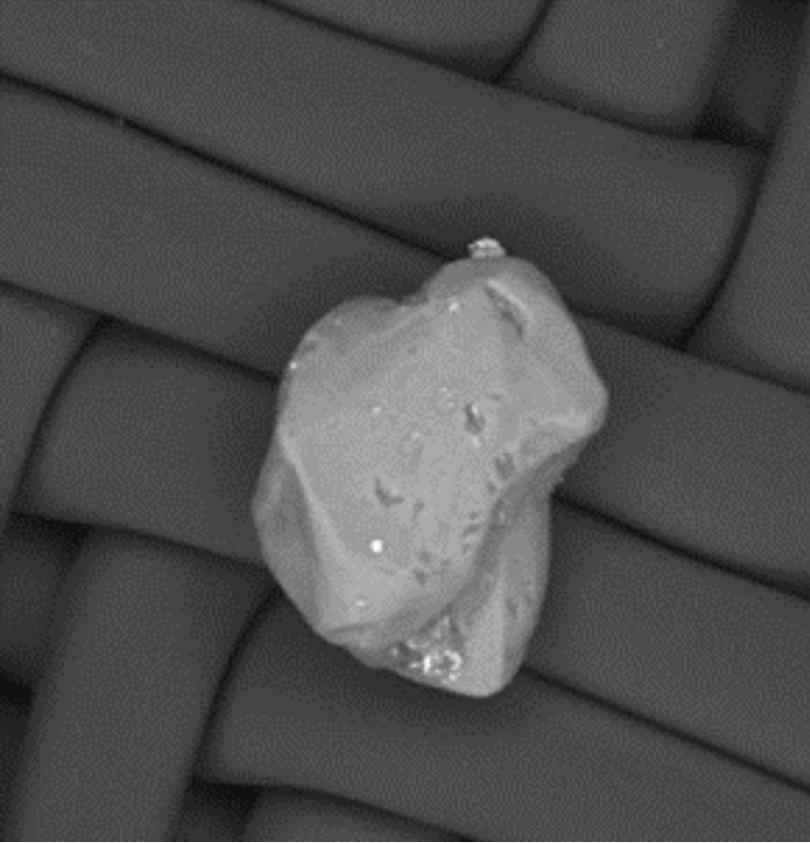
Application examples:

- Large components with dry adhesive particles
- Non-wet extractable components or materials, e.g. micro and process electronics, cable harnesses, battery cell modules and many more
- Inspection of component cleanliness within the production process between the individual assembly steps
- Cleaning before installation and use of modules in e.g. power electronics

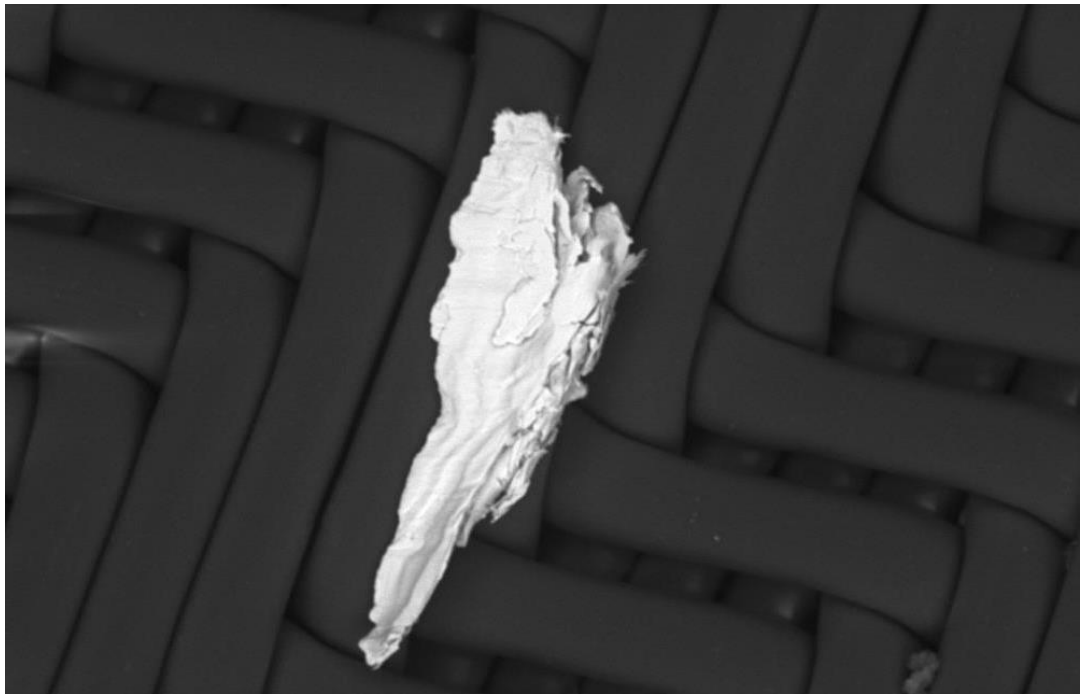
+ TECHNICAL DATA +

- Integration in a separate **ESD room** (clean room class 5 in accordance with ISO 14644)
- Particle suction extraction system with manual/robot-assisted guidance of the particle suction lance
- Components can be clamped reproducibly using a grid clamping system in a modular construction
- Component can be dynamically excited to dissolve the particles before or during extraction
 - Oscillating orbital impact with freely selectable parameters
 - Vibrating impact





CONTAMINATING PARTICLES





EXTRACTION.

Cleanroom class 8 in accordance with DIN 14644

Extraction methods:

- Rinsing, spraying, flooding, ultrasonic
- Air extraction (manual or robot-assisted) with or without dynamic component excitation

Component dimensions:

- Weight: 5 g – 1,000 kg; Size: 1 – 2,500 mm

Extraction media:

- Aqueous solution, solvent-based cleaning medium, air

Standards:

- VDA 19/19.1/ISO 16232 as basis, possible to adapt to all other standards

PARTICLE ANALYSIS.

So that you see what we are seeing.

Analysis methods:

- Reflected light microscopy
- Scanning electron microscopy
- RAMAN and FT-IR spectroscopy
- Optical Particle Counter (OPC)

Classification:

- Particle types: metallic / non-metallic / mineral / fibres
- Quantity and size classes
- Defectiveness: hardness, conductivity, magnetism

Standards:

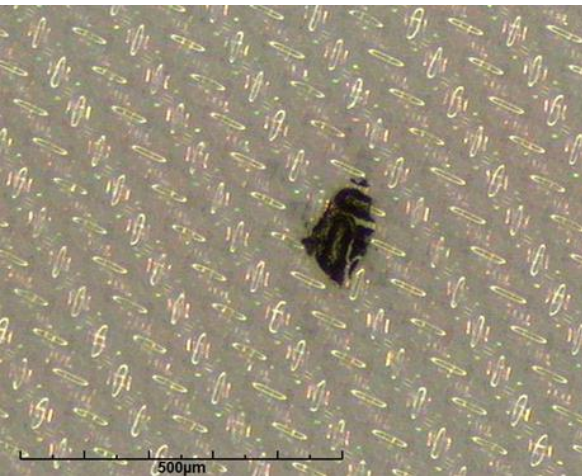
- VDA 19/19.1/ISO 16232 as basis, possible to adapt to all other standards



REFLECTED LIGHT MICROSCOPY.

Particle analysis with polarised light provides information on:

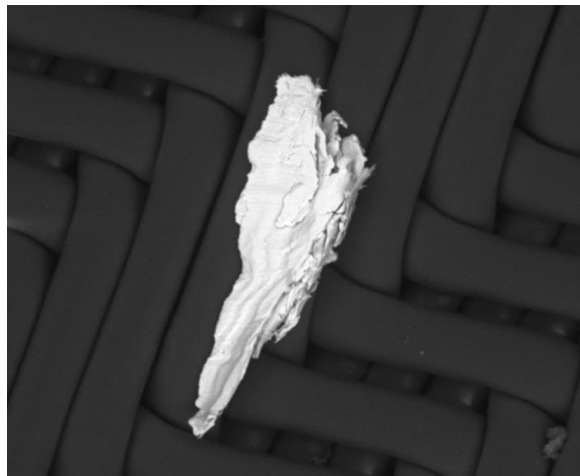
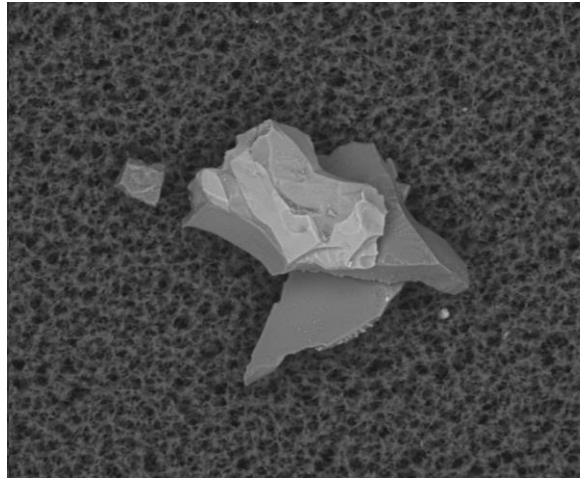
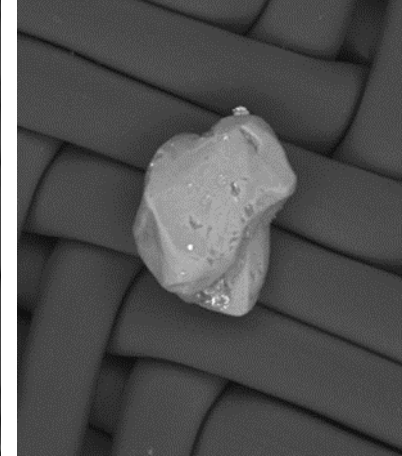
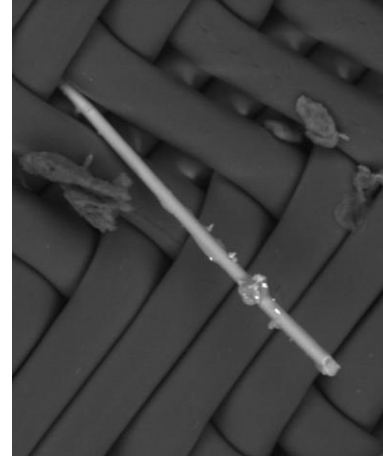
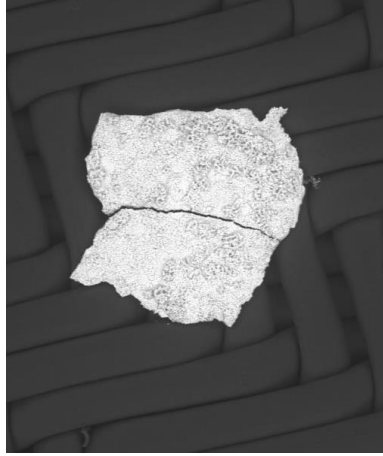
- Type of particle:
 - Metallic shiny
 - Non-metallic shiny
 - Non-fibrous
 - Fibres
- Quantity and size classes of the particles
- No material assignment
- No definition of the defectiveness

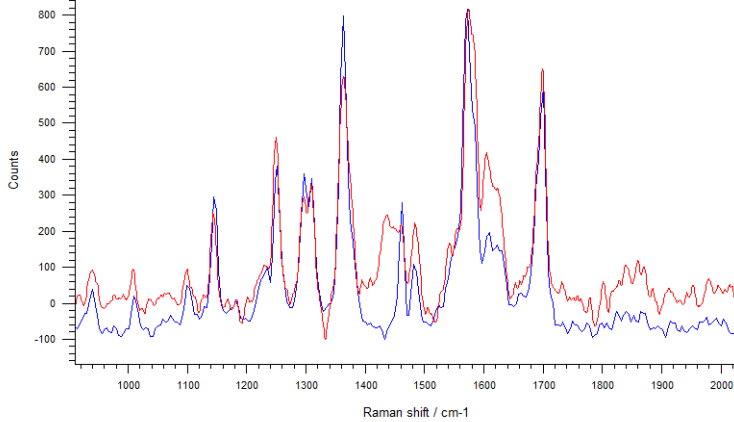
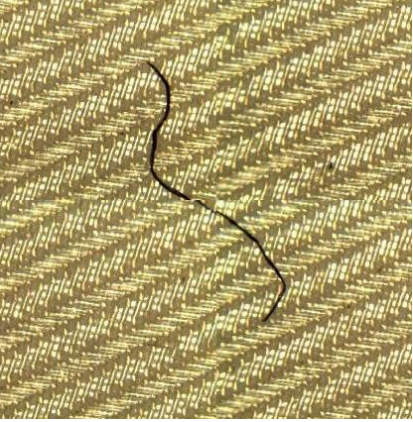


SCANNING ELECTRON MICROSCOPY.

Fully automated particle analysis with EDX provides information on:

- Type of particle
 - Hard metallic particles
 - Hard mineral particles
 - Soft particles
 - Electrically conductive/non-electrically conductive particles
 - Magnetic/non-magnetic particles
- Quantity and size classes of the particles
- Material assignment
- Definition of the defectiveness via hardness classes, conductivity and magnetism





RAMAN & FT-IR SPECTROSCOPY.

Fully automatic analysis of the particles via spectral comparison provides information on:

- Type of particle:
 - Fibres
 - Plastics/elastomers
 - Salts
- Quantity and size classes of the particles
- Material assignment
- Definition of the defectiveness



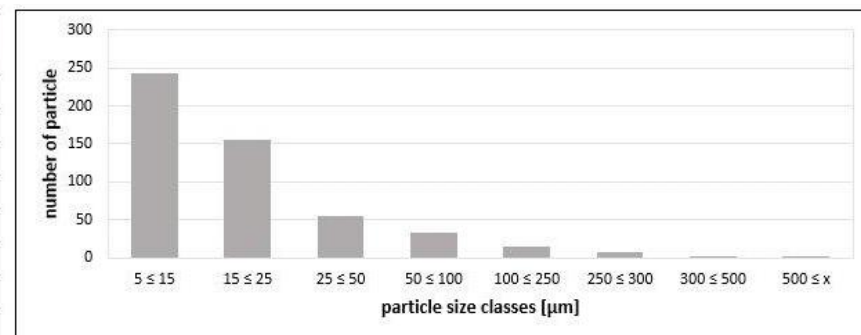
OPTICAL PARTICLE COUNTER (OPC).

Optical particle counter for liquids provides information on:

- Quantity and size classes of the particles
- No information about type of particle
- No material assignment
- No definition of the defectiveness



particle size classes [μm]	number of particles
$5 \leq 15$	243,0
$15 \leq 25$	156,0
$25 \leq 50$	56,0
$50 \leq 100$	33,0
$100 \leq 250$	15,0
$250 \leq 300$	7,0
$300 \leq 500$	3,0
$500 \leq x$	2,0



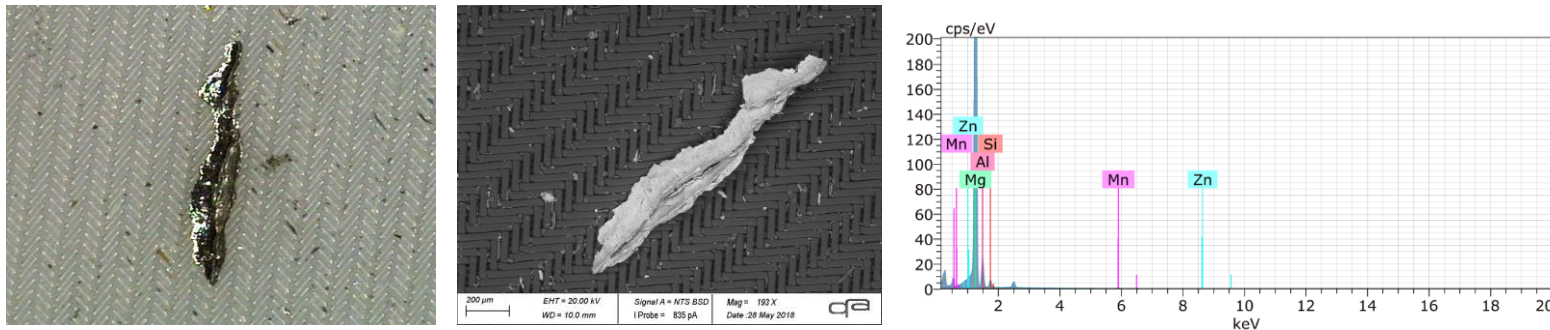
INFORMATION ADVANTAGE DUE TO CORRELATIVE PARTICLE ANALYSIS.

We combine our **microscopy and spectroscopy methods** to acquire harmful particles reliably. As such, along with reflected light microscopy we use also SEM-EDX analysis and RAMAN & FT-IR spectroscopy for comprehensive particle analysis. In this way we can clearly identify organic and inorganic particles in relation to material and defectiveness.

Your advantage: You receive detailed, comprehensive results for organic and inorganic particles.

In your test report you receive detailed information on:

- Quantity and size class: from 5 μm
- Material classes & composition: metals, minerals, salts, organics
- Damage behaviour: hardness class, conductivity, magnetism



Light microscopic image; scanning electron microscope image; EDX analysis to identify the material



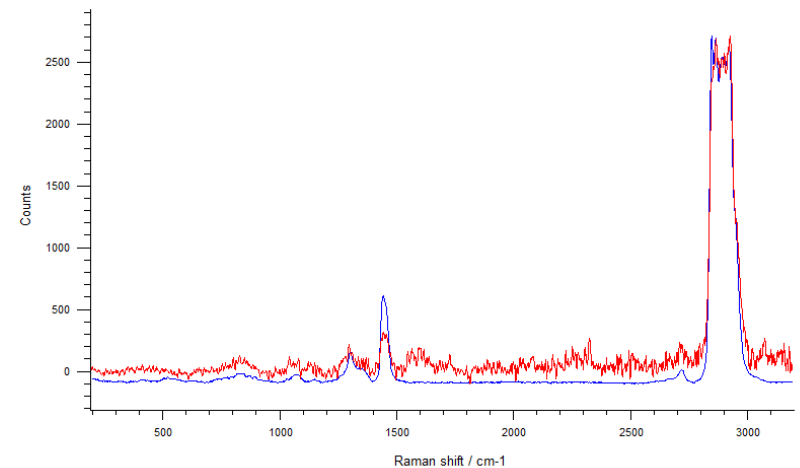
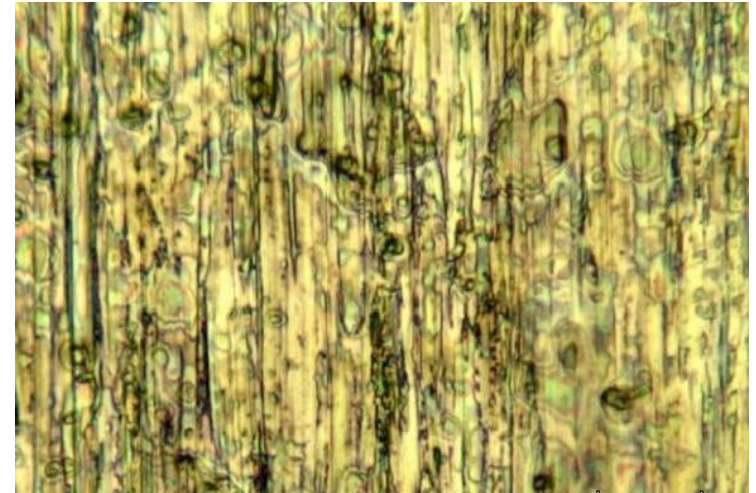
CONTAMINATING FILMS

CONTAMINATING FILMS.

Chemical-filmic contaminations on surfaces can interfere with or hinder subsequent manufacturing steps such as bonding, welding, printing or assembly. Using chemical analytics, we identify manufacturing and cleaning residues such as grease, oil, coolants, cleaning media, etc. –both quantitatively and qualitatively.

Analysis methods:

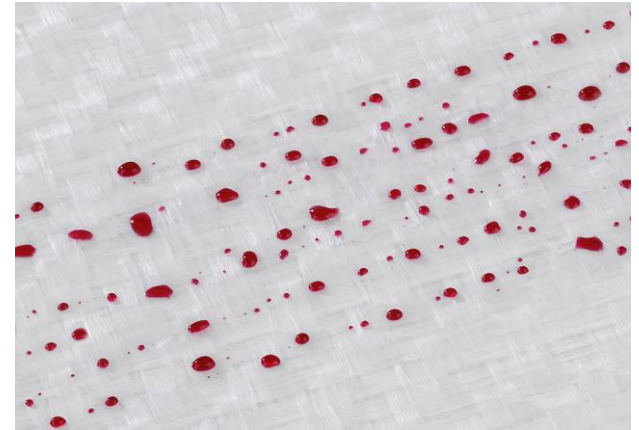
- Determination of the surface tension by means of test ink
- Gravimetric determination
- Detection of filmic contamination by fluorescence measurement
- Quantification by gas chromatography (GC) with flame ionization detector (FID)
- Identification and quantification by gas chromatography (GC) coupled with mass spectrometry (MS)
- Detection and material identification by RAMAN and FT-IR spectroscopy



CONTAMINATING FILMS.

Test ink

- Surface tension determines the wettability
- Measurement of the surface tension on various materials using test ink
- The higher the surface tension value, the cleaner the surface
- Surface tension/energy in mN/m



Gravimetric determination

- Extraction using suitable solvents and separation of the solid residues by filtration
- Gravimetric determination of the mass of the soluble residues after evaporation of the solvent using a highly accurate analysis scale
- Indication in mg/component or mg/m²



CONTAMINATING FILMS.

Fluorescence measurement

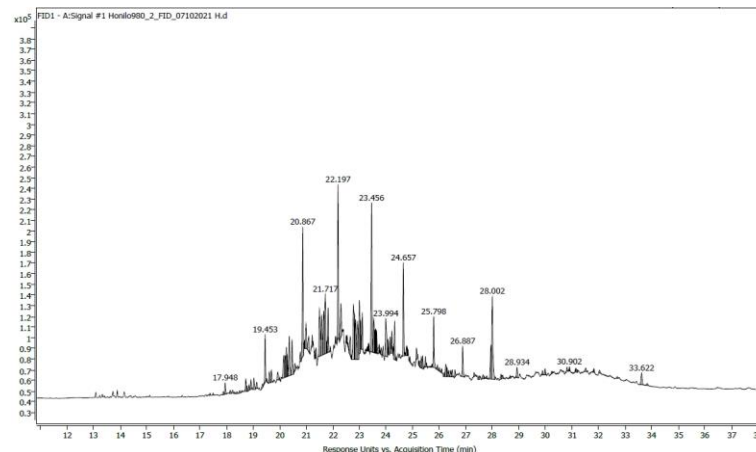
- Detection of fluorescent substances such as fats, oils and waxes by means of UV light
- Detection of non-fluorescent substances, such as silicone oils, using added fluorescent dyes
- Contactless detection of organic substances on metallic surfaces
- Reference value: clean surface
- The higher the measured fluorescence value, the stronger the filmic contamination
- Indicated measured value: RFU (relative fluorescence units)



CONTAMINATING FILMS.

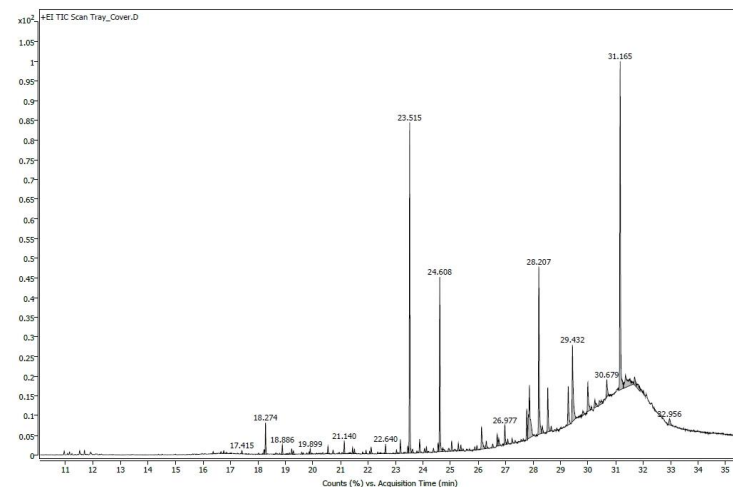
Detection and quantification by gas chromatography coupled with a flame ionization detector (GC-FID)

- Extraction using suitable solvents
- Analysis of dissolved organic residues
- Result: Sum of soluble organic contaminations in mg/component or mg/m²



Identification and quantification by gas chromatography coupled with a mass spectrometer (GC-MS)

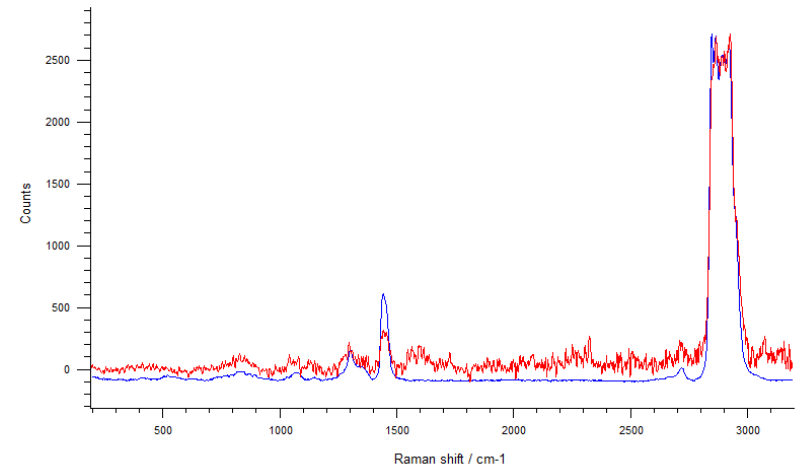
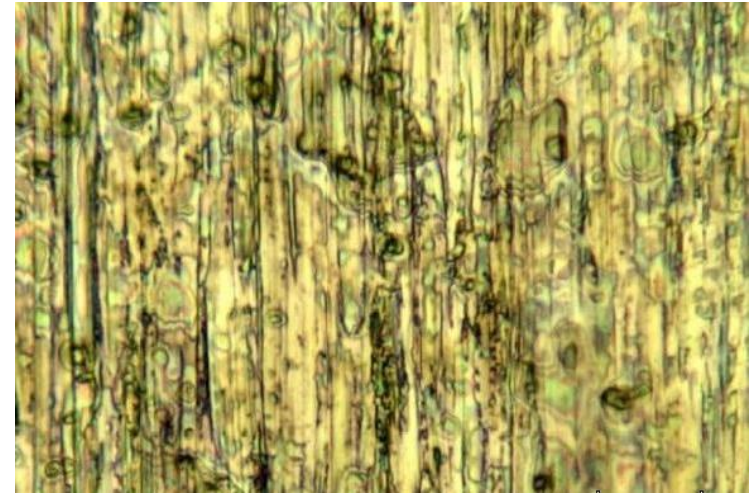
- Extraction using suitable solvents
- Analysis of dissolved organic residues
- Result: Sum of soluble organic contaminations in mg/component or mg/m²
- Identification of individual components

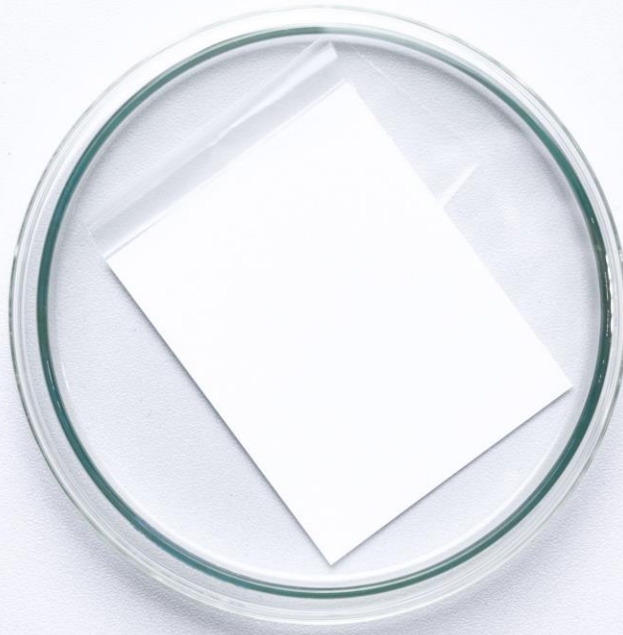


RAMAN AND FT-IR SPECTROSCOPY.

Detection and identification by RAMAN and FT-IR spectroscopy

- Analysis of oils, fats, cooling lubricants, cleaners, preservatives, solvents and many more
- Analysis directly on the component surface
- Clear detection and identification of the contamination
- Identification of the contamination by means of reference databases





PARTICLE MONITORING

PARTICLE MONITORING.

Particle trap analysis for monitoring environmental effects

- Evaluation with/without Illig value calculation = particulate precipitation per hour per 1,000 cm²
 - Sum of all particles with weighted size classes referred to a unit of time
- Acquisition of influencing factors:
 - Production or logistics environment
 - Building services
 - Organisation
 - Complete logistics and added value chain
- Important for conclusions about component cleanliness
- Systematic short-term or long-term analysis





MATERIALOGRAPHY

WE LOOK DEEP INTO THE DETAIL.

Optimise processes, processes with informative analyses: Our microscopic and spectroscopic analyses help you to characterise materials, check production processes, prevent damage, find the causes if damage occurs and optimise processes in product development.

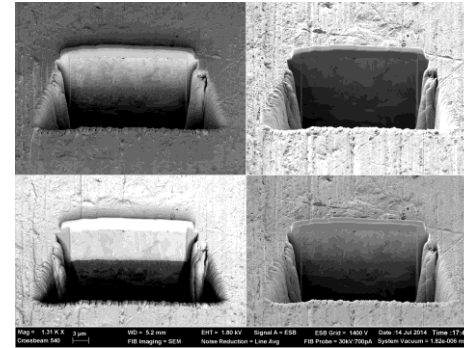
- Detailed, dependable analysis results thanks to many years of know-how
- Accredited test laboratory with more than 400 m²
- Highly modern, specialised analysis equipment: Zeiss, Renishaw, Bruker, Struers, Agilent, Netzsch
- Very small and large components in all materials



WHAT'S NEW?

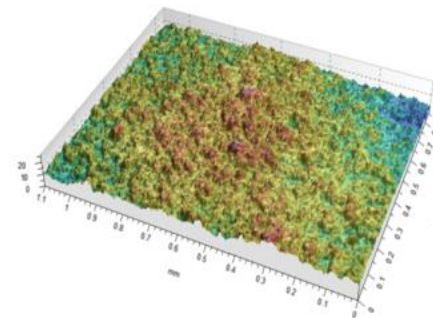
Entry into nanoanalytics

The ZEISS Crossbeam 350 is a high-resolution scanning electron microscope (SEM) with a focused ion beam (Ga-FIB) and an integrated femtosecond laser. In this way we obtain insights into what is inside a sample and at the same time remove material locally in the smallest quantities using the ion beam to expose these cross-sections of the sample directly for the SEM.



Expansion of the microscopy spectrum

The confocal laser scanning microscope LSM 900 MAT from ZEISS is an ideal instrument for material analyses. Using this microscope we can combine light microscopic and confocal imaging. In this way we obtain precise, three-dimensional imaging and have expanded our range with topographic analyses of nanomaterials, metals, polymers and semiconductors.



Source: Carl Zeiss AG

WHAT'S NEW?

High-contrast and detailed imaging of microcracks using fluorescence microscopy

Our new **ZEISS Stereo Discovery.V12 fluorescence stereomicroscope** enables us to visualize and evaluate microcrack patterns on plastic housings, such as connectors used in the electronics industry, or on printed circuit boards with high contrast effects.

The fluorescent coating (usually a slightly viscous, oily liquid) can be used directly on the component surface or only afterwards in the prepared section. It is absorbed into the crack and remains there without running.

This results in the following analysis possibilities:

- Detection of microcracks directly on the component surface (especially suitable for plastics)
- High-contrast imaging of insulating gels/masses of the semiconductor industry in prepared sections (often used for electronic components)
- Representation of micro-cracks and micro-crack paths in the prepared microsection



Quelle: Carl Zeiss AG

WHAT'S NEW?

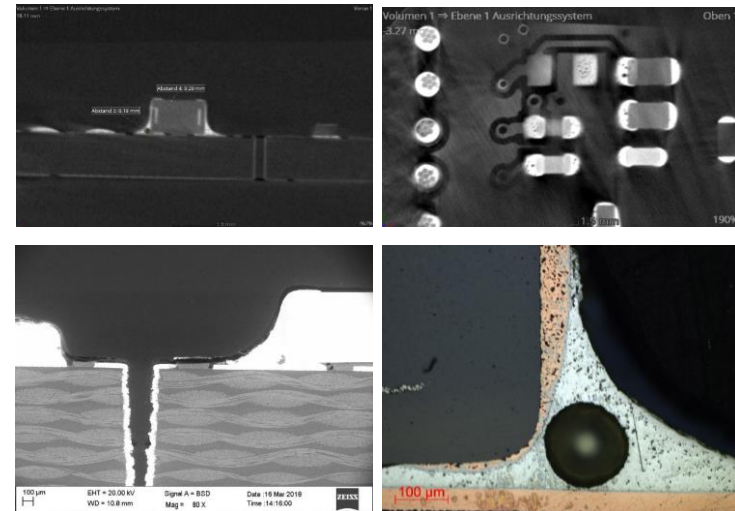
Stress Testing & Analytics

Detection and analysis of material change and component behavior through targeted stress simulations, such as.

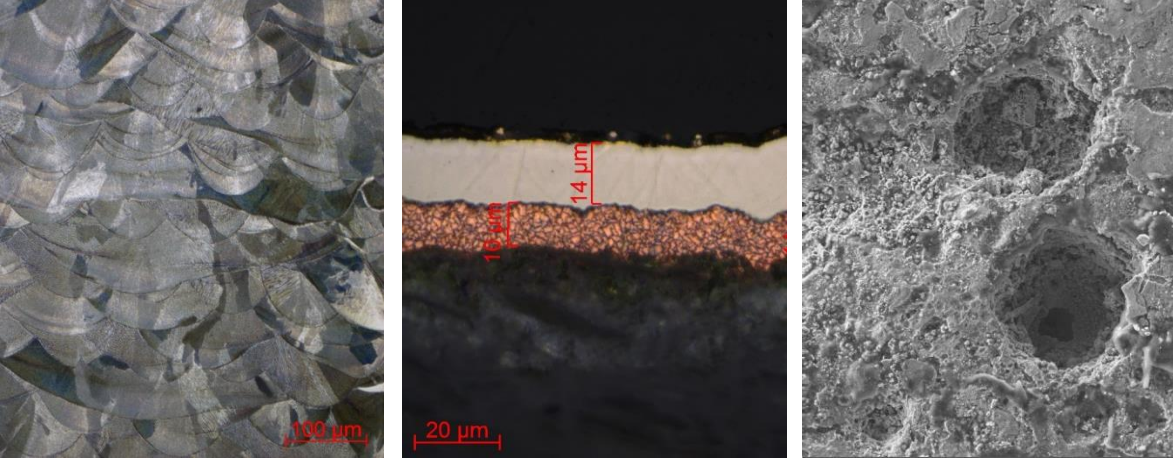
- Thermal stress: thermal shock, climate change or temperature change
- Stressing under defined environmental conditions (environmental simulation)
- Corrosion change test
- Salt spray test

Through the targeted application of component stress simulations, we can detect and analyse changes in the shape of components or defect patterns such as cracks, fractures, inclusions or assembly conditions in downstream analysis. We offer a **wide range of non-destructive and destructive analysis options** for this purpose.

Especially for electronic components, such as printed circuit boards, but also plastic or ceramic components, the comprehensive analysis offers a better understanding of the damage processes and the damage behavior on the component.

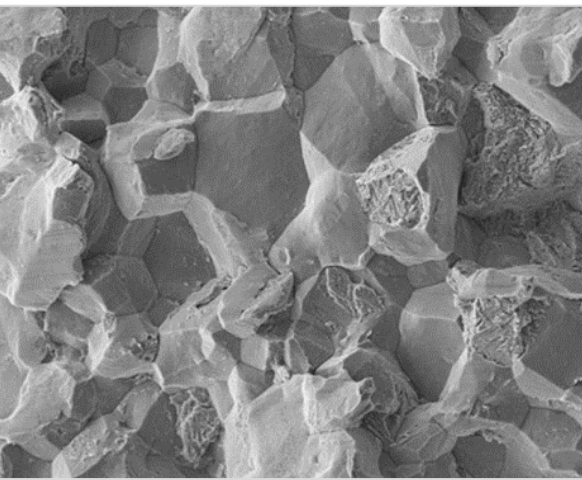
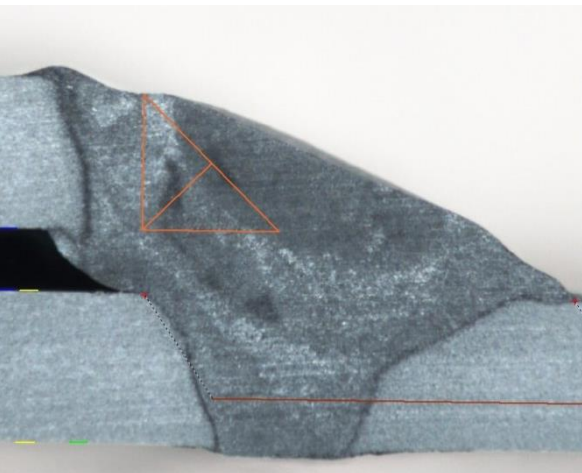


METALLOGRAPHY.



Destructive material testing for quantitative and qualitative analysis of material characteristics for metallic materials

- Metallographic sample preparation
- Testing of soldered joints and welded joints
- Microstructure analysis
- Layer thickness measurement
- Scanning electron microscopy
- Hardness testing
- Spark emission spectroscopy (OES)



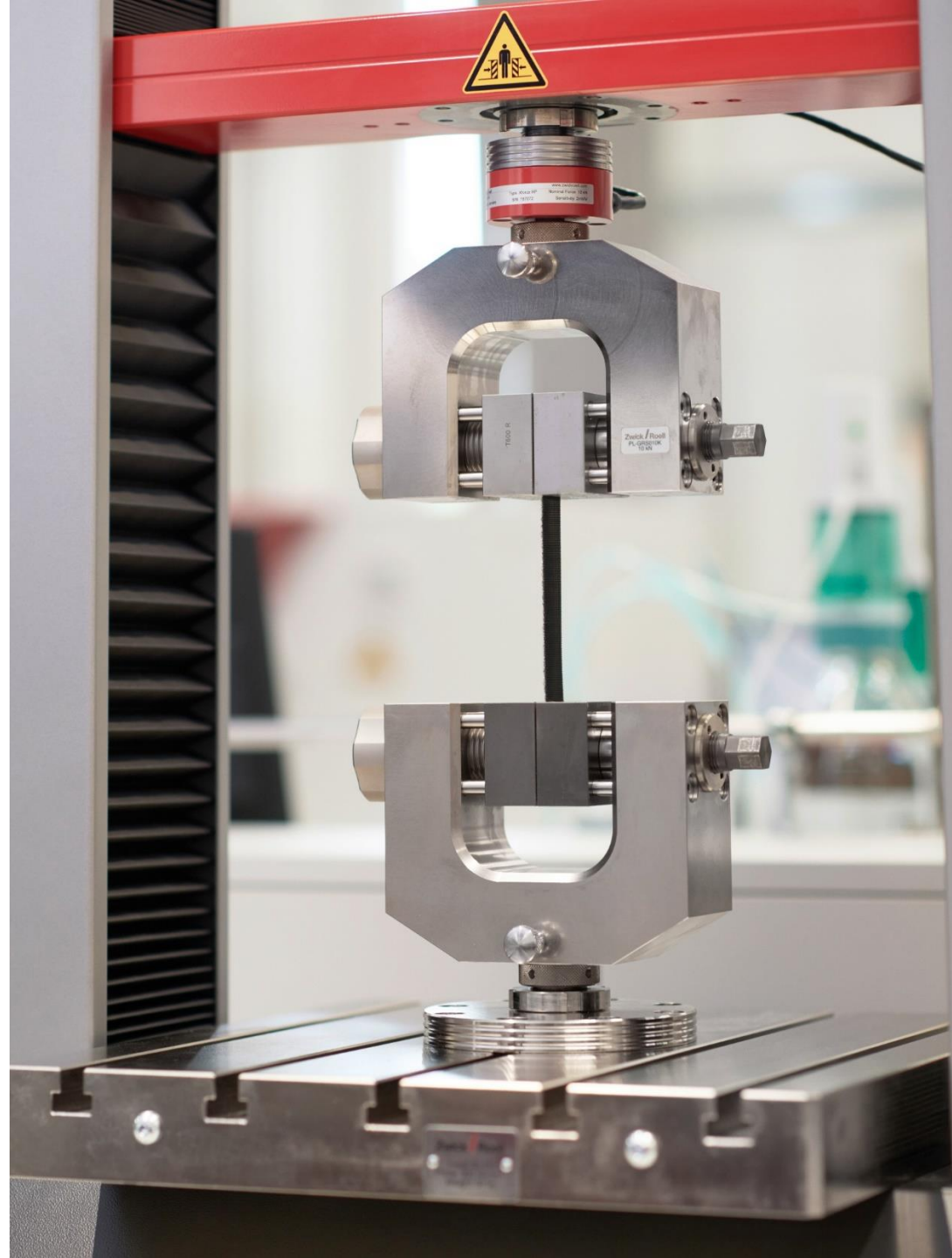
TENSILE- AND BENDING TEST.

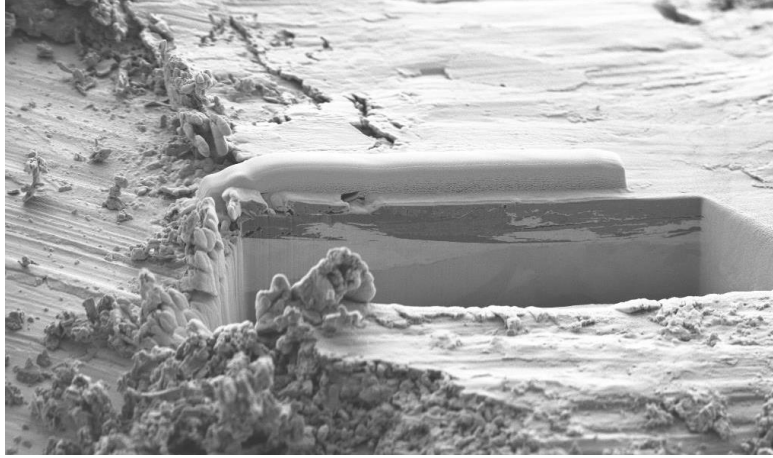
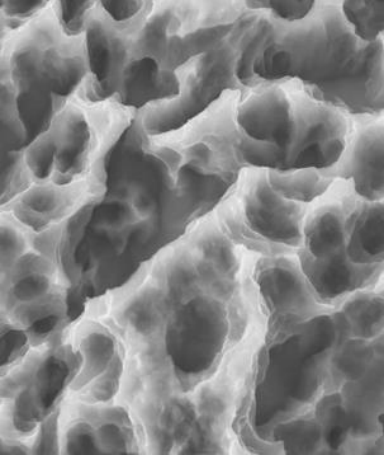
Perform standardized tensile, compression, bending and shear tests on materials and components, such as.

- Press-in and press-out tests on components and parts on printed circuit boards
- Bending tests on solder joints for complex interfaces
- Control of joining and pressing processes on precision engineering components
- Shear tests on bonded joints and/or jelly rolls (wound batteries)

Analysis equipment:

ZwickRoell ProLine

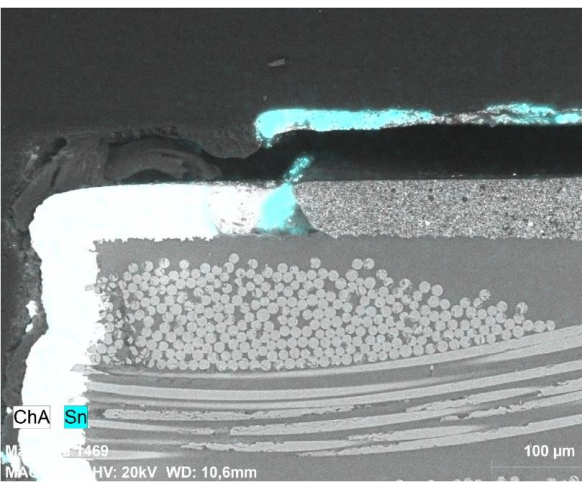
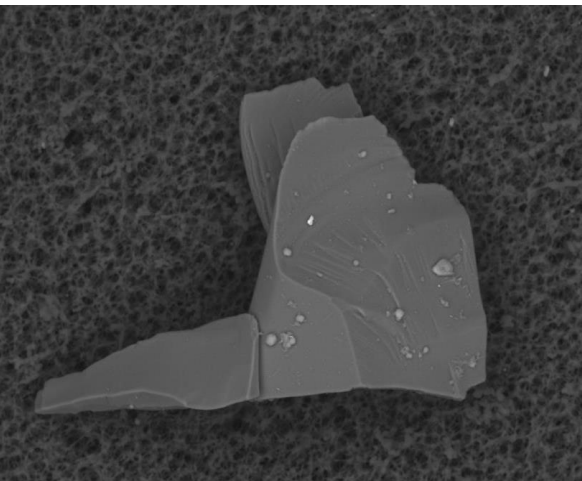




SCANNING-ELECTRON-MICROSKOPY.

High-resolution depiction and analysis of surfaces and structures

- Imaging of the topography of various materials and components
- Depth analysis
- Depiction of material contrasts
- Determination of the chemical composition (EDX analysis) of surfaces and coatings
- Fully automatic particle analysis using Smart PI



Analysis equipment:
ZEISS EVO MA 15, MA 25, Supra 40VP,
Crossbeam 350

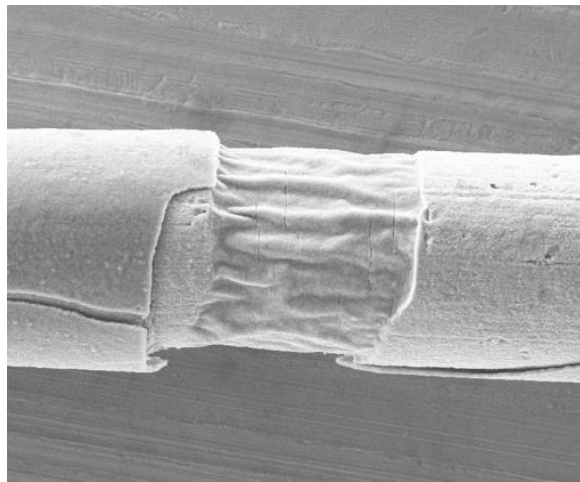
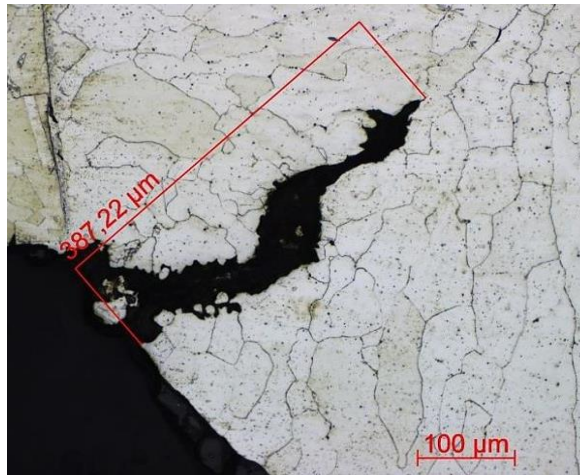
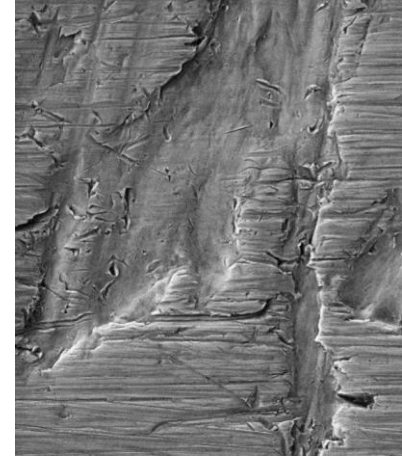
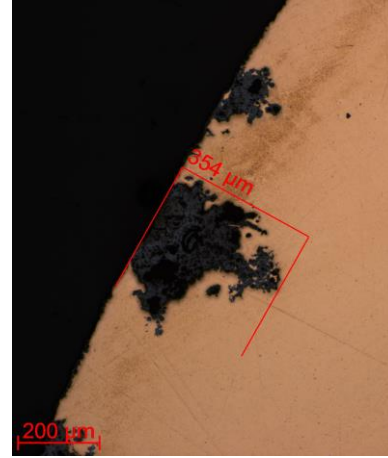
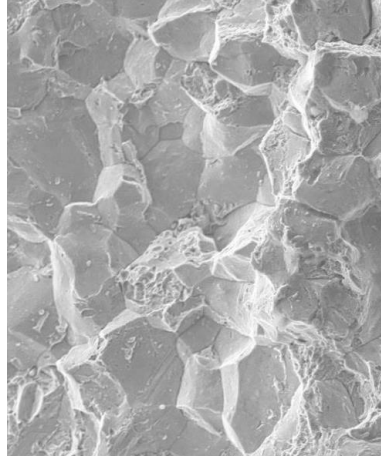
DAMAGE-ANALYSIS.

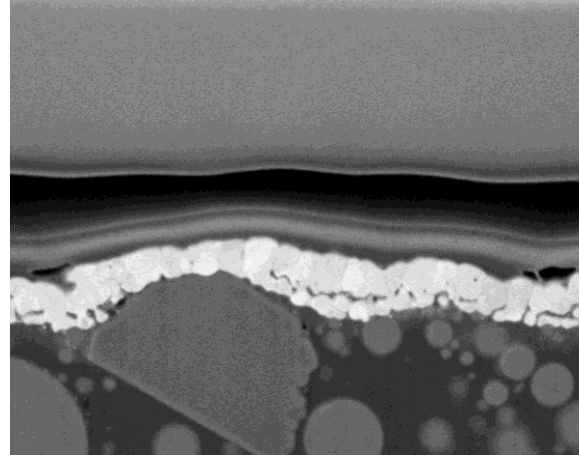
Systematic damage analysis on statically and dynamically loaded components

- Fracture surface analysis
- Crack analysis
- Analysis of corrosion behaviour
- Checks on welding defects
- Wear analysis (tribology)

Analysis methods:

Sample preparation, light and scanning electron microscopy, hardness testing, OES, and much more





FIB-SEM- MICROSKOPY.

3D imaging with preparation on nano-scale using FIB-SEM microscopy

- Target preparation of thermally sensitive coatings without the application of heat (cross-section)
- Analysis of coatings and coating systems
- Analysis of flaws, e.g. cracks or deposits of foreign material
- Analysis of microstructures, deposits at the particle boundaries and intermetallic phases
- Analysis of electronic assemblies

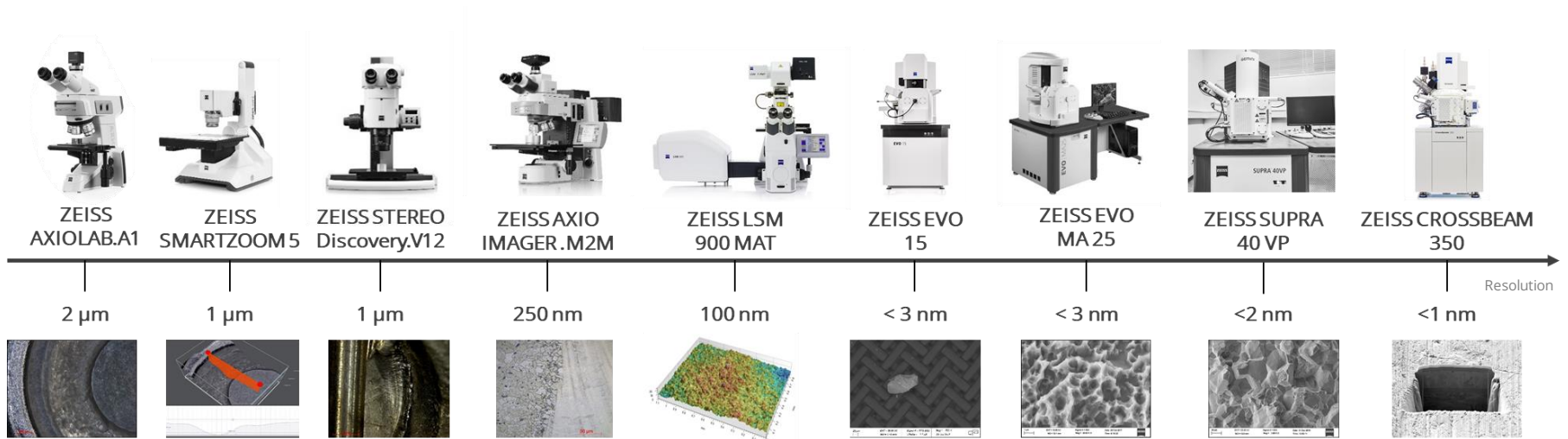
Analysesystem:
ZEISS Crossbeam 350



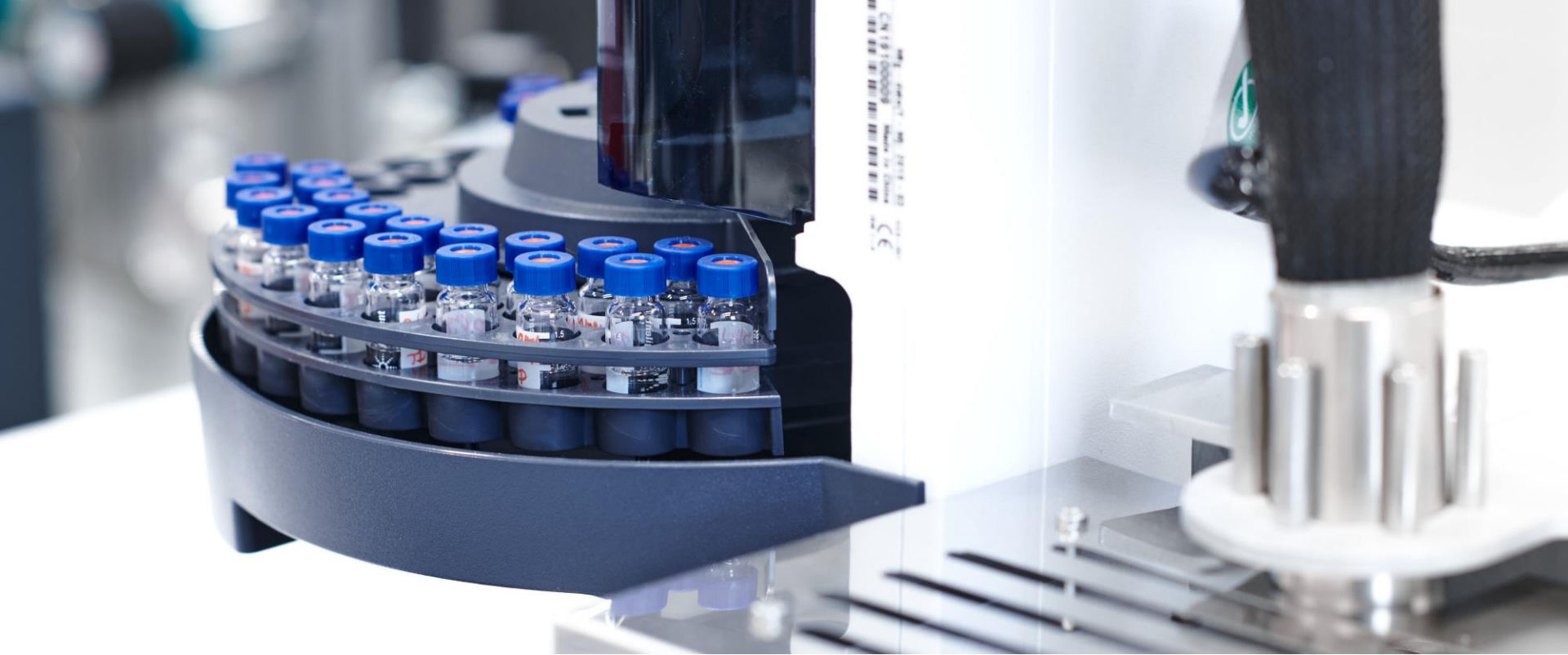
TECHNICAL EQUIPMENT.

Materialography

Versatile light, laser and electron microscope for comprehensive material analyses, e.g. for the analysis of layer thicknesses or weld seams, microstructure analyses or for systematic damage analysis.



Source: Carl Zeiss AG



CHEMICAL ANALYTICS

COMPREHENSIVE ANALYSES WITH VERSATILE APPLICATION POSSIBILITIES.

In our laboratory for analytical chemistry, we **qualify and quantify chemical substances** by means of various analytical methods of the wet chemical analysis and the instrumental analysis. We analytically accompany your production or development process and analyse plastics, filmic residues, particulate contaminations and water samples.

- Detailed, dependable analysis thanks to highly specialised experts
- Accredited test laboratory with more than 400 m²
- Highly modern, specialised analysis equipment: Renishaw, Bruker, Agilent, Netzsch, Hach





PLASTICS ANALYSIS

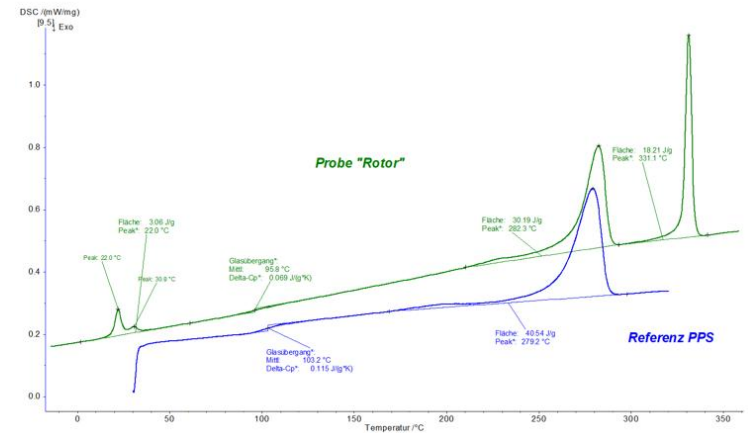
DIFFERENTIAL SCANNING CALORIMETRY (DSC).

Determination of DSC parameters for material characterization of thermal properties

- Determination of the melting temperature
- Determination of the glass transition temperature
- Determination of enthalpies (heat of melting, crystallization, transformation and reaction)
- Determination of the crystallinity
- Determination of the specific heat capacity

These parameters provide information on/for:

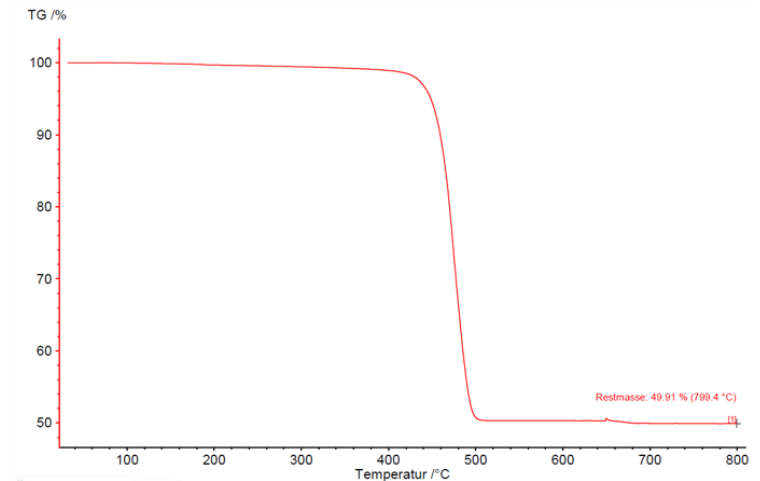
- Material identity and recipe components
- Modifications and additional components
- Cleanliness / contamination
- Thermal history
- Temperature effects
- Crystallinity / crystallinity degree
- State of hardening / degree of cure



THERMOGRAVIMETRIC ANALYSIS (TGA).

TGA for measuring changes in mass of a sample in dependence on temperature or time:

- Quantification of the material composition
 - Polymer contents
 - Plasticizer contents
 - Filler contents (glass fiber, soot, chalk, other inorganic fillers)
 - Residual mass / Ashes
- Analysis of the thermal decomposition process
 - Determination of decomposition temperatures (start / middle / end)
- Do decomposition products, volatile components or substances form? We identify and quantify these by combining TGA with FT-IR-spectroscopy and GC-MS.

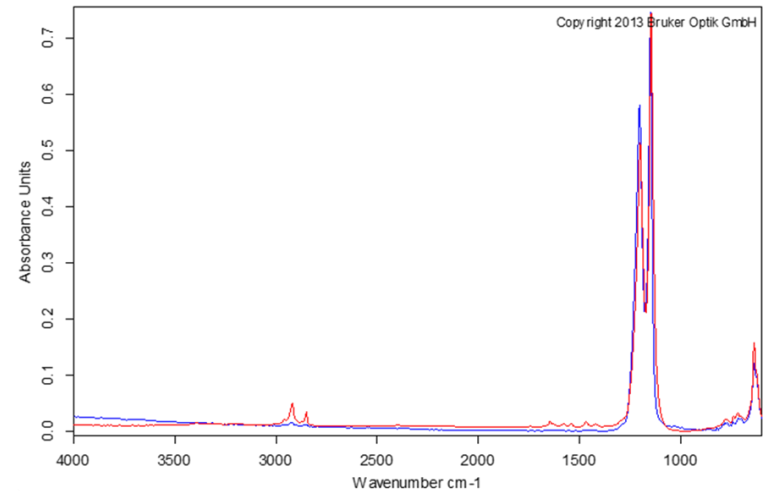


SPECTROSCOPIC ANALYSIS.

With **RAMAN** and **FT-IR** spectroscopy, we characterize materials easy and quickly. Both methods provide a spectrum which is characteristic for the specific vibrations of a molecule, a „molecular fingerprint“ so to speak.

Analysis options:

- Identification of plastics, fibres and smallest particles (from 1 μm)
- Detection of contaminations
- Quantitative determination of known substances



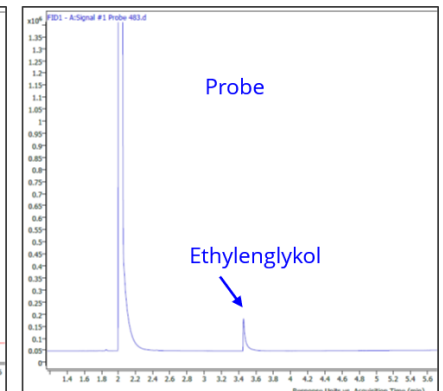
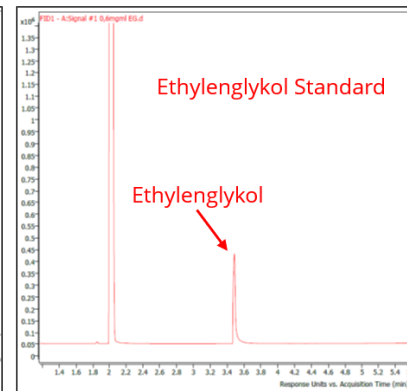
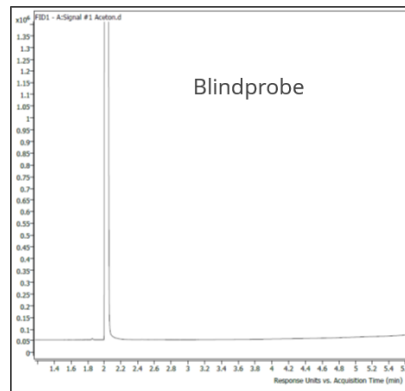
GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY (GC-MS).

With the GC-MS analysis, we analyse plastic samples for volatile organic compounds. We separate the mixture of substances chromatographically into the individual substances and then identify and quantify them using the mass spectrometer (MS).



Analysis options:

- Plasticizers
- Vulcanising agents
- Solvents
- Flame retardants
- Oils



KARL-FISCHER-TITRATION (KFT).

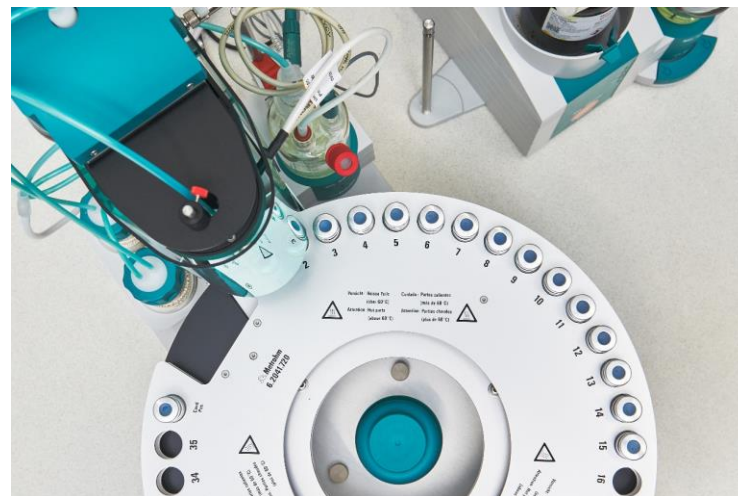
We use Karl Fischer titration to determine the exact water content in plastic samples. The results of this method are independent of the type of sample as well as the presence of other volatile components and are available within a very short time.

Analysis options:

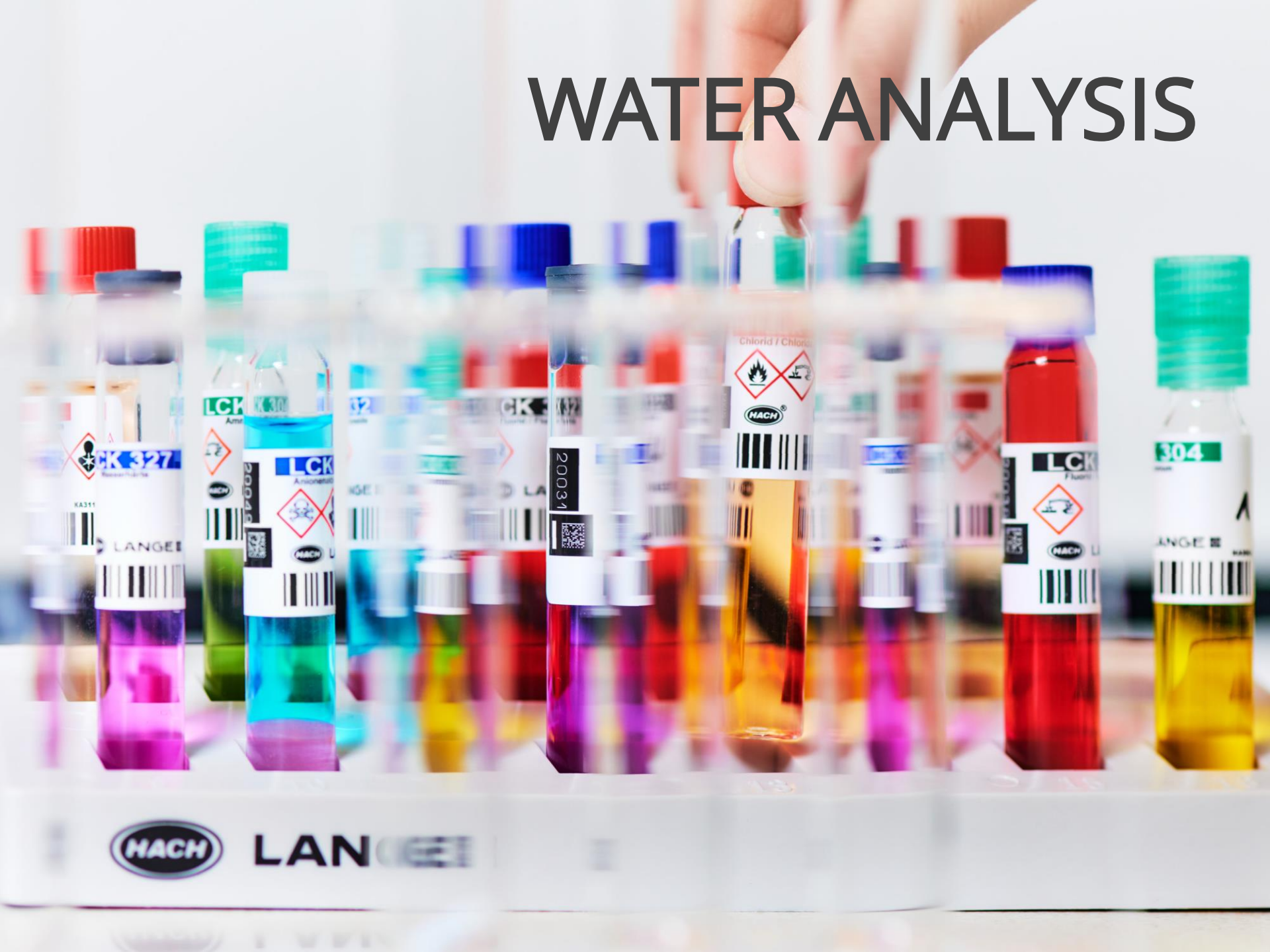
- Coulometric and volumetric method with oven technology
- Determination from 0.001% to 100%

Analysis system:

- Metrohm Titrando 852
- Metrohm 874 Oven Sample Processor



WATER ANALYSIS



METHODS AND APPLICATION.

Testing of water-mixed cooling lubricants, cooling water, process water and cleaning baths

- pH measurement
- Conductivity measurement
- Determination of water hardness
- Determination of the biochemical oxygen demand (BOD) in accordance with DIN-EN 1899-1
- Determination of the chemical oxygen demand (COD) in accordance with DIN-ISO 15705
- Determination of the total organic carbon (TOC) in accordance with DIN-EN 1484
- Turbidity measurement in accordance with DIN EN ISO 7025
- Colour measurement (photometric) in accordance with DIN EN ISO 7887 (colour index, hazen, iodine, gardner, yellowness)
- Quantitative determination of organic and inorganic ingredients (e.g. nitrites, nitrates, sulphates, ammonia and many more)





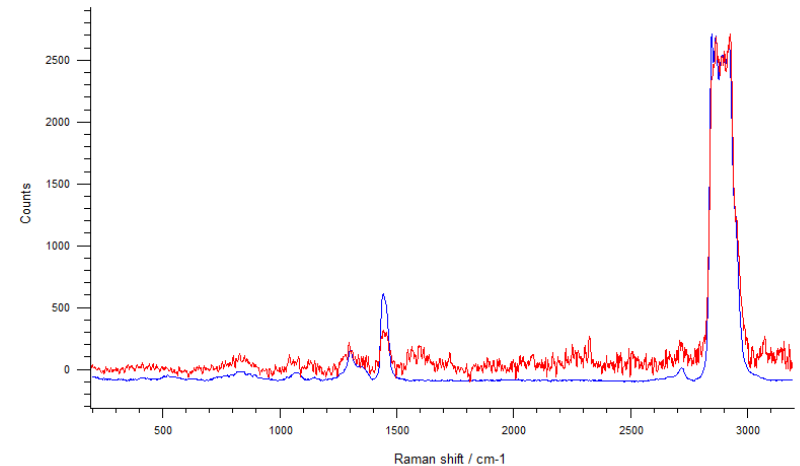
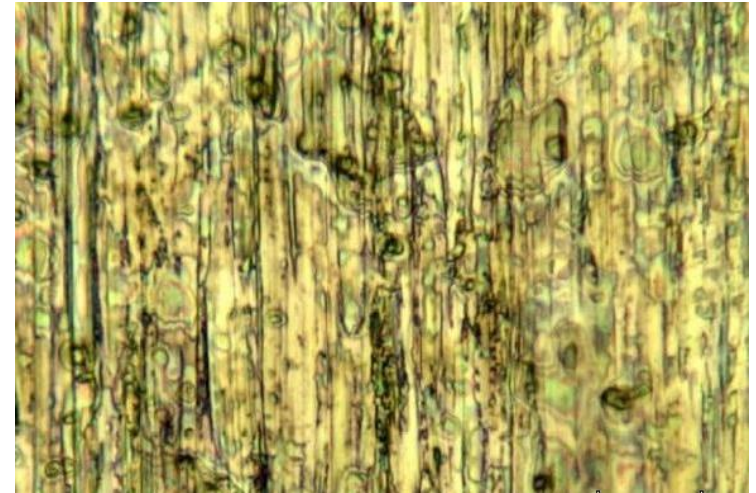
CONTAMINATING FILMS

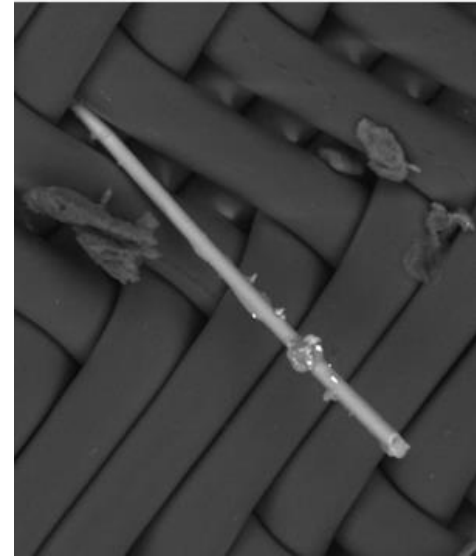
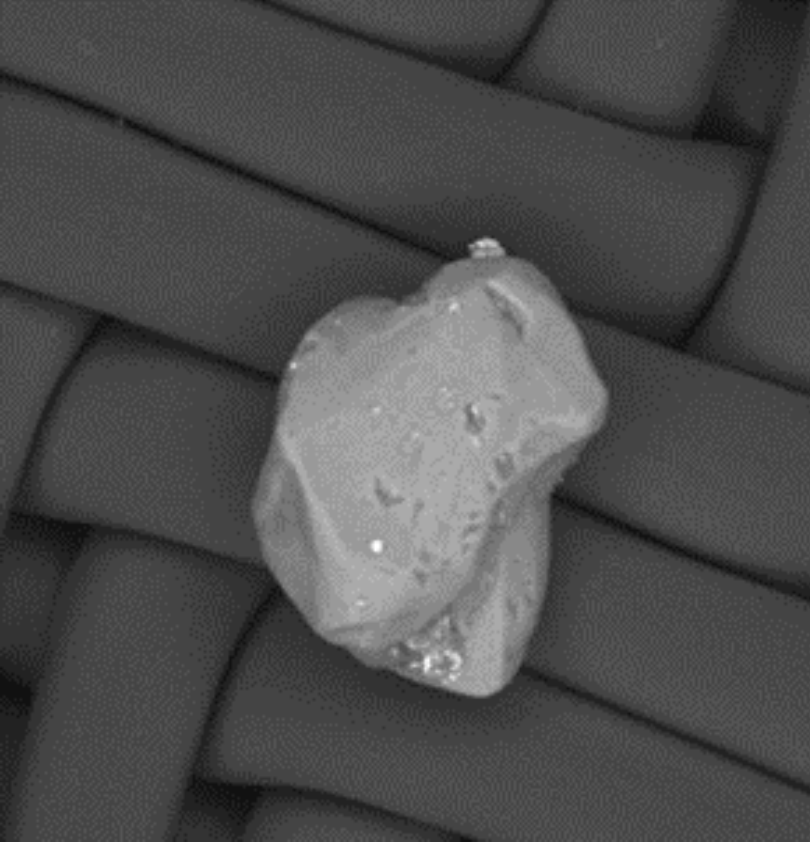
CONTAMINATING FILMS.

Chemical-filmic contaminations on surfaces can interfere with or hinder subsequent manufacturing steps such as bonding, welding, printing or assembly. Using chemical analytics, we identify manufacturing and cleaning residues such as grease, oil, coolants, cleaning media, etc. –both quantitatively and qualitatively.

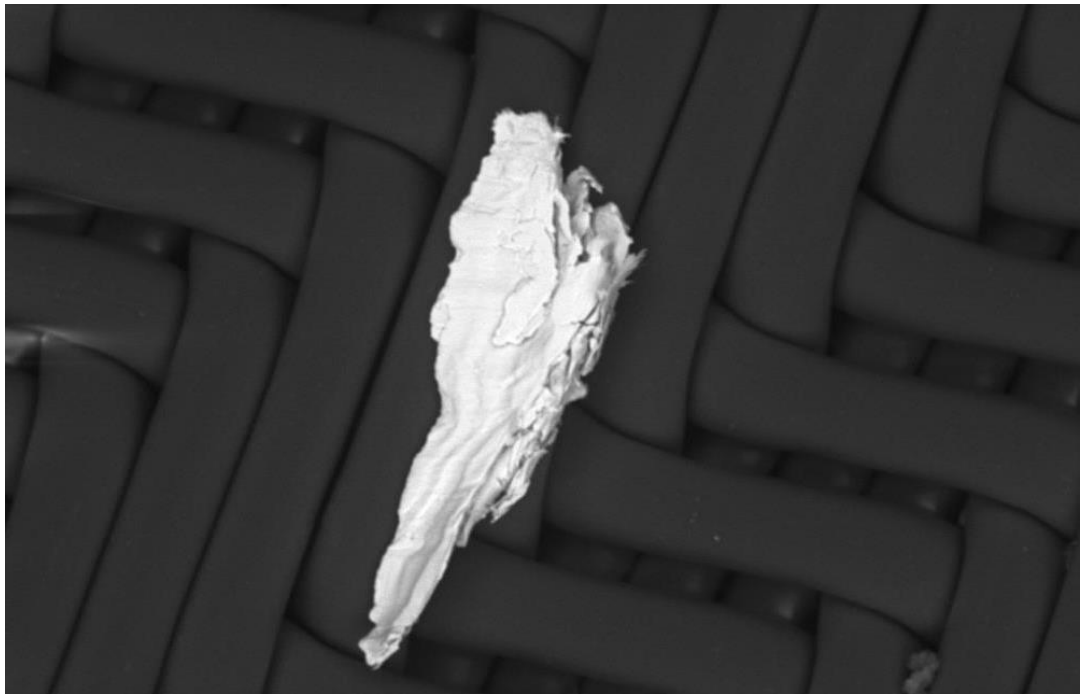
Analysis methods:

- Determination of the surface tension by means of test ink
- Gravimetric determination
- Detection of filmic contamination by fluorescence measurement
- Quantification by gas chromatography (GC) with flame ionization detector (FID)
- Identification and quantification by gas chromatography (GC) coupled with mass spectrometry (MS)
- Detection and material identification by RAMAN and FT-IR spectroscopy





CONTAMINATING PARTICLES

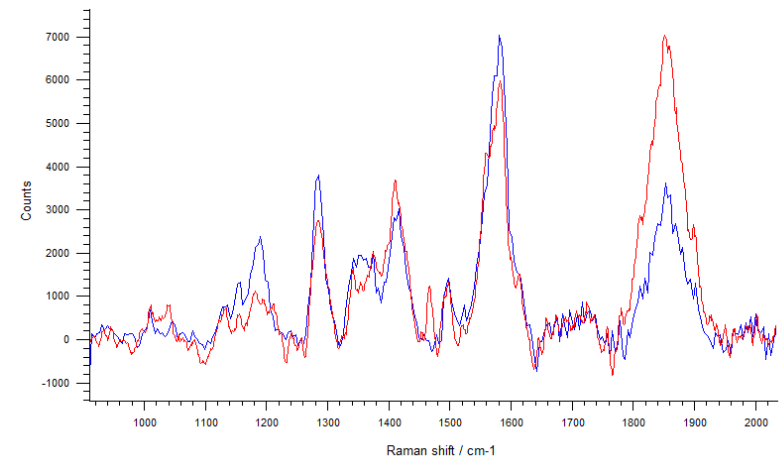


CONTAMINATING PARTICLES.

Organic and inorganic particles and fibres can lead to long-term functional limitation up to system damage. By means of **RAMAN and FT-IR spectroscopy** we identify organic and inorganic particles and fibres on relevant surfaces within the scope of technical cleanliness.

Fully automatic analysis of the particles by spectrum comparison provides information about:

- Type of particle
 - Fibres
 - Plastics/elastomers
 - Salts
- Quantity and size classes of the particles
- Material assignment
- Definition of the defectiveness



TECHNICAL EQUIPMENT.

Chemical analytics

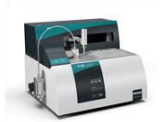
High-performance systems for the qualitative and quantitative analysis of organic and inorganic substances, such as plastics, contaminating films and particles.



NETZSCH DSC
204 F1 Phoenix



Bruker
Invenio-S



NETZSCH TG 209
F1 Libra



Agilent 8890 GC
(MS & FID)



Bruker
LUMOS



RENISHAW
inVia Qontor



Metrohm Titrand 852



Metrohm 874 Oven
Sample Processor

TG-FT-IR-Kopplung

TG-GC-MS-Kopplung

Quelle: Erich NETZSCH GmbH & Co. Holding KG, Agilent Technologies Inc. Bruker Corporation, Renishaw GmbH, Deutsche METROHM GmbH & Co. KG

Water analysis

We use the following analytical equipment to test water-mixed cooling lubricants, process water and cleaning baths:



Hach Lange
DR 6000 UV-VIS



Hach
TL2310



Hach
HQ40D

Quelle: Hach Lange GmbH

STANDARDISED TEST METHODS. ACCLAIMED QUALITY ASSURANCE.

Accredited test laboratory in accordance with DIN EN ISO/IEC 17025:2018

Our accreditation means for you one thing above all else: certainty. You can rely on high standards, excellent services and guaranteed quality standards. As your partner, we accompany you during product development, innovations and safeguard product quality together with you.

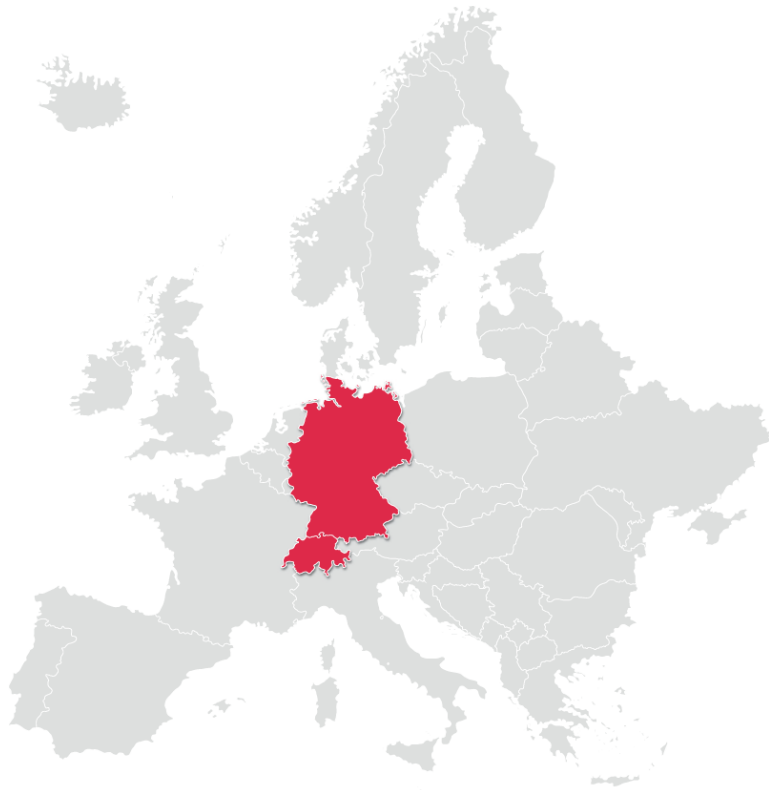
Advantages of our accreditation:

- Impartiality and confidentiality
- International validity (ILAC)
- Dependability due to conformity assessment
- Reproducibility and comparability
- Standardised measurement and analysis methods
- Highest requirements on the technical standard
- Monitoring of the management system and the competence of the specialist personnel



QUALITY ASSURANCE IN NUERTINGEN AND SWITZERLAND.

It is possible to implement your projects worldwide from our sites.



GERMANY

Grosser Forst 1
D-72622 Nuertingen
www.qa-group.com



SWITZERLAND

Badenerstrasse 13
CH-5200 Brugg
www.qa-group.com



CONTACT PERSON.

INDUSTRIAL COMPUTED TOMOGRAPHY & INDUSTRIAL METROLOGY

GERMANY



Peter Ernst
General Manager
COO

Phone +49 (0) 7022 2796-620
Mobile +49 (0) 152 299 289 70
Email p.ernst@qa-group.com



Sascha Raschinsky
Sales Manager

Phone +49 (0) 7022 2796-623
Mobile +49 (0) 176 403 646 37
Email s.raschinsky@qa-group.com



Peter Mohl
Sales Manager

Phone +49 (0) 7022 2796-622
Mobile +49 (0) 173 947 932 7
Email p.mohl@qa-group.com

CONTACT PERSON.

TECHNICAL CLEANLINESS VERIFICATION, MATERIALOGRAPHY & CHEMICAL ANALYTICS

GERMANY



Julia Banzhaf
Sales Manager

Phone +49 (0) 7022 2796-631
Mobile +49 (0) 172 615 234 6
Email j.banzhaf@qa-group.com



Sascha Raschinsky
Sales Manager

Phone +49 (0) 7022 2796-623
Mobile +49 (0) 176 403 646 37
Email s.raschinsky@qa-group.com



Jasmin Krammer
Sales Manager

Phone +49 (0) 7022 2796-630
Mobile +49 (0) 176 563 146 20
Email j.krammer@qa-group.com

CONTACT PERSON.

ALL DEPARTMENTS

SWITZERLAND



Sascha Raschinsky
COO
Technology and Sales

Phone +41 (0) 56 223 954 6
Mobile +41 (0) 79 155 108 7
Email s.raschinsky@qa-group.com