Anton Paar

Instrumented Indentation Testers
Scratch Testers

Mechanical surface characterization

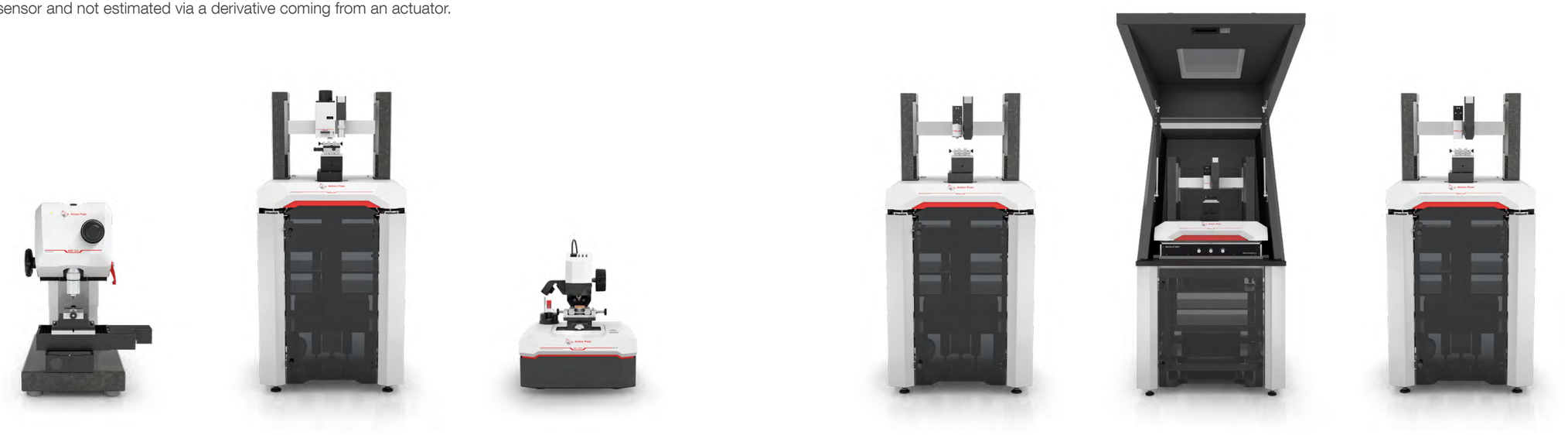
Multifunctional Testers:
For a Wide Range of Materials

- ✓ All-in-one instrument: seamless transition between measuring methods
- ✓ 2x faster: easy sample navigation combining extraordinary magnification range and continuous zoom
- ✓ Help when you need it: worldwide support via 37 subsidiaries and a full 3-year warranty
- ✓ Cost-reducing automation: We provide support if you want to increase testing throughput capability
- ✓ No compromise on sample size: measure the samples directly off the production line

Anton Paar's surface mechanical testers are versatile, multifunctional instruments that measure a wide range of mechanical properties of materials – from the hardest diamond-like carbon (DLC) coating to the softest hydrogels.

Anton Paar's mechanical surface testers cover four of the most important test methods for mechanical surface characterization: indentation, scratch, tribology and calotest. Thorough characterization of surface mechanical properties is the outcome.

We measure what others estimate: Anton Paar is the only company to offer high-resolution nanoindentation and nanoscratch testers with a real force sensor. This means force is continuously measured with a direct sensor and not estimated via a derivative coming from an actuator.



RST 300 ↓ | **MCT³ (Step 101)** ↓ | **Hit 300** ↓ | **NHT³ (Step 301)** ↓ | **UNHT³ NST³ (Step 701)** ↓ | **UNHT³ Bio (Step 301)** ↓

Hard → ← **Soft**

Diamonds | **Hard Coatings** | **Metals** | **Bones** | **Polymers** | **Hydrogels**

Surface Testing Platform (Step): All-in-one

Stay one STEP ahead

Step platforms are the basis for Anton Paar's mechanical surface measuring heads. They can house various types of testing on a single platform and ensure you're perfectly prepared for future lab upgrades.

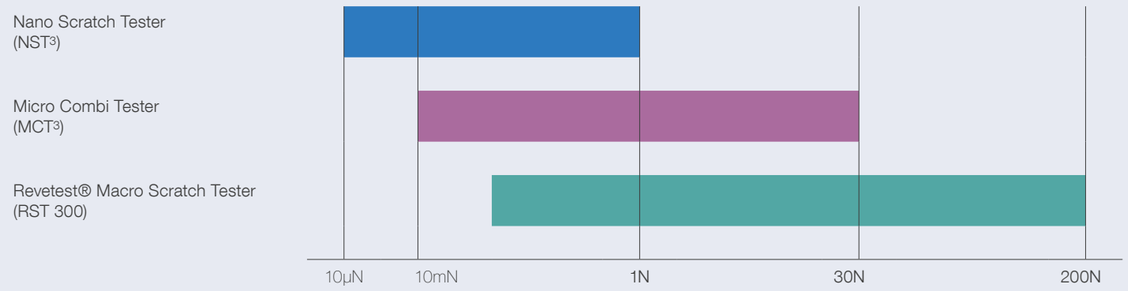
Revolutionize your testing capabilities
Step is your all-in-one platform for wide force range scratch, instrumented indentation, automatic conventional hardness, and tribology testing. Transition from one method to another with zero setup adjustments. Buy a single head or a full all-in-one setup. Either way, our Step platform solution equips you for future upgrades and constant competitiveness.

2x faster
Visualize samples 2x faster than with the previous model. The unique dual view microscope has a continuous zoom, exceptional magnification range 20x to 10,000x, and provides seamless transition from panoramic surface overview to maximum magnification.

Reduce costs via automation
Reduce costs and increase measurement throughput: We'll help you integrate your Step platform into the QC area of your production plant for automatic sample handling, loading, and testing.

Reduce effort, save time
Mount differently-sized samples on the instrument and measure these directly off the production line, saving time and effort. Unlock bespoke solutions designed specifically for your sample holding needs, available upon request.

Scratch Testing:
Features & Measuring Principles

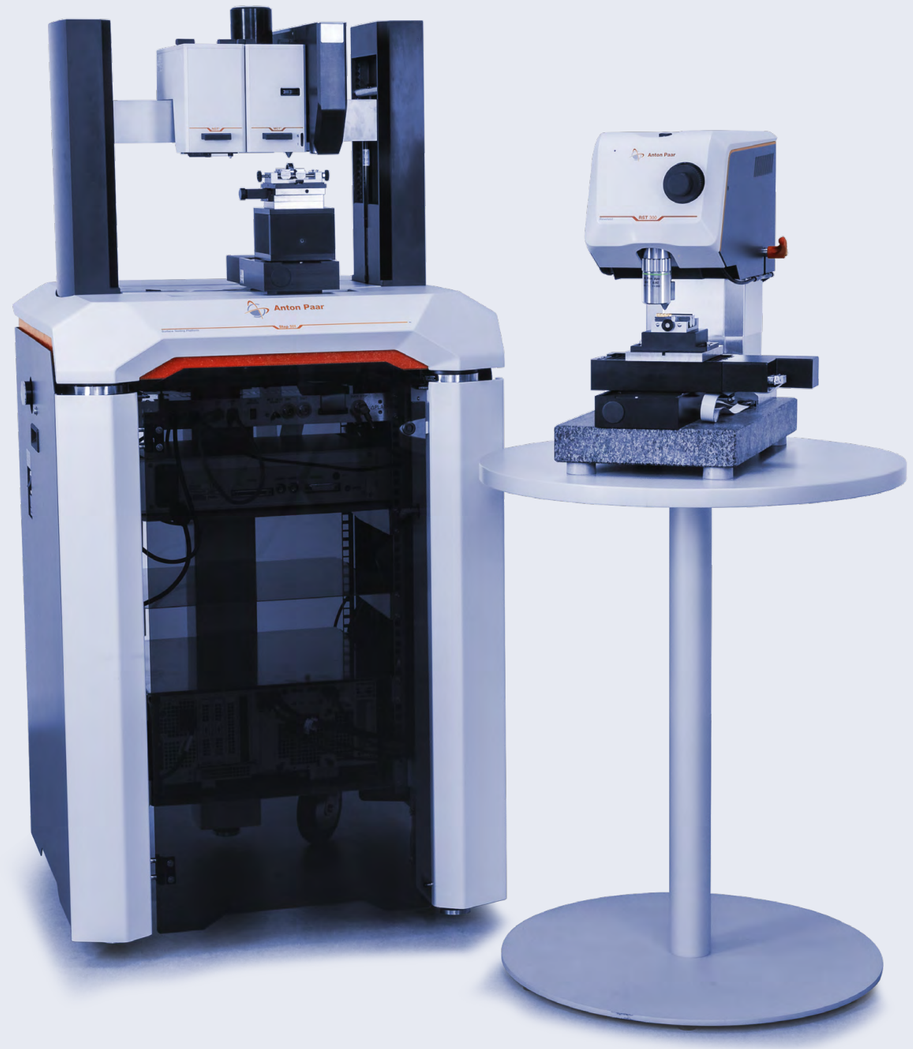


Scratch testers from Anton Paar are used to characterize film-substrate systems and quantify properties parameters such as adhesive and cohesive fractures, deformation, elastic recovery, friction force and conventional hardness using a variety of complementary methods. They are invaluable tools for the determination of coating adhesion, scratch and mar resistance, in research, development, and quality control.

The technique involves generating a controlled scratch with a diamond tip on the sample being tested.

Key features

- → Patented synchronized panorama
- → True penetration depth measurements for advanced elastic recovery studies
- → Active force feedback for full reproducibility even on complex surfaces
- → Automatic detection of critical loads to optimize results

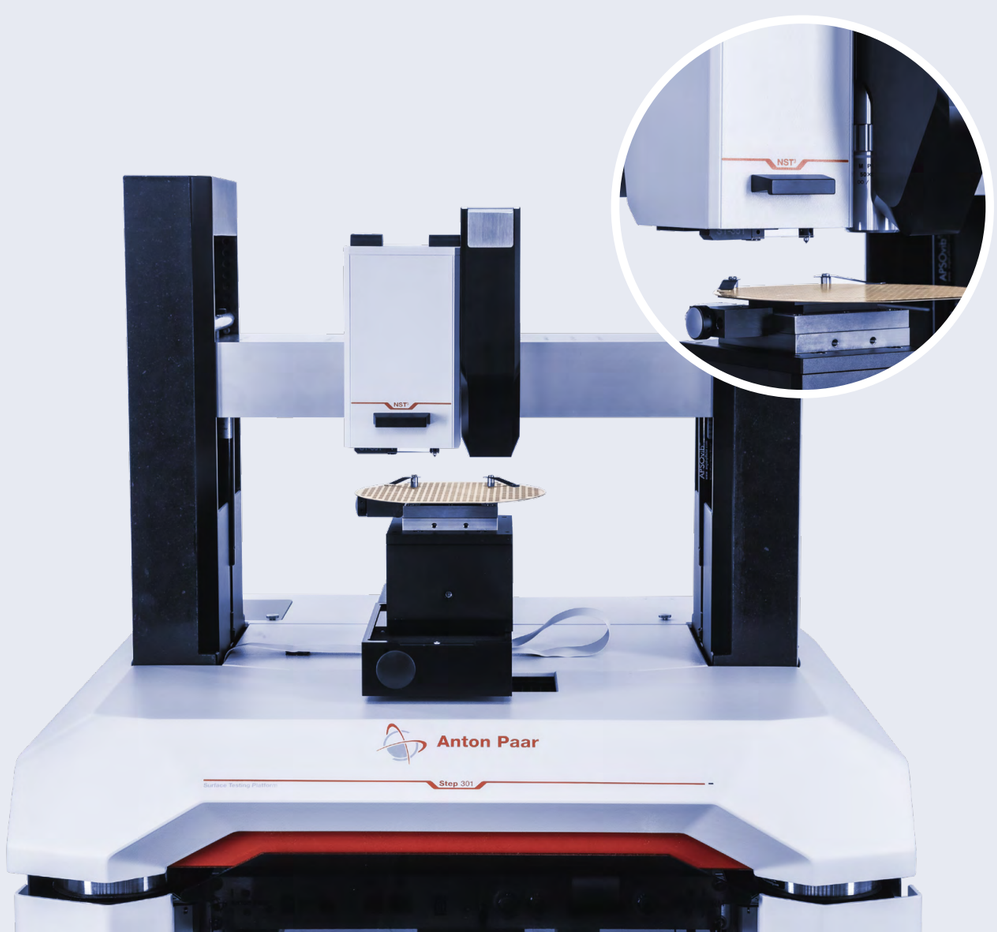


NST³
Nano Scratch Tester

FIND OUT MORE

www.anton-paar.com/apb-nst-3

The NST³, the most accurate nano scratch tester on the market, is particularly suited for characterizing the adhesion of films and coatings with a typical thickness below 1 µm. You can use the NST³ to analyze all types of coatings. The unique design of the NST³ includes two sensors for force and depth measurements associated with a state-of-the-art piezoelectric actuator. On top of exceptional accuracy, these features deliver a response time of milliseconds and flexibility for all kinds of scratch measurements.



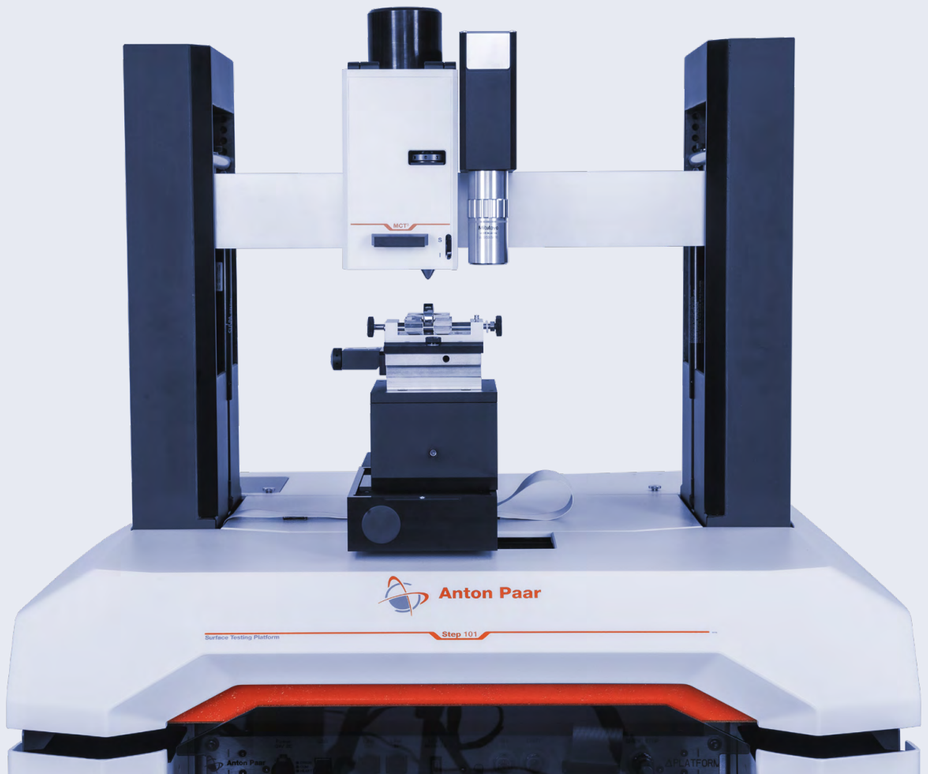
MCT³
Micro Scratch Combi

FIND OUT MORE

www.anton-paar.com/apb-mct-3

MCT³ is the only high-quality 4-in-1 setup for scratch, basic tribology, instrumented indentation and automatic conventional hardness testing. Perform measurement of coating adhesion, scratch resistance, hardness, friction and wear for various materials including hard coatings, thermal/plasma spray coatings, metals and polymers.

This scratch tester is widely used to measure adhesion and scratch resistance of coatings with a typical thickness below 5 µm.



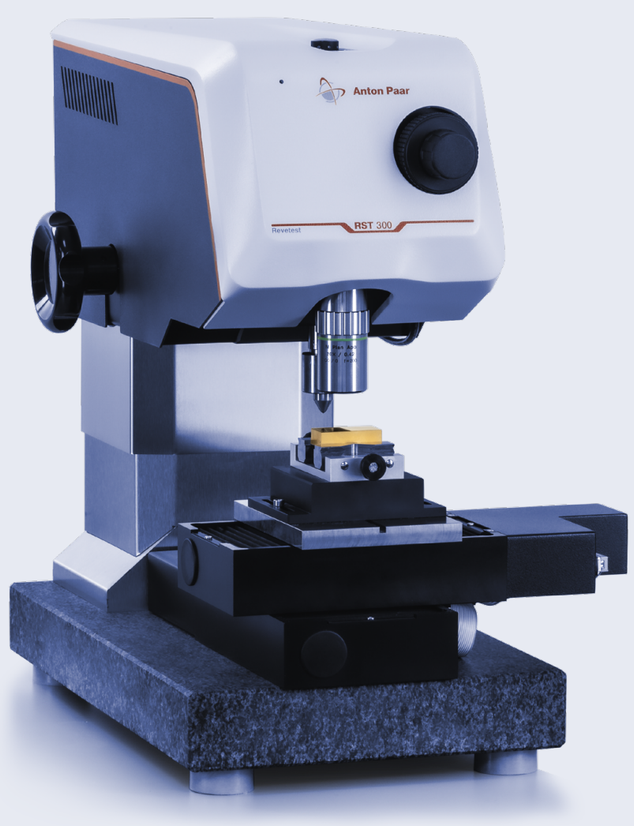
RST 300
Revetest® Scratch Tester

FIND OUT MORE

www.anton-paar.com/apb-rst-300

With more than 1,500 units sold around the world, the RST 300 is the industry standard widely used for evaluating hard-coated materials. The RST 300 is a robust, reliable instrument for the characterization of coating/substrate adhesion of all types of coatings for various applications, including magnetic and decorative applications.

The easy-to-use software enables you to perform basic tribological analysis as well as conventional Vickers hardness tests with automatic detection of the imprint.



Reliable.
Compliant.
Qualified.

FIND OUT MORE

www.anton-paar.com/service

Our well-trained and certified technicians are ready to keep your instrument running smoothly.

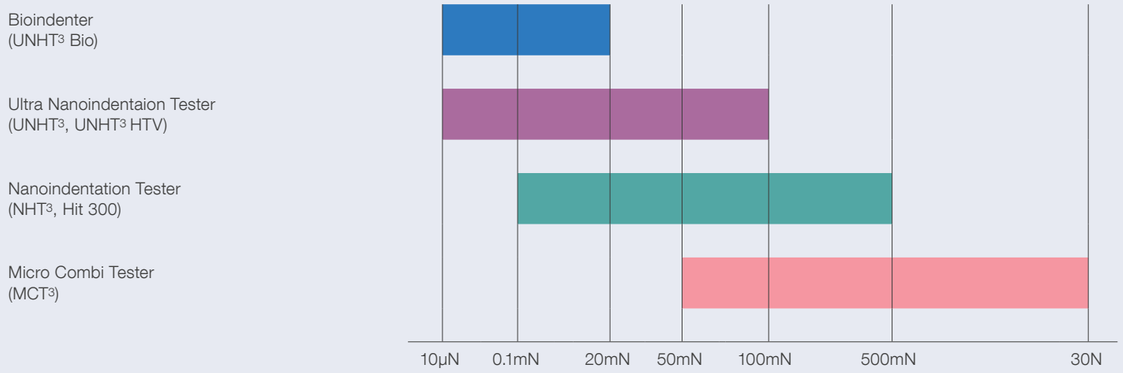
Maximum uptime
Regardless of how intensively you use your instrument, we help you keep your device in perfect shape and safeguard your investment. For at least 10 years after the discontinuation of a device, we'll provide you with any service and spare part that you might need.

Warranty program
We're confident in the high quality of our instruments. That's why we provide a full 3-year warranty. Just make sure to follow the relevant maintenance schedule. You can also extend your instrument's warranty beyond its expiration date.

Short response times
We know that sometimes it's urgent. That's why we provide a response to your inquiry within 24 hours. We give you straightforward help from great people, not from bots.

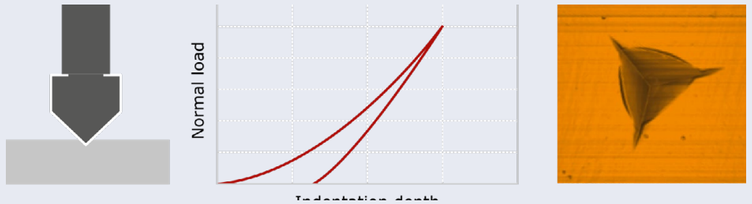
A global service network
Our large service network for customers spans 86 locations with more than 600 certified service technicians. Wherever you're located, there's always an Anton Paar service technician nearby.

Indentation Testing:
Features & Measuring Principles



Anton Paar indentation testers offer a wide range of testing modes from standard quasi-static DMA to stress-strain properties measurement, along with a broad spectrum of test results: hardness, elastic modulus, viscoelastic properties, creep, adhesion forces and stress-strain curves. A combination of unique top-surface referencing for maximum thermal stability, together with DualView microscope, precise positioning and high throughput, makes the Anton Paar indentation tester the best choice for mechanical surface characterization.

The instrumented indentation technique involves pressing a sharp indenter of known geometry into the surface while recording penetration depth and normal load.



Key features

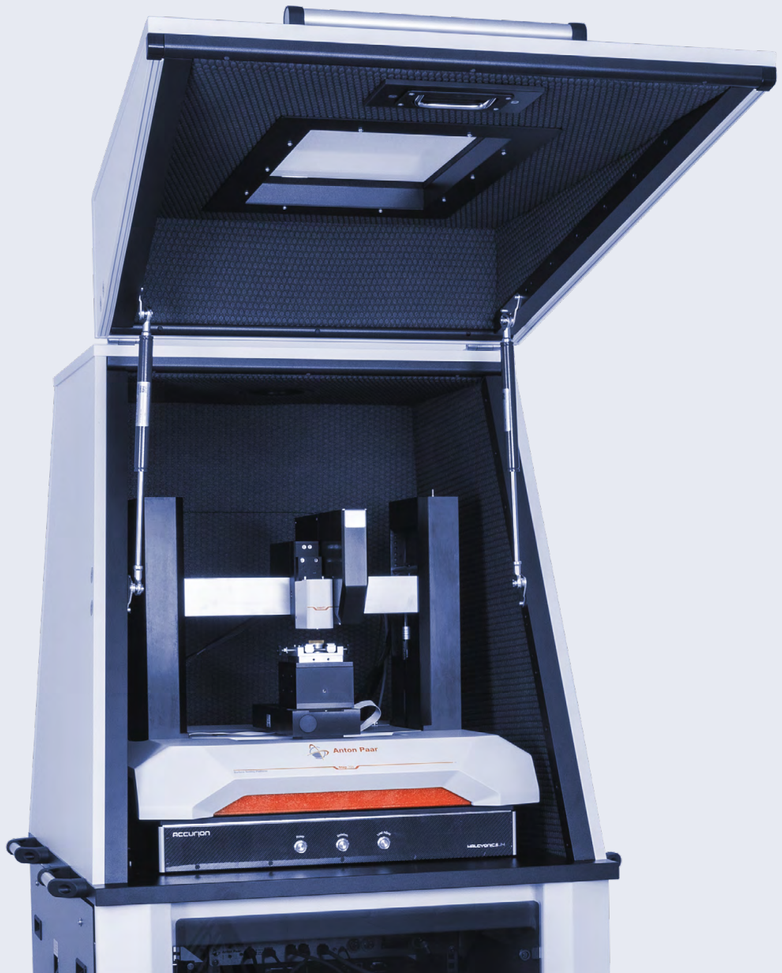
- → The highest thermal stability (0.0008 nm/s) and frame stiffness on the market (10^8 µN/µm) for the most accurate results without any corrections
- → High repositioning accuracy; <1 µm precision for indentation targeting
- → Wide range of testing modes: quasi-static, DMA, constant strain rate, stress-strain and others

UNHT³
Ultra Nanoindentation Tester

FIND OUT MORE

www.anton-paar.com/apb-unht-3

The UNHT³ tester with a real force sensor examines the mechanical properties at the nanoscale. It eliminates the effect of thermal drift (raw drift rate down to 0.0008 nm/s) and compliance due to its patented active surface referencing system (EP 1828744 and US 7685868). You can perfectly use it for long-term measurements related to all types of materials, from polymers to hard coatings. The UNHT³ includes advanced indentation modes such as sinus mode, load/depth control, constant strain rate and many others.

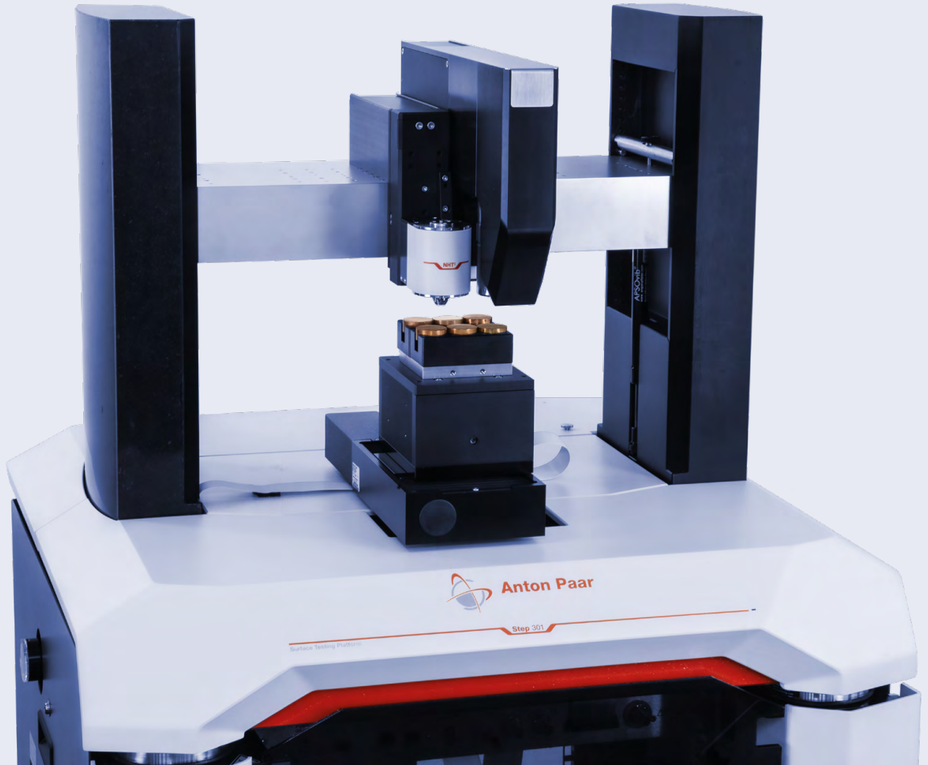


NHT³
Nanoindentation Tester

FIND OUT MORE

www.anton-paar.com/apb-nht-3

NHT³ is a robust, fast instrument for multiple advanced indentation modes: continuous multi cycles (CMC), user-defined sequences, sinus mode, and multi-sample protocols. Thanks to the top surface referencing design, it features high load frame stiffness (10^7 N/m) and exceptional thermal stability (raw drift rate down to 0.003 nm/s) – resulting in high accuracy. NHT³ is also compatible with liquid testing and in a specific configuration provides an ECR testing mode.



Hit 300

The simple-to-use, robust nanoindentation instrument Hit 300 is a premium yet highly affordable nanoindentation instrument with a self-explanatory interface. The integrated active anti-vibration damping and a unique two-laser targeting system make it accurate to <1 mm in all environments. Start-up takes 15 minutes, and within an hour, you will be able to go from training straight to results. Hit 300 is a delightful fusion of simplicity and power.

FIND OUT MORE

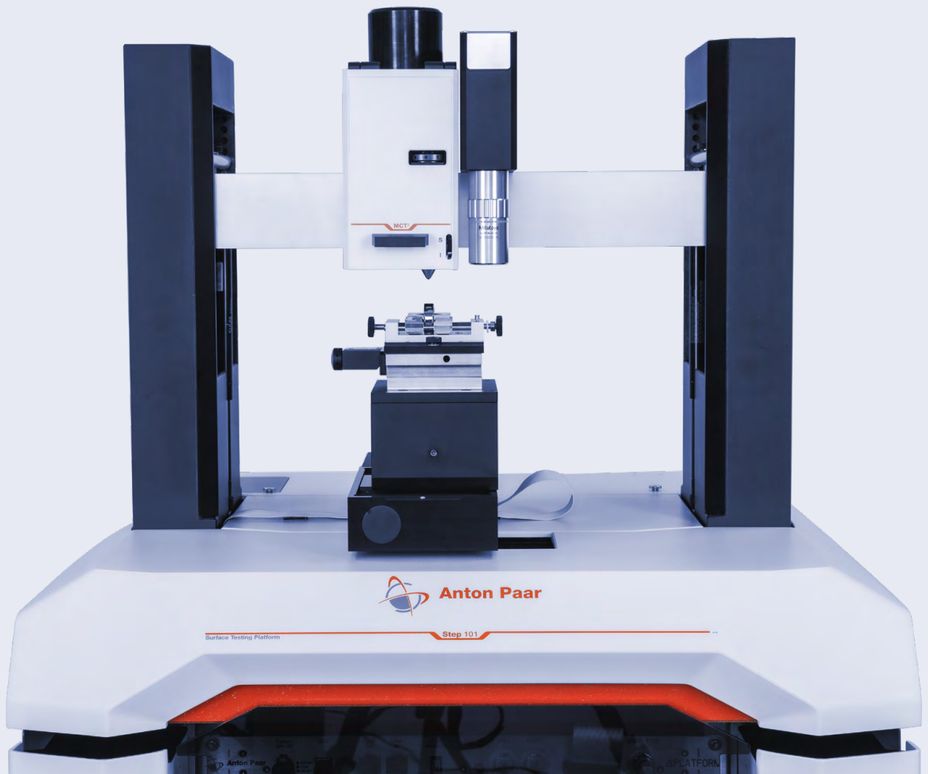
www.anton-paar.com/apb-hit-300

MCT³
Micro Combi Tester

The MCT³ is the only high-quality 4-in-1 setup for scratch, basic tribology, instrumented indentation and automatic conventional hardness testing. It measures the hardness and elastic modulus using high loads: instrumented indentation testing up to 10 N, and automatic conventional hardness testing up to 30 N. The combination of instrumented indentation testing for thin coatings and conventional hardness testing for bulk samples with rough surface broadens the spectrum of measurable properties.

FIND OUT MORE

www.anton-paar.com/apb-mct-3

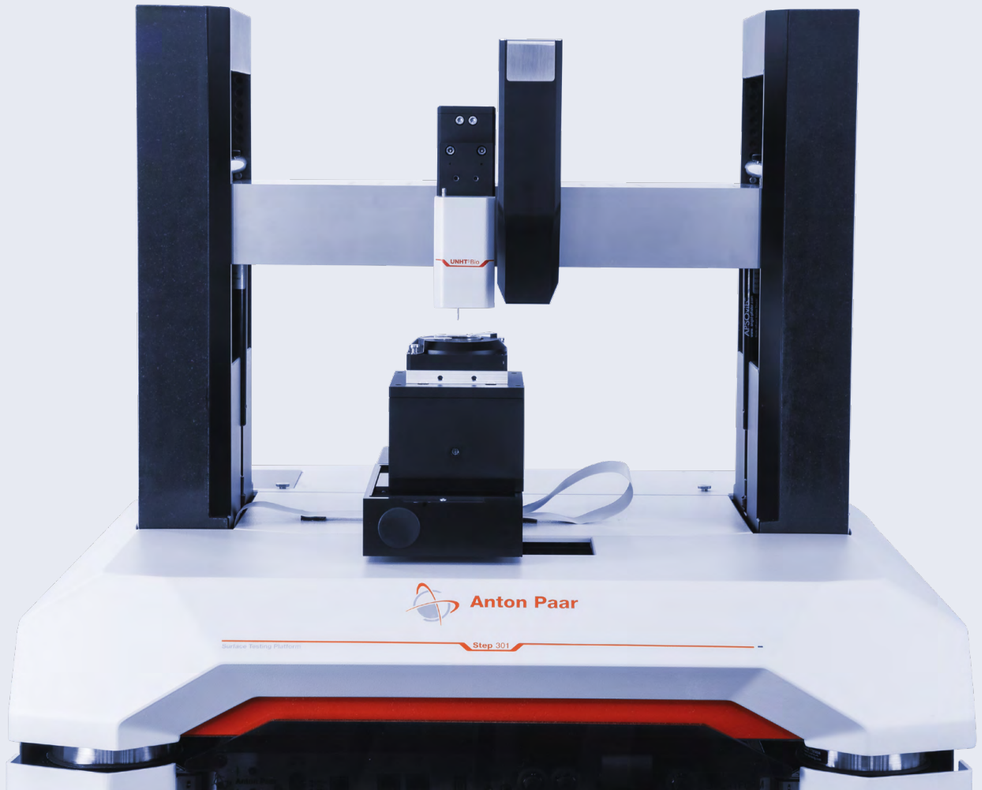


UNHT³ Bio
Bioindenter

FIND OUT MORE

www.anton-paar.com/apb-unht3-bio

The Bioindenter measures local mechanical properties of soft and biological samples, combining instrumented indentation with the requirements for testing of soft polymer and biological samples, in dry or liquid conditions. The Bioindenter has a wide range of indenters, comes with integrated Hertz model analysis commonly used for soft samples, and is an ideal tool if you are studying time-dependent properties such as creep or viscoelasticity.



UNHT³
HTV High-Temperature Ultra Nanoindentation Tester

FIND OUT MORE

www.anton-paar.com/apb-unht-3-htv

The UNHT³ HTV is an instrumented indentation tester for high temperature testing up to +800 °C. The actuating system is based on the patented technology of the UNHT³ with two independent depth and load capacitive sensors. Thermal barriers, water circulation, and reflective mirrors prevent the head from heating, resulting in unmatched stability. In addition, a high-vacuum chamber minimizes oxidation as well as heat loss from convection. The lowest thermal drift over the entire temperature range ensures high reliability of measurements.

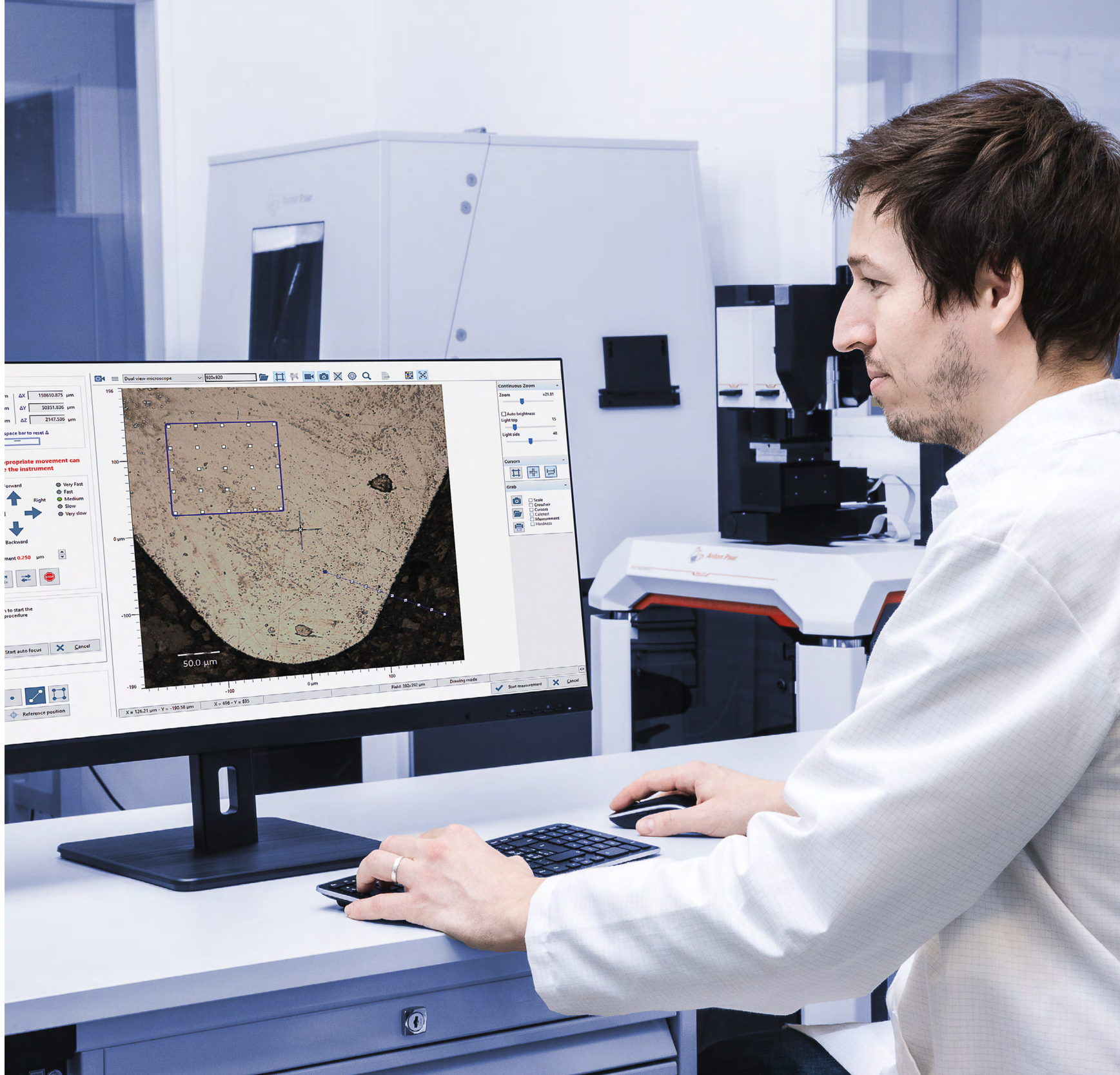
Software
Made for You

High-resolution microscope
The DualView microscope integrates a high-resolution top-view microscope with a side-view camera, making it quicker to locate the testing area.

Continuous zoom
The continuous zoom, exceptional magnification range 20x to 10,000x, seamless transition from panoramic surface overview to maximum magnification to closely examine the details.

Streamlined workflow
A dynamic software workflow enables streamlined control of the measurement process, from sample mounting to final report. The unique drawing wizard simplifies test definition and offers a clear visual representation of your measurements.

Automatic conventional Vickers hardness
This scratch software feature automatically detects and measures the area of the imprint of a conventional Vickers test, eliminating user influence on the Vickers hardness results.



Choose Your Perfect **Combination**

Combine different measuring heads and imaging solutions to obtain the measuring platform you need. To provide configuration flexibility, multiple testing and imaging heads can be installed together on the same platform. Customized platforms for glovebox, vacuum chamber and humidity chamber are available.

Step 101

→ No anti-vibration table available

→ Basic or advanced video microscope (obligatory choice)

→ Motorized x (75 mm), y (75 mm), z (30 mm) table included

Step 301

→ Anti-vibration table included

→ Basic or advanced video microscope (obligatory choice)

→ Motorized x (75 mm), y (75 mm), z (30 mm) table included

Step 501

→ Anti-vibration table included

→ Advanced video microscope (obligatory)

→ Motorized x (215 mm), y (75 mm), z (30 mm) table included

Step 701

→ Acoustic enclosure included

→ Active anti-vibration table included

→ Advanced video microscope (obligatory)

→ Atomic force microscope can be ordered as an option

→ Motorized x (215 mm), y (75 mm), z (30 mm) table included

	NHT³ ↓	**UNHT³** ↓	**UNHT³ Bio** ↓	**MCT³** ↓	**NST³** ↓	**AFM** ↓	**Advanced video microscope** ↓	**Basic video microscope** ↓
Max. load	500 mN	100 mN	20 mN	30 N	1000 mN	-	-	-
Step 101				✓			✓	✓
Step 301	✓		✓	✓	✓		✓	✓
Step 501	✓		✓	✓	✓		✓	
Step 701	✓	✓	✓	✓	✓	✓	✓	

Application & Industries

1 Hard coatings
Optimize hard coatings processes with our precise instruments. Swift data analysis, customizable views, and advanced techniques like nanoindentation and scratch optimize quality control. The instruments are ideal for cutting tools, and for use in the automotive and aerospace industries.

2 Semiconductors
Transform semiconductor processes with state-of-the-art methodologies implemented via our UNHT^3 and NST^3 instruments. From R&D characterization of new wafers to quality control in manufacturing, we ensure precision. Ideal for wafers, sensors, MEMS, and electronics components, our solutions empower you to excel in hard disk characterization and low K dielectrics quality control.

3 Automotive
Upgrade automotive standards with our advanced techniques. Ensure DLC coating injector quality, brake pad durability, and engine component integrity. The techniques are ideal for coatings, varnishes, plastics and lubricants. Choose between comprehensive characterization or targeted analysis: scratch, tribology, or nanoindentation, for precise results. Operate with ease, customize data views, and perform instant quality assessments.

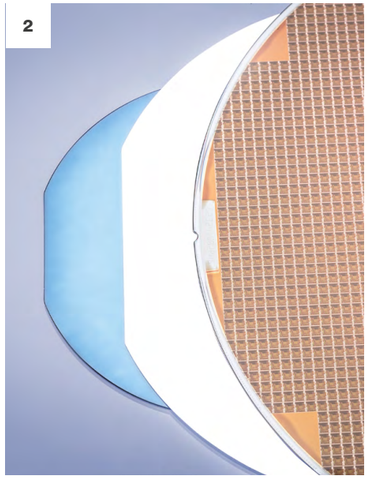
4 Optical and glass
Elevate your optical and glass standards with our innovative techniques. From enhancing resistance in eyeglass lenses to precision control in photography optics, we ensure quality. These techniques are ideal for optical glass in watches, smartphone displays, and more. Leverage advanced methods like nano scratch and ultra nanoindentation for comprehensive characterization and accurate assessments.

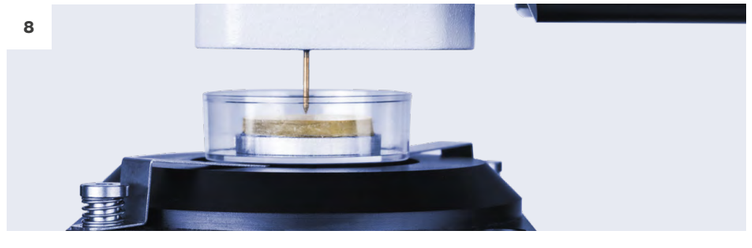
5 Metallurgy
Ensure optimal mechanical properties of metallic components, from strength to durability. These advanced methods are ideal for metals and alloys in various applications. Perform comprehensive characterization and precise evaluation, assisted by intuitive product interfaces for seamless integration.

6 Civil engineering
Evaluating the scratch resistance of ceramic tiles or tracking the evolution of the mechanical properties of cement with humidity – in both cases our techniques deliver precise analysis for durability and performance enhancement, guaranteeing product quality. If you need customizable sample holders to accommodate specific testing samples, we can help.

7 Biomedical
Our advanced methods cater to diverse needs. Whether you're addressing wear in prosthetics, assessing arterial stent resistance, studying tablet hardness, examining osteoporosis, or evaluating cornea elasticity, our instruments deliver precise results and personally tailored data views. With customizable holders and intuitive interfaces, seamless operation is ensured.

8 Academia
Benefit from accurate results to drive innovative discoveries across diverse fields. Whether for pure research or specific applications, experience the distinct advantages of our products. Achieve swift, accurate measurements, expedite sample preparation and waiting time, and maintain control with raw – not corrected – data.





	NST³	MCT³	RST 300
	↓	↓	↓
SCRATCH TESTING			
Maximum load [N]	1	30	200
Load resolution [µN]	0.01	10	100
Load noise floor [rms] [µN]*	0.1	100	1,000
Loading rate [N/min]	up to 100	up to 300	up to 300
Depth range [µm]	600	1,000	1,000
Depth resolution [nm]	0.1	0.05	0.05
Depth noise floor [rms] [nm]*	1.5	1.5	2.5
Data acquisition rate [kHz]	192	192	192
Scratch speed [mm/min]	0.1 to 600	0.1 to 600	0.4 to 600
OPTIONS			
Heating stage up to 200 °C		✓	
Heating stage up to 450 °C		✓	
Liquid testing	✓	✓	✓

	UNHT³	NHT³	Hit 300	MCT³	UNHT³ Bio	UNHT³ HTV
	↓	↓	↓	↓	↓	↓
INDENTATION TESTING						
Maximum indentation load [mN]	100	500	500	30,000	20	100
Load resolution [µN]	0.003	0.02	0.02	6	0.001	0.006
Load noise floor [rms] [µN]*	<0.05	<0.5	<1	<100	0.1	0.5
Maximum indentation depth [µm]	100	200	200	1,000	100	100
Depth resolution [nm]	0.003	0.01	0.01	0.03	0.006	0.006
Depth noise floor [rms] [nm]*	<0.03	<0.15	<0.3	<1.5	0.25	0.15
Data acquisition rate [kHz]	192	192	192	192	192	192
OPTIONS						
Sinus mode	✓	✓	✓		✓	✓
Liquid testing	✓	✓	✓	✓	✓	
Heating stage up to 200 °C	✓			✓		
Heating stage up to 450 °C				✓		
Heating stage up to 800 °C						✓
Petri dish holder					✓	

Additional options and accessories are available on specific request: Electrical contact resistance (ECR), cooling for low temperatures (-150 °C in vacuum), wafer holder, multiple sample holder, ...
*Noise floor value specified under ideal laboratory conditions and using an anti-vibration table.

✓ available option

Measurands

↓

SCRATCH TESTING

Adhesive strength, friction force, coating adhesion, scratch, and mar resistance

INDENTATION TESTING

Hardness and elastic modulus, creep compliance, relaxation, Hertz analysis, dynamic mechanical analysis (E', E'', tan delta), stress-strain curve, fatigue

Standards

↓

SCRATCH TESTING	
ISO14577	Metallic materials — instrumented indentation test for hardness and materials parameters
ISO 6507	Metallic materials — Vickers hardness test
ISO19278	Instrumented microindentation test for hardness measurement of plastics materials
ISO 4516	Metallic and other inorganic coatings – Vickers and Knoop microhardness tests
ASTM E2546	Standard practice for instrumented indentation testing
ASTM C1327	Standard test method for Vickers indentation hardness of advanced ceramics
ASTM C1326	Standard test method for Knoop indentation hardness of advanced ceramics
ASTM B933	Standard test method for microindentation hardness of powder metallurgy (PM) materials
ASTM E384	Standard test method for Knoop and Vickers hardness of materials
ASTM B578	Standard test method for microhardness of electroplated coatings

INDENTATION TESTING	
ISO 20502	Fine ceramics – determination of adhesion of ceramic coatings by scratch testing
DIN EN1071	Advanced technical ceramics – methods of test for ceramic coatings
ASTM C1624	Standard test method for adhesion strength and mechanical failure modes of ceramic coatings by quantitative scratch testing
ASTM D7187	Scratch/Mar behavior of paint coatings by nanoscratching
ASTM G171	Scratch hardness of materials using a diamond stylus
ISO 27307:2015	Thermal spraying – evaluation of adhesion/cohesion of thermal sprayed ceramic coatings by transverse scratch testing

Patents

↓

EP 1828744 and US 7685868	Active top surface referencing (UNHT³)
EP 2065695 and US 8261600	Synchronized panorama mode (scratch testers)
US 6520004	True penetration and residual depth (scratch tester)

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