

 **Micro Materials**
Excellence in Nanomechanics

NanoTestTM *Vantage*

THE COMPREHENSIVE NANOMECHANICAL
TESTING CENTRE THAT'S NOW SMARTER, FASTER
AND EVEN MORE FLEXIBLE



NANOTEST VANTAGE: NEXT GENERATION NANOMECHANICAL TESTING

For over 20 years, Micro Materials (MML) has been a leading international innovator in the highly specialised world of nanomechanical testing – constantly developing and refining equipment that has consistently set new benchmarks for performance, cost-effectiveness and adaptability.

The NanoTest Vantage continues that tradition of innovation and functionality. We are proud to be an organisation that is at the forefront of nanomechanical testing.

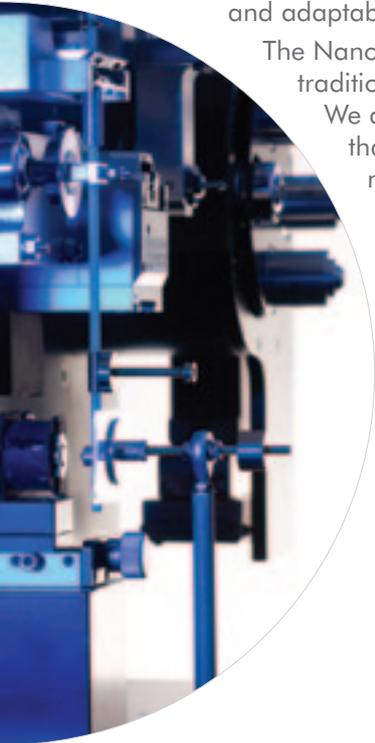
MML recognise that laboratory equipment has to constantly justify its outlay, and so we design equipment that is not only robust, reliable and highly accurate, but which also performs a wide range of roles. This flexibility continues to set the NanoTest apart from other systems on the market.

The unique, modular approach of our NanoTest Vantage means that just one testing center will be all you need to perform a complete range of nanomechanical and nanotribological tests in a range of real-world environments related to your application.

Amongst other parameters, the NanoTest Vantage will measure hardness, modulus, toughness, fracture, fatigue, wear, fretting and many other properties of thin films and other solid surfaces.

More than that, we future-proof our equipment to ensure that – as technology evolves and new demands are made – we can provide upgrades to keep pace. Years from now, the NanoTest Vantage will still be performing a critical role in your research and development.

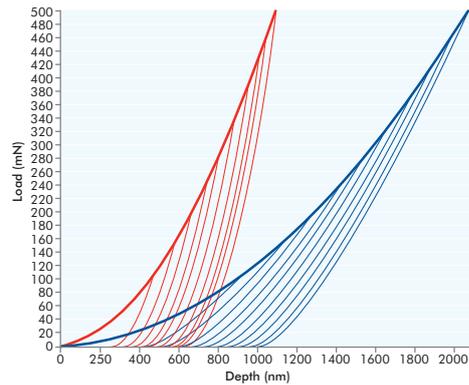
Improvements brought by the NanoTest Vantage have focussed on four key areas: improved ease of use; increased speed of set up, calibration and training; improved system performance; and system robustness. High turnover of users is often a reality in a research setting, meaning that instruments must be easy to understand and use. This is fully addressed by the Vantage.



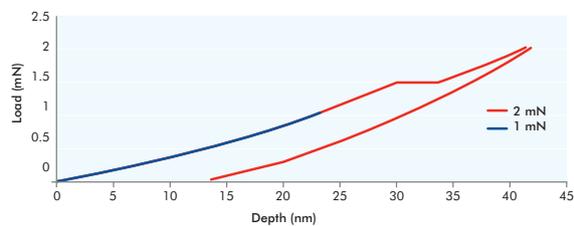
Mechanical Testing

Core features of the NanoTest

- ▶ Excellent low load data – making the NanoTest one of the most sensitive systems on the market.
- ▶ Both targeted area specific and multiple indentation modes available.
- ▶ Indentation mapping - helping you to visualise your results.
- ▶ High level of automation enabling prolonged, unsupervised test periods.
- ▶ Space to mount large and small samples, or even real components.
- ▶ Non-destructive nature allows pre-testing before the components go into service.
- ▶ Both ISO 14577 and ASTM 2546 compliant for complete confidence in your results for a wide range of industries.
- ▶ System lifelong after sales support right around the world, with direct access to our expert engineering team.
- ▶ Low thermal drift through a dedicated environmental enclosure with active heating and high thermal mass of the NanoTest system.
- ▶ Software updates from the user support area on our website.



Consistency of NanoTest results shown by loading curve superimposition in repeat nanoindentations at different positions to peak loads of 100-500 mN. Sets of 10 load/unload indentations obtained over a wide depth range. The overlapping loading curves demonstrate excellent consistency. Each load/unload curve produces hardness and modulus values corresponding to its particular depth of indentation.



Low load nanoindentation curves on single crystal sapphire. Contact is completely elastic until a pop-in at 1.5 mN.



APPLICATIONS FOR THE NANOTEST VANTAGE

The NanoTest has already secured its place at the heart of leading edge R&D and Quality Assurance in a host of different applications, including:

Aerospace

The unique, high temperature capability of the NanoTest system has opened up a wide variety of applications in the aerospace sector, including interconnect technology and turbine improvement with thermal barrier coatings.

Automotive

Recent automotive development has concentrated on the optimisation of thin films and coatings (for example hard PVD coatings for coating piston rings, valve stems, bearings and gears) as well as the scratch resistance of paints and clearcoats, brake pads and the fatigue wear of gears.

Many components experience high temperatures during operation. With the NanoTest hot stage, it is possible to optimize the mechanical and tribological properties of coated components at their operating temperature.

"The NanoTest system helps unlock new frontiers in surface engineering and is therefore a valuable research tool."

Tom Bell - Research Fellow University of Birmingham

Biomedical

Optimising the mechanical properties of biomedical devices is a key step in determining their clinical performance. This is particularly the case for long-term implantable devices, such as total joint replacements, which need to function effectively over periods of 20 years or more – making laboratory tests essential to optimise performance. This is where the NanoTest system has proved so effective in industry and academic research, enabling mechanical and wear tests to be carried out on actual medical devices, with their complex geometries.

MEMS

Control of friction and wear of moving parts is a key issue for the reliability of Microelectromechanical (MEM) Devices. Unlubricated SiO₂ surfaces are very prone to attracting water and so suffer from high friction and wear, as well as unwanted adhesion. Solid lubrication approaches are being developed to combat this: low friction, hard coatings that are resistant to abrasive wear and which lower the surface energy. The NanoTest is being used to assess potential overcoat formulations, such as DLC, ta-C and other novel materials.

The NanoTest Vantage provides proven testing excellence in all areas of research and industry - from automotive R&D through to optical.

Thin Film Coatings

The NanoTest Vantage's wide range of complementary techniques provides the most comprehensive characterization and optimization of the properties of PVD and CVD films and coatings. Taken together, the results provide far greater confidence and reliability than those from nanoindentation alone.

Polymer Applications

Thermal stability of the testing instrument is key to meaningful measurements of the viscoelastic properties of time-dependent materials. At room temperature, the thermal drift of the NanoTest is very low - typically a whole order of magnitude less than some other commercial systems. This is equally critical when testing at elevated temperatures.

Semiconductors

The NanoTest Vantage is an ideal tool-kit for solving a wide range of mechanical reliability problems throughout the microelectronics industry.

Thick Coatings and Surface Treated Materials

The high applied load (20 N) possible with the MicroTest loading head of the NanoTest Vantage, together with the range of techniques (depth-sensing microindentation, micro-scratch, micro-wear and micro-impact) make the system also ideally suited for testing and optimisation of the properties of coatings (either single layers or multilayers) where the total thickness is greater than about 5microns.

Pharmaceutical

The NanoTest's advanced scheduling capability enables fully-automatic testing over an extended period. This makes it ideally suited to R&D and quality assurance in a highly competitive industry where both rapid high data throughput and reliability of results are essential. The pharmaceutical industry has made use of the relation between nano indentation, nano impact and the relative compaction of tablets to the real dose release mechanism to improve the performance of their products.

Other applications include:

There are many applications in which the performance, reliability and longevity of components are dependent on surface mechanical properties. Virtually all such applications can utilise the power of NanoTesting. The list of such applications continues to grow, including oil & gas, nuclear, motorsport, solar power, body armour and optics.



USER BENEFITS OF THE NANOTEST VANTAGE

User friendly software

A simplified interface, while maintaining full flexibility, makes the software easier to navigate and more intuitive - making it ideal for both new and inexperienced users.

Industry-leading stability

The NanoTest Vantage provides industry-leading stability, due to its dedicated environmental enclosure and the high thermal mass of the frame, whilst offering greatly enhanced force and displacement capability.

High automatic throughput

The automatic scheduling facility allows maximum throughput without the need for user intervention, enabling the equipment to be used 24/7.

Unrivalled flexibility

The NanoTest Vantage software offers a wide range of selectable parameters, allowing the user optimum flexibility of experiment design – making it ideal for research and development.

Purpose-designed for experiments

The NanoTest Vantage has been designed and constructed with your experiments in mind. A large working area between the motor stage and the indenter allows you to set up custom experiments.

▲ *Quantitative mapping of distribution and hardness of intermetallic phases present in a lead free solder joint.*

Modular design to grow your research options

The NanoTest Vantage is a fully modular system that allows the user to configure the system to meet their individual needs, and can be expanded at a later date to include further modules. This allows the system to evolve as the needs or research interests of the user changes. Users can swap between testing modules quickly and easily.

Comprehensive after-sales service & care

At Micro Materials Ltd, we pride ourselves on our strong customer after sale care, which includes direct access to our expert engineering team who can help with your experiment design and custom software setup. This will keep your equipment updated and fully functional for years to come, significantly reducing overall lifetime cost.

Peer-collaboration and knowledge exchange

Many of our testing modules have been developed in response to the needs of our customers. You can be part of this collaborative approach to enhance your research programmes.

Cutting edge technology for enhanced research

We apply the very latest and most accurate technology in our NanoTest Systems which allows you to break through into new and pioneering research - proven by the wealth of published data using the NanoTest system.

Patented nano-impact and fatigue testing

This technique enables the simulation of small repetitive stresses and interrupted contact that many modern materials suffer during their service life – and thus allows more accurate prediction of materials behaviour. This, in turn, helps you design better materials or coatings for erosive protection, cutting tool, engine and other applications.

High temperature measurements

This allows the testing of samples at temperatures up to 750°C. This is extremely useful for a range of applications, including cutting tools, aerospace, and other emerging technologies which require a coating or material to operate under high temperature conditions.

Liquid cell facility

Allows the testing of a sample fully immersed in a fluid without the buoyancy problems associated with vertical loaded indentation.

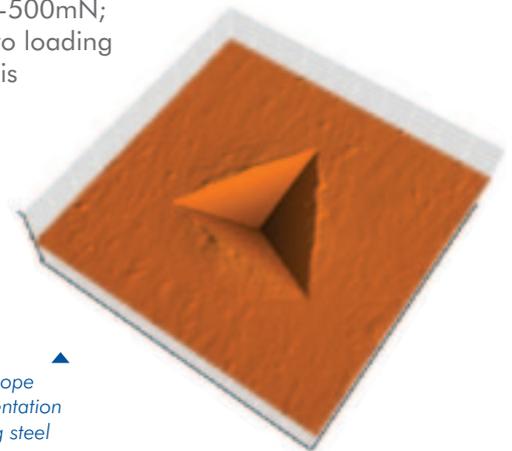
Load / partial-unload technique

This enables users to rapidly build up a complete profile of the variation of hardness and modulus with depth.

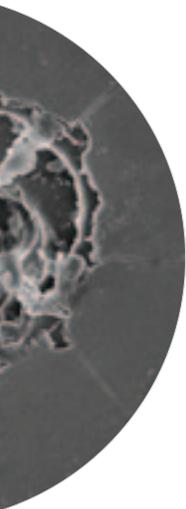
◀ *Ring and radial cracks emerging from central impact crater on a commercial coating caused by nano-impact employing a spherical probe with a 25 micron radius.*

Wide load range

Nano loading head allows forces of 10 μ N-500mN; adding the Micro loading head extends this range to 20N.



▲ *Atomic force microscope image of a nanoindentation in a polished bearing steel sample.*



What the NanoTest Vantage can deliver...

The NanoTest Vantage can measure the following properties:

- ▶ Hardness
- ▶ Elastic modulus
- ▶ Adhesion
- ▶ Creep
- ▶ Stress-strain
- ▶ Wear resistance
- ▶ Toughness
- ▶ Viscoelastic properties
- ▶ Impact resistance

Customer-specific applications

MML has pioneered a series of testing methods which allow a sample to be tested in an environment which can be adjusted to closely replicate conditions that these materials actually see in everyday use. If you have an application that needs an innovative approach, just talk to us.

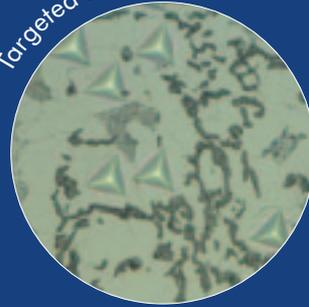
and what our modular approach can add...

The modular design of the NanoTest Vantage enables you to specify these functionalities:

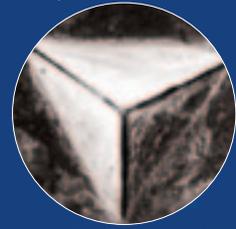
Scratch



Targeted indents



Indentation



NanoTest[™] Vantage Nanoindentation

Low load and/or High load
(10 μ N-500 mN) (0.2-20 N)

Controlled Environment

Dynamic loading

Characterisation

High temperature (750°C max)
Low temperature (-30°C min)
Liquid (H₂O, Oil)
Dry, humid (15-80% RH)
Inert atmosphere (Ar, N₂)
Low oxygen atmosphere (0.1% min)

Scratch
Wear
Fretting
Sample impact
Pendulum impact

3D imaging - surface profiling/nanopositioner
Depth profiling
3D imaging high resolution - AFM
Acoustic emission
Targeted and mapped Indentation

A GLOBAL PRODUCT SUPPLY



SEE THE NANOTEST VANTAGE IN ACTION

Reading about the NanoTest Vantage is one thing... seeing it in action is another. Regardless of your location you can see it in operation – either at our UK headquarters, at a local user site near you or through a videolink – running test experiments that have relevance to you. Get in touch and we will do the rest.

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