THE NANOTEST VANTAGE: NEXT GENERATION
NANOMECHANICAL TESTING AND MATERIALS
DEVELOPMENT FOR THE AUTOMOTIVE SECTOR

- High performance paints
- Polyurethanes
- PVD Coatings
- High performance coatings
- Big end bearing shells
- Fuel injectors
- Piston alloys
- Lightweight chassis materials
- Composite tyres
- Clutch linings, discs and bearings
- Brake pads and discs
- Fuel cells
Nano mechanical tests for automotive applications

High performance materials
Materials and components in the automotive sector have an increasingly tough job to perform – needing to work reliably and consistently in extreme operating environments. The NanoTest Vantage provides the performance data you need to optimise such materials. For example, to meet environmental and commercial concerns, researchers are developing advanced materials and coating systems to achieve engines with greater fuel efficiency.

Reliability
Increasing reliability has always been important to both large commercial vehicles with a typical 10^6 miles warranty, and the domestic market, which is now extending vehicle warranties. This drives the need for more research and development in this area. The optimisation of coatings and surface treatments for wear resistance is an essential step in designing for improved efficiency coupled with reliability.

Unique capabilities of the NanoTest Vantage – such as the capability to perform nanomechanical testing at temperatures up to 750°C – mean that it is increasingly being used for measurements of the mechanical properties of high performance materials for a wide range of applications in the automotive industry, from chassis to engine development.

Nano-impact to assess fatigue and fracture

High temperature impact shows that the TiAlN coating is more resistant to fracture due to fatigue at 500°C (blue curve) than 25°C (red curve). PVD coatings such as TiAlN and AlCrN are often used as cutting tool coatings, but their good oxidation resistance and high hot hardness have many other applications under extremes of loading, loading rate and temperature, all of which are found in the automotive industry. Collaboration with scientists at McMaster University in Canada, Polytech Tours in France and Balzers AG in Liechtenstein, we have begun to investigate the nanomechanical properties of these and other coatings at high strain rates and elevated temperatures.

Ring and radial cracks emerging from central impact crater on a commercial coating caused by nano-impact using a spherical probe of 25 µm radius.

The NanoTest Vantage can be configured with nanoindentation, nano-scratch, nano-impact and nano-fretting.
Lightweight materials
Iron aluminides, like other lightweight intermetallics, are being investigated for use in the automotive industry. For applications involving tribo-contact – such as valves in IC engines – abrasion resistance could be a crucial factor in determining the life and performance of FeAl parts.

Scratch and wear resistance
Researchers at Birmingham University have used both the constant load and ramped nanoscratch capabilities of the NanoTest to evaluate the effectiveness of surface treatments in improving their scratch and wear resistance. The surface treatment involved thermal oxidation at 1000°C for 30-150 hr. The critical load for brittle fracture (buckling and chipping) of the oxide layer could be increased by lengthening the oxidation time.

The Birmingham surface engineering group also confirmed the expected interrelation between tribological and mechanical properties; finding that relative scratch resistance scaled with the dimensionless Hardness/Modulus (H/E) ratio.

Improvement in scratch resistance as a result of increased H/E, ratio.

Nanoindentation and nano-scratch testing showed that by increasing thermal oxidation time they could improve the abrasion resistance of the FeAl alloys. Surface treatment by the thermal oxidation route developed should extend the applicability of FeAl alloys to harsher tribo-contact conditions.

Variation in critical load with time of oxidation at 1000°C.

Quantitative mapping of distribution and hardness of intermetallic phases present in a lead free solder joint.
NanoTest Vantage: the user benefits

High temperature measurements
Allows the testing of samples at temperatures up to 750°C, allowing evaluation of true ‘in-service’ mechanical properties.

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

Industry-leading stability
The system has a dedicated environmental enclosure and a high thermal mass frame, ensuring ultimate instrument stability.

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.

Purpose-designed for experiments
A large working area between the motor stage and the indenter allows you to set up custom experiments.

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.

Comprehensive after sales service & care
Our strong customer after sale care includes direct access to our expert engineering team who can help with your experiment design and custom software setup.

Peer-collaboration and knowledge exchange
Many of our testing modules have been developed in response to the needs of our customers. You too can opt to be part of this collaborative approach.

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.

Patented nano-impact and fatigue testing
This technique helps you design better materials or coatings for erosive protection, cutting tool, engine and other applications.

Liquid cell facility
Allows the testing of a sample fully immersed in a fluid without indenter 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.

Wide load range 10µN - 20N
With our micro and nano load heads you have a wide range of loads to choose from which adds to the flexibility of use for the system.

FIND OUT THE FULL STORY
This has been a brief appraisal of the NanoTest Vantage’s operating capabilities. To find out how one of the new generation models could transform your testing capabilities, get in touch and we can provide a detailed analysis of how it could benefit your operation. To see the NanoTest Vantage in action (either at our UK headquarters, through one of our worldwide distributors or through a videolink) running test experiments that have relevance to you, again, just get in touch and we will do the rest.