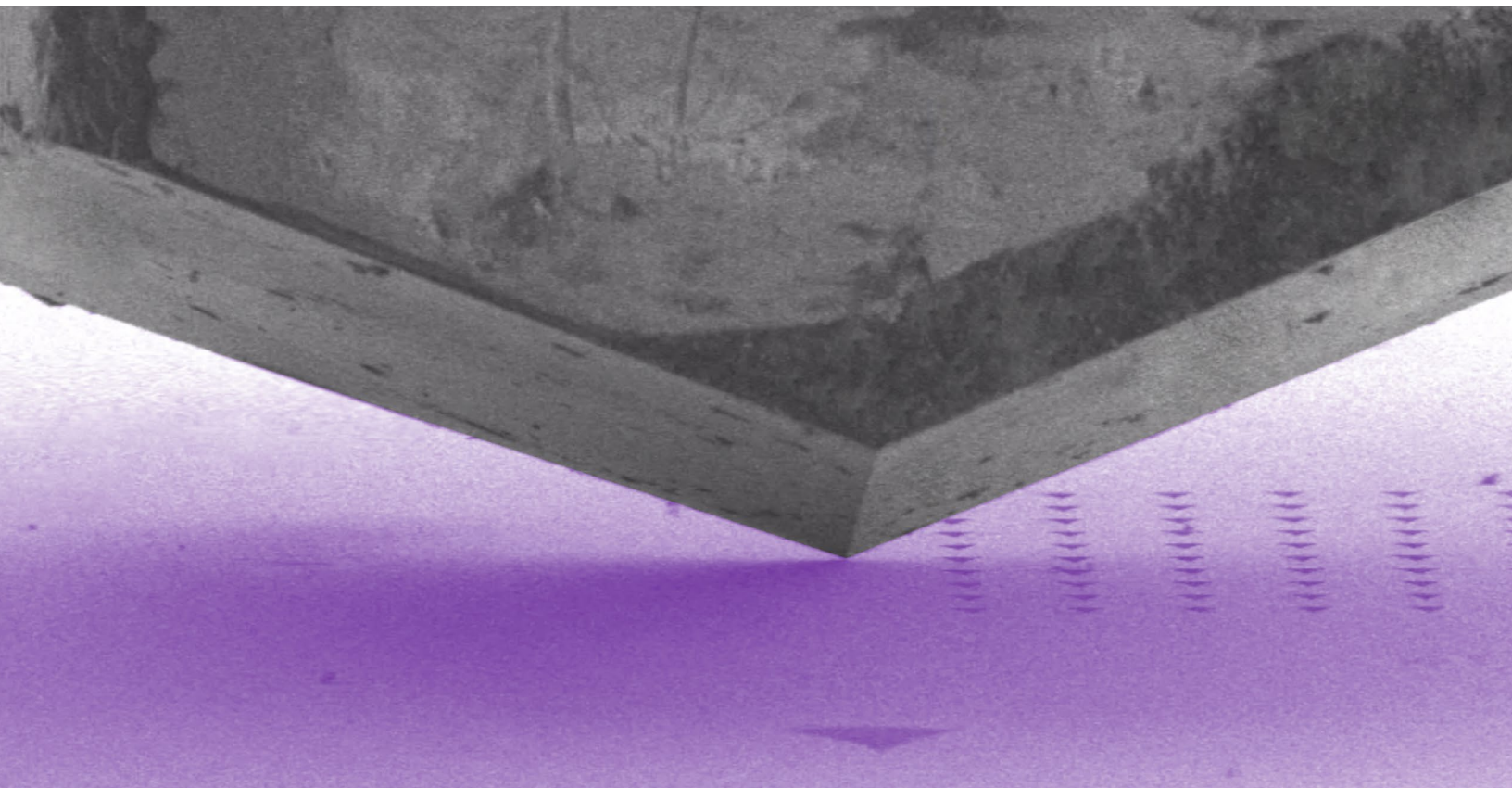


# Nano Indenter® G200X

Nanomechanical Tester



## Features

- Upgradeable, multi-mode platform for nanomechanical property measurement, scanning probe microscopy, high temperature measurement and conductive nanoindentation, complete with statistical data analysis package
- Large suite of pre-programmed nanomechanical test methods for ease-of-use
- Load ranges from 1 $\mu$ N to 1N for tests on a wide variety of materials, including soft polymers and hard materials
- Fast indentation using the NanoBlitz 3D option for generation of mechanical property maps in minutes
- Upgradeable NanoBlitz 4D option for high strain rate measurements
- Built-in scratch and wear testing for analysis of thin film delamination
- Proprietary online nanoindentation courses taught by nanoindenter experts, and mobile apps for live updates to test methods

## Nano Indenter® G200X

### Precise mechanical testing for micro-to-nano range of loads and displacements

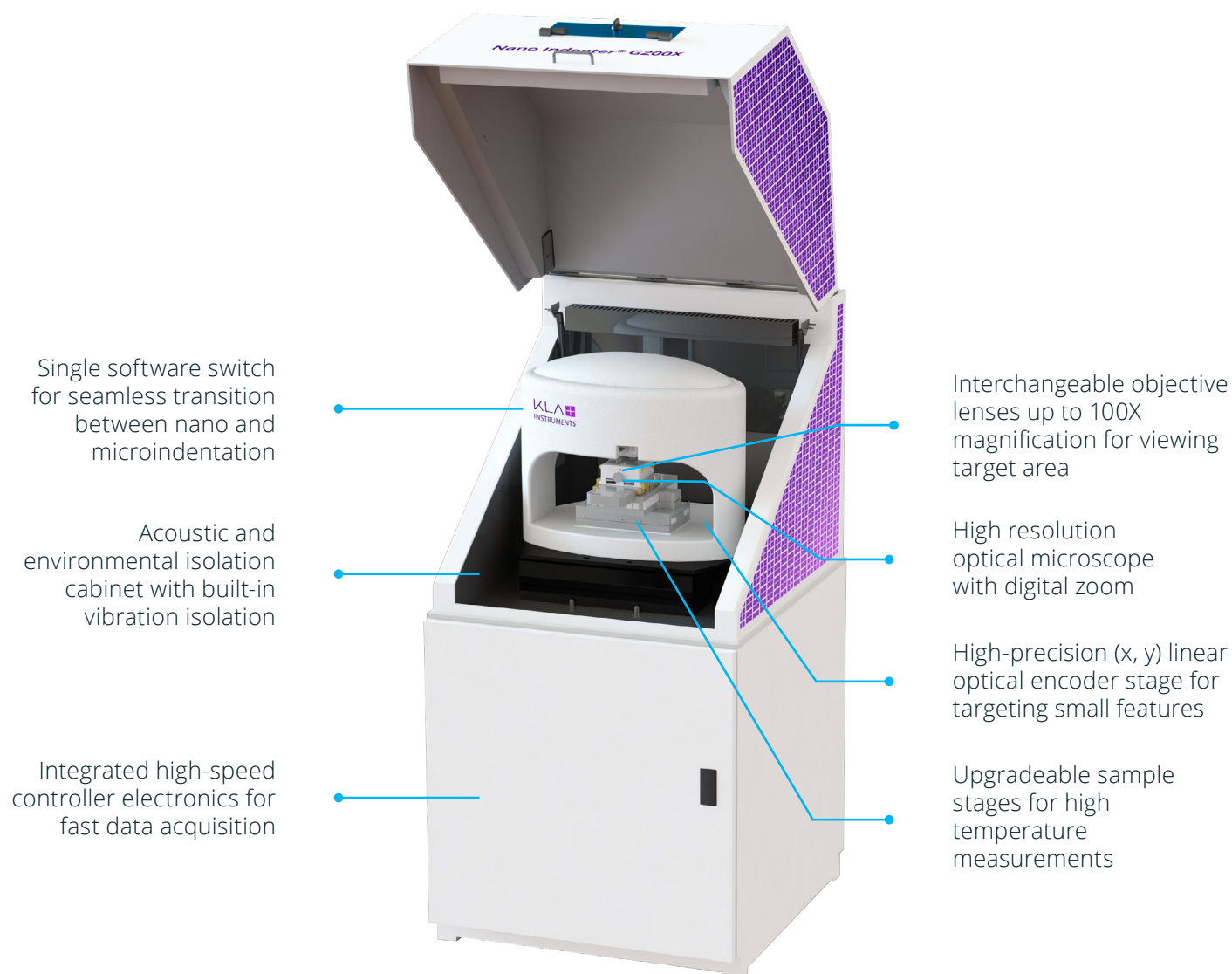
The Nano Indenter® G200X system is an accurate, flexible, user-friendly instrument for nanoscale mechanical testing. The G200X measures Young's modulus and hardness, including measurement of deformation over six orders of magnitude, from nanometers to millimeters. The system can also measure the complex modulus of polymers, gels and biological tissue, as well as the creep response (strain rate sensitivity) of thin metallic films. Modular system options can accommodate a variety of applications: frequency-specific testing, quantitative scratch and wear testing, integrated probe-based imaging, high-temperature testing and custom test protocols.



Apart from its capability to advance research in universities, the Nano Indenter® G200X can perform nanoindentation and scanning probe microscopy for the following materials and industries:

- |                       |  |
|-----------------------|--|
| ▪ Hard coatings       | ▪ Biomaterials, biological and artificial tissue |
| ▪ Composites          | ▪ MEMS   |
| ▪ Fibers and polymers | ▪ Semiconductors                                 |
| ▪ Metals              |  |
| ▪ Ceramics            |  |

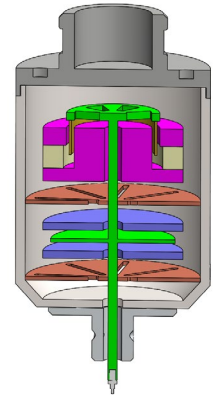
## Features and Options Overview



## KLA Core Technology

The Nano Indenter G200X is powered by electromagnetic transducers to deliver precise, reliable measurements at the nanoscale level. The system is designed to provide accurate sample positioning, easy sample viewing, and simple sample height adjustment. Depending on the configuration, the G200X utilizes either the InForce 1000 or InForce 50 indentation head, and a modular controller that allows users to add capabilities as needed. In addition, the G200X gives users the ability to program each transducer for specific measurements, and switch between them at any time. The system has a small footprint to conserve lab space and conforms to ISO 14577.

The G200X proprietary InView software suite includes RunTest with on-screen controls for simplified test setup, ReviewData for data analysis during or after testing, and InFocus for generating graphs and reports for presentations and documentation.

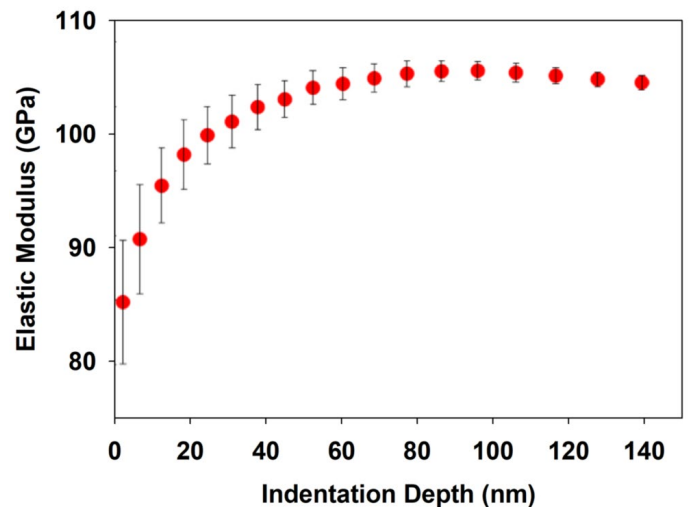


Schematic image of coil-magnet assembly and three-plate capacitors within the indenter head

## Continuous Stiffness Measurement (CSM)

- Measures stiffness and other material properties during the indentation cycle

The CSM option involves oscillating the probe during indentation to measure properties as a function of depth, force, time, or frequency. The option comes with a constant strain rate experiment that measures hardness and modulus as a function of depth or load, which is the most common test method used across academia and industry. The CSM option includes the Biomaterials Method Pack for measurement of complex modulus of biomaterials with shear moduli on the order of 1kPa. The pack includes a flat-punch tip and a test method for evaluation of viscoelastic properties.

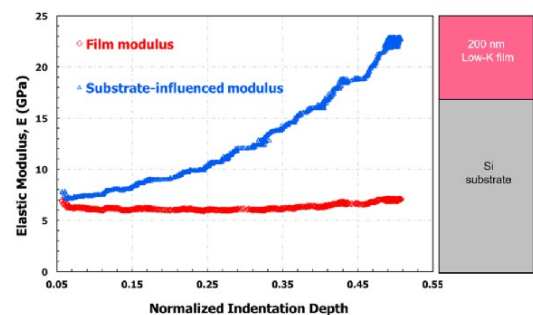


Measurement of elastic modulus as a function of indentation depth using the CSM option

## AccuFilm™ Thin Film Method

- Allows for characterization of ultra-thin films by correcting for substrate influence on the measurement

The AccuFilm Thin Film Method option is a test method package with a specialized indenter tip for measuring substrate-independent material properties with the CSM module. AccuFilm uses the Hay-Crawford model to correct for substrate influence, for measuring hard films on soft substrates, or soft films on hard substrates.

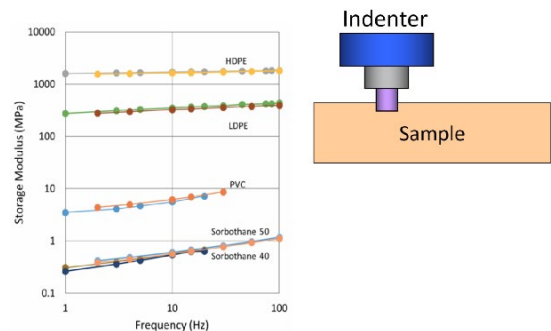


Substrate-influenced modulus and film-only modulus as a function of normalized indentation depth using AccuFilm thin film method

## ProbeDMA™ Local Dynamic Mechanical Analysis

- Enables dynamic mechanical analyses (DMA) on soft polymers and other materials with sample geometries and/or material volumes that are not suitable for standard DMA tests

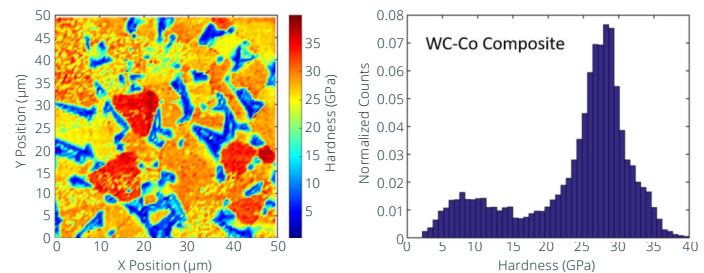
The ProbeDMA option turns the nanoindenter into a localized Dynamic Mechanical Analysis instrument by enabling measurement of storage modulus, loss modulus, and loss factor as a function of frequency. ProbeDMA utilizes the CSM module and the precision of the iMicro actuators to provide quantitative results that match traditional DMA testing. It is fully compatible with the 300°C sample heating option, described below.



Storage modulus of a series of standard polymer samples, tested using flat punch tip

## NanoBlitz 3D Rapid Mechanical Property Mapping

- Quickly and quantitatively maps surface mechanical properties
- Gives statistically significant results based on the increased number of observations
- Measures rough surfaces and/or heterogeneous materials



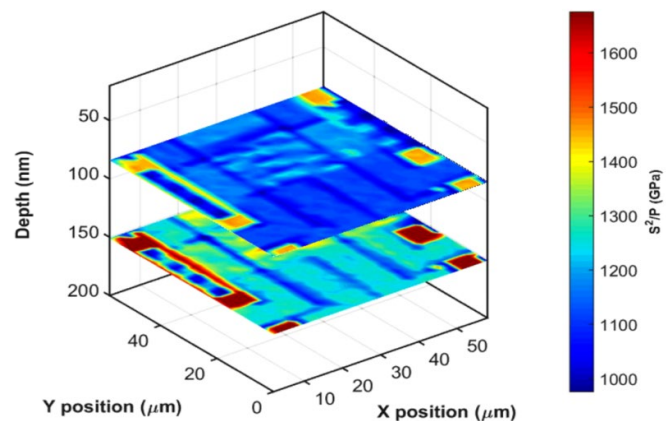
Hardness mapping and statistical histogram of hardness on WC-CO composite materials using the NanoBlitz 3D option

The NanoBlitz 3D option measures elastic modulus and hardness as a function of (x, y) position, generating thousands of data points in a short period of time. The quantitative data is combined with powerful visualization techniques to assess differences in microstructure and gradients in mechanical properties.

## NanoBlitz 4D Mechanical Property Tomography

- Extends the Continuous Stiffness Measurement (CSM) technique to include mechanical property tomography

To assess elastic modulus and hardness as a function of (x, y) position and depth, the NanoBlitz 4D option rapidly creates a user-defined array of constant strain rate indents using the CSM module. Because each indent is performed in about 7 seconds, the system can generate a statistically significant amount of data to accurately characterize complex microstructures and components.



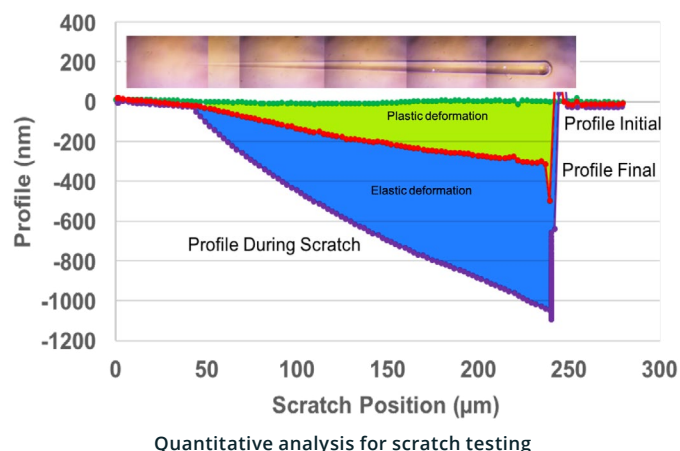
Elastic and plastic property mappings at two different indentation depths, on multiple layers of thin film using the NanoBlitz 4D option



## Scratch and Wear Test Method

- Applies a constant or ramped load to an indenter tip as it moves across the sample surface

Coatings and films are subjected to many processes that challenge the strength of these films and their adhesion to the substrate, such as chemical-mechanical polishing (CMP) and wire bonding. Scratch testing allows characterization of numerous materials such as thin films, brittle ceramics and polymers.



## Scanning Probe Microscopy Options

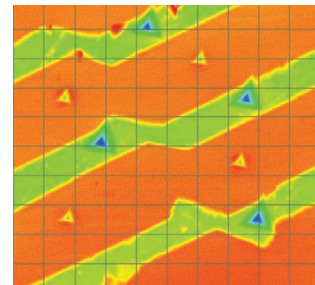
### NanoVision Stage

Featuring a closed-loop nanopositioning stage for high-resolution 3D imaging and precise targeting, NanoVision allows users to target indentation test sites with nanometer-scale precision and characterize individual phases of complex materials. NanoVision users can also examine residual impressions to quantify material response phenomena such as pile-up, deformed volume and fracture toughness.

### Survey Scanning

The G200X system provides a wide array of imaging capabilities, including a survey scanning mode that is ideal for scratch and wear testing on large samples, or for working with large, irregularly-shaped, and/or heterogeneous samples.

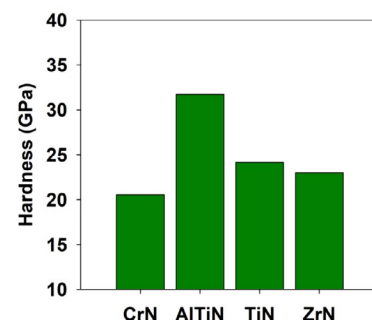
The Survey Scanning option utilizes the accurate, repeatable (x, y) motion of the G200X system to provide a maximum scan size of 500μm by 500μm. The NanoVision stage and Survey Scanning options can be used together for precise location targeting for nanoindentation tests, particularly valuable for determination of sample fracture toughness.



The Survey Scanning option delivers 3D imaging with accurate indentation targeting

## Internationally Standardized Nanoindentation Testing

The iMicro is compliant with internationally recognized mechanical testing ISO 14577 standards for nanoindentation.



Hardness values of a series of standard samples, tested in compliance with ISO 14577 standards

Additional Nano Indenter G200X Upgrade Options	
300°C Sample Heating	The 300°C sample heating option allows the sample to be placed into a chamber for uniform heating during tests. The option includes high-precision temperature control, inert gas backfills to reduce oxidation, and cooling to remove waste heat. ProbeDMA, AccuFilm, NanoBlitz and CSM are all compatible with the 300°C sample heating option.
DataBurst Mode	DataBurst mode enables systems to record displacement data at rates > 1kHz, for measuring high strain step loads, pop-in and other high-speed events.
InView Experiment Scripting	InView offers a powerful and intuitive experiment-scripting platform for designing novel or complex experiments.
True Test I-V Measurements	The True Test I-V option allows the user to apply specific voltages to a sample and measure the current at the tip, to characterize local changes in electrical properties during nanomechanical measurements.
Indenter Tips and Calibration Samples	Interchangeable tips for the InForce 50, InForce 1000, and Gemini actuators include Berkovich, cube corner, Vickers, and flat and sphere punches.

## The Nanoindenter Family of Products

KLA offers a full range of ambient and in situ nanoindenter solutions, including iMicro, iNano®, NanoFlip, and InSEM® HT.



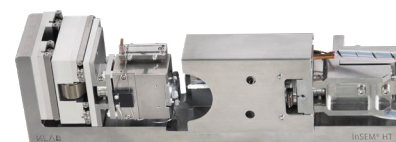
iNano®



iMicro



NanoFlip



InSEM® HT

## Applications Support

KLA application scientists are available to assist with test design and planning. With experience in both materials science and mechanics, our scientists have developed best practice testing techniques and have contributed to many of the key papers in the industry.

## Customer Service

KLA nanoindenters are known for problem-free operation. If you do have a question or need help, our customer service personnel can log in to your equipment to resolve your issue within 24 hours. Most repairs do not require an onsite service visit. The G200X is backed by local service and support around the world, for onsite service or installation.



#### KLA SUPPORT

Maintaining system productivity is an integral part of KLA's yield optimization solution. Efforts in this area include system maintenance, global supply chain management, cost reduction and obsolescence mitigation, system relocation, performance and productivity enhancements, and certified tool resale.

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