Performech® II & TriboScan™ 10

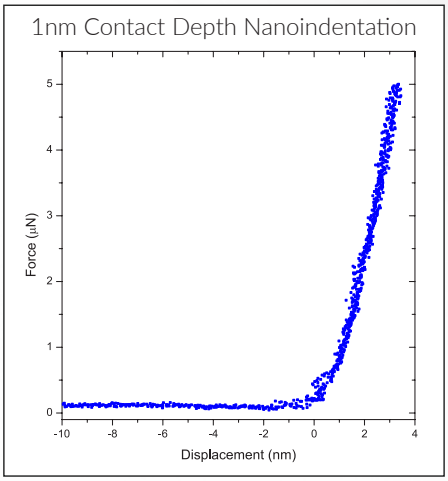
Industry-Leading Control Technologies for Superior Nanomechanical and Nanotribological Testing

Performech® II Advanced Control Module

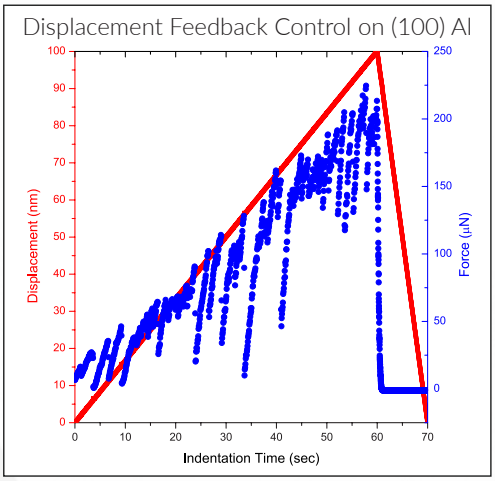
Hysitron's Performech II advanced control module provides the speed and precision necessary for rapid, reliable, and quantitative characterization to the low end of the nanoscale. Based on a state-of-the-art digital-signal-processor (DSP) with field-programmable-gate-array (FPGA) architecture, the Performech II delivers ultra-fast feedback control of user-definable test functions, data sampling rates, and data acquisition speeds. Combined with industry-leading force and displacement noise floor performance, the Performech II enables 500x faster nanoindentation testing for accelerated, high-resolution nanomechanical property mapping. Fully integrated multi-technique control capabilities allow the Performech II to seamlessly control multiple Hysitron transducers, piezo scanners, dynamic signal generators (nanoDMA® III), and electrical sourcing and measurement (nanoECR®) with maximized signal synchronicity. Additionally, a modular controller design with auxiliary data acquisition and hardware control capabilities provides unparalleled flexibility and upgradeability in nanomechanical and nanotribology-based characterization.

Superior Feedback Control

All Hysitron test instruments offer powerful force and displacement feedback control modes for precise control during nanomechanical and nanotribological characterization. All feedback control functionalities are performed onboard the Performech II Advanced Control Module by the dedicated DSP and FPGA embedded within the controller. Proprietary feedback control algorithms were specifically developed for the physics of Hysitron's transducers as well as the rapidly changing indenter-specimen contact stiffness conditions that occur during nanoindentation. An ultra-fast feedback loop rate of 78kHz, running on up to 24 channels simultaneously, assures the system can effectively respond to fast transient events such as dislocation nucleation, fracture, and thin film delamination while accurately reproducing any test function defined by the user.



A 1nm contact depth nanoindentation measurement performed on fused quartz showing the low noise floor of the Performech II advanced control module.



Displacement controlled nanoindentation test on (100) Al showing substantial dislocation activity throughout the loading cycle, made possible by the 78kHz feedback loop rate of the Performech II.

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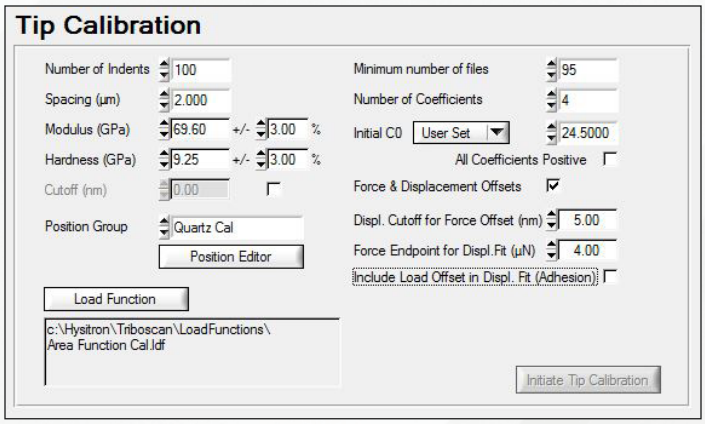
TriboScan™ 10 Control Software

TriboScan 10 provides full integration of Hysitron's complete suite of testing techniques into a single, intuitive software package. The tab-based software architecture simplifies software navigation and helps users follow the instrument operational sequence. A flexible, segment-by-segment test definition graphical user interface streamlines the test setup in all modes of operation. TriboScan 10 was developed to be extremely flexible and versatile for researchers, while allowing routine and repetitive testing to be executed with ease. Packed with exciting new features and characterization techniques, TriboScan 10 enables materials to be reliably understood like never before.

Automated System Calibrations

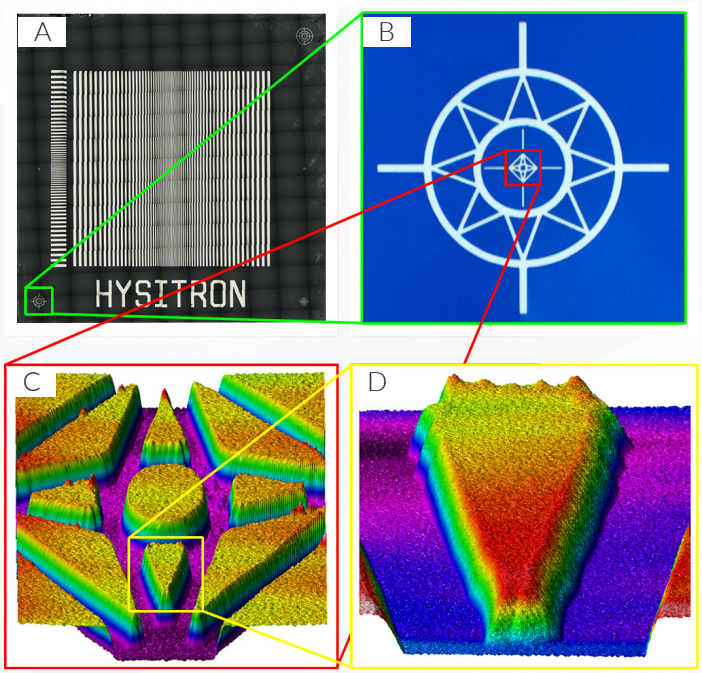
TriboScan 10 automates the most important system calibrations for maximum reliability and repeatability during nanomechanical testing. Automated calibration routines ease system operation, increases testing throughput, and eliminates potential sources of operator error. Operators can focus on their testing and allow TriboScan 10 to handle:

- Transducer Calibrations
- Tip Area Function Calibrations
- Tip-to-Optics offset Calibrations



Multi-Scale Imaging

TriboScan 10 incorporates new powerful multi-scale imaging functions that ease sample navigation, streamlines the testing workflow, and allows the direct correlation of various imaging modes and data sets. Optical surveying of the whole sample provides point-and-click specimen navigation and test positioning, while allowing the operator to continuously zoom from a macroscale view of the sample, through the microscale, and into the nanoscale using positionally correlated SPM imaging. A comprehensive overlay of testing sites can be superimposed over a whole sample optical survey, providing quick feedback of already tested and available testing areas.



(A) Millimeter scale optical survey of Hysitron's tip-to-optics offset calibration grid, (B) 500µm x 500µm optical image, (C) 30µm x 30µm in-situ SPM image, (D) 5µm x 5µm in-situ SPM image.

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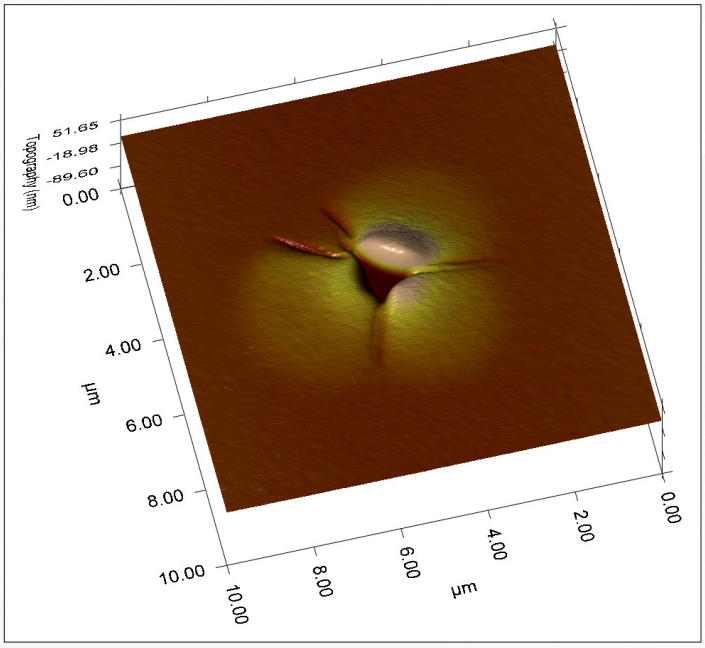
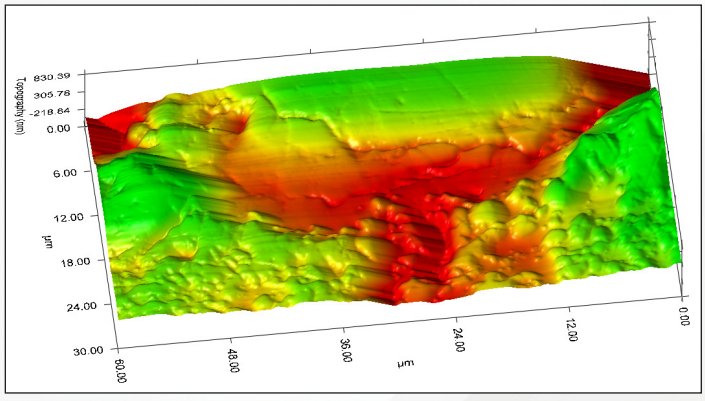
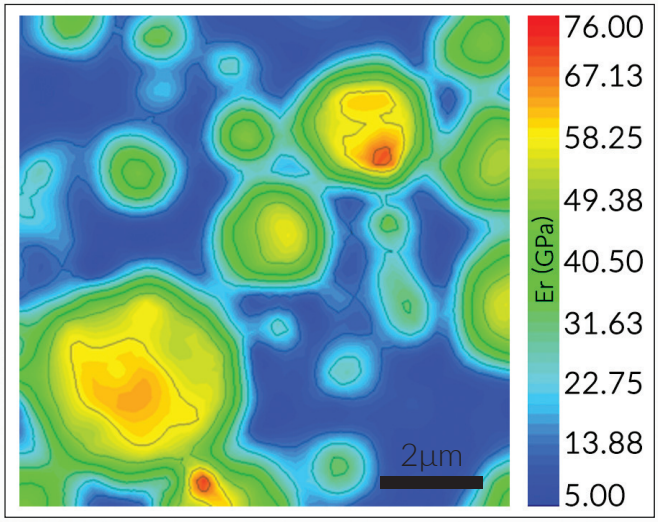
SPM+ Imaging

Hysitron's new SPM+ brings nanomechanical Scanning Probe Microscopy imaging capabilities to a whole new level. With SPM+, scan size and image resolution are fully customizable to meet your specific sample analysis needs, allowing operators to view testing sites, indents, pile-up, fracture cracks, wear pits, and scratches clearer than ever before.

- High resolution topography imaging up to 4096 x 4096
- 64 x 64 fast scans allow rapid test site identification and placement
- Customizable combinations of X-Y scan dimensions and resolutions enables large pixel density imaging of high aspect ratio features







400 point XPM property map of a particle filled polymer.

XPM™ Accelerated Property Mapping

Hysitron's XPM can perform quantitative nanoindentation measurements at speeds up to 6 indents per second. Hundreds of measurements can be performed in minutes and full local property maps can be generated 500x faster than traditional nanoindentation routines. XPM is a powerful method to create high density grids over large areas and can also be used to acquire large amounts of statistically significant data in a short period of time. Additionally, routine calibrations such as the tip area function can be completed within a minute using the XPM technique. An intuitive XPM test function editor and analysis routines are fully integrated within the TriboScan 10 software package.

Tribo iQ™ Versatile Data Analysis

Hysitron's new Tribo iQ data analysis software package works in conjunction with TriboScan 10 to deliver basic to advanced data analysis. TriboScan 10 outputs data from all operational modes in a standard TDM file format for ultimate flexibility in data analysis. User-writable analysis modules, sharable amongst the Hysitron community, provides limitless analysis potential and streamlines time to results.

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Performech II Highlights

- State-of-the-art Digital Signal Processor (DSP) plus Field Programmable Gate Array (FPGA) controller architecture
- Fully integrated multi-technique control for seamless operation of multiple Hysitron transducers, piezo scanners, dynamic signal generators (nanoDMA® III), and electrical sourcing and measurement (nanoECR®) provide maximum signal synchronicity
- Industry-leading force and displacement noise floors enable characterization to the bottom of the nanoscale: 0.1nm displacement and 20nN force (standard Hysitron transducer); 0.01nm displacement and 1nN force (Hysitron's xProbe™ transducer)
- Ultra-fast feedback control loops and data acquisition rates reliably track fast transient events and deliver high speed testing capabilities
- Modular controller architecture with up to 24 channels of auxiliary data acquisition and external device control
- Simultaneous 1.2MHz data sampling rate and 78kHz feedback loop rate on all channels

TriboScan 10 Highlights

- Full integration of Hysitron's complete suite of testing techniques into a single, intuitive software package
- Tab-based software architecture simplifies software navigation and helps users follow the instrument operational sequence
- Flexible, segment-by-segment test definition graphical user interface streamlines the test setup in all modes of operation
- XPM ultra-fast nanoindentation for rapid property mapping and fast acquisition of statistically significant data sets
- SPM+ high resolution in-situ imaging with customizable scan resolution and dimensions
- Multi-scale sample imaging with whole sample optical surveying, macro-to-nanoscale zoom capabilities, and data overlays
- Automated tip area function, transducer, and tip-to-optics offset calibrations increases data reliability, enhances testing throughput, and minimizes potential for operator error