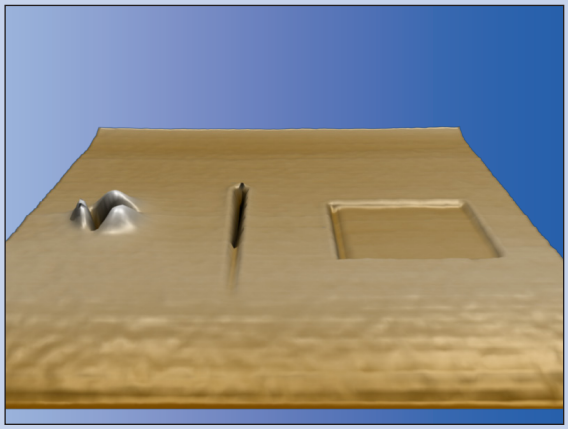
TS-SERIES

HYSITRON®

TS 70 TriboScope®



In-situ SPM image of a nanoindentation, scratch indentation, and Scanning Wear test performed and imaged with the **TS 70**. The total scan size is 5 microns.

TS 70 TriboScope

Quantitative rigid probe nanomechanical testing for AFM

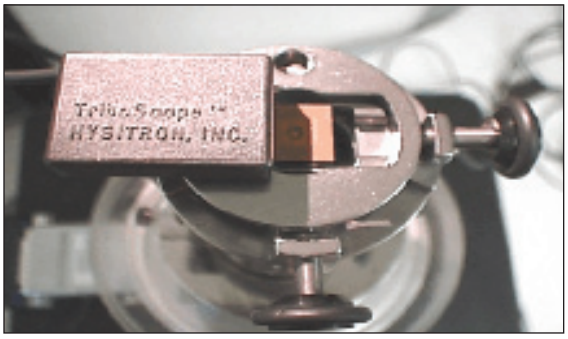
The **TS 70** nanomechanical test instrument is an AFM attachment that offers industry-leading nanoscale mechanical characterization combined with scanning probe microscopy (SPM) imaging. The synergy created by interfacing the uncompromised sensitivity of the Hysitron capacitive transducer* to an AFM provides superior testing capabilities previously unavailable to the materials characterization community.

In-situ SPM imaging

The *in-situ* SPM imaging capability of the **TS 70** is critical for precise test placement and microstructure identification. The *in-situ* images are obtained by raster scanning the indenter probe over the sample surface and can be used to reliably place a test within 10 nm of the desired testing location. This technique allows for effortless pre- and post- test topographical imaging without the need to reposition an auxiliary imaging instrument over the nanoscale testing site. The force and displacement results acquired during the test, in conjunction with the *in-situ* imaging* capability, offer an unparalleled wealth of information concerning the material deformation behavior and mechanical properties of the material.

Quantitative, repeatable results

The compact design of the Hysitron transducer allows it to be interfaced to most commercially available AFM's via a simple, temporary modification. The Hysitron transducer replaces the SPM detector assembly and provides topographic feedback for imaging. Utilizing the same indenter probe to obtain *in-situ* SPM images and perform the nanoindentation experiment guarantees quantitative and repeatable data. Additionally, the transducer utilizes a rigid indenter probe that makes the quantification of the force and displacement measurements much more reliable than measurements made with a cantilever-based probe system, which intrinsically introduces many uncertainties into the measurement. The **TS 70** combines nanoNewton force sensitivity and picometer displacement resolution with SPM imaging for a powerful tool to aid in material studies from basic research to product development and quality control.



TS 70 transducer interfaced to a commercial AFM.

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Available testing modes

Standard

- **Quasistatic nanoindentation** – Measure Young's modulus, hardness, fracture toughness and other mechanical properties via indentation
- **ScanningWear™** – Observe and quantify wear volumes and wear rates using *in-situ* imaging capability

Upgrade options

- **nanoDMA®** – Investigate time-dependent properties of materials using a dynamic testing technique designed for polymers and biomaterials
- **TriboAE™** – Monitor fracture, delamination and phase transformations that occur under nanoscale contacts
- **Modulus Mapping™** – Quantitatively map the storage and loss stiffness and moduli over an area from a single SPM scan
- **Feedback control** – Operate in closed loop load or displacement control to allow testing techniques such as creep and stress relaxation
- **Scratch testing** – Quantify scratch resistance, critical delamination forces, friction coefficients and more with simultaneous normal and lateral force and displacement monitoring
- **Automated TriboScope®** – Automated indentation using predetermined patterns or **ClickMode™** allows faster data collection with less operator time
- **Thermal control** – Heating or heating/cooling stages can be added for investigation of mechanical properties at non-ambient temperatures
- ***performech*™** – DSP embedded controller featuring a sub 30 nN force noise floor and an enhanced digital feedback routine

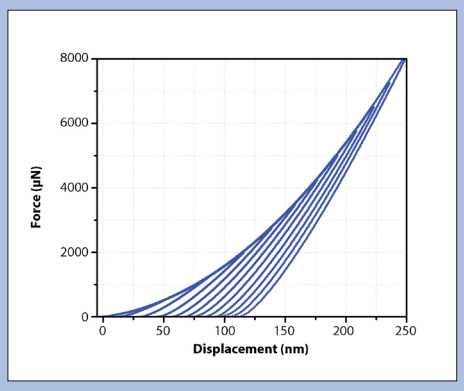
The **TS 70** TriboScope transducer and controller.

Highlights

- Stability of the Hysitron transducer design minimizes set-up time and the necessity of specialized lab environments
- *In-situ* imaging provides nanometer precision positioning and the convenience of SPM topography
- User-friendly, Windows®-based software for test design and analysis
- Real-time data display and automated analysis routines yield data in minutes
- Numerous tip geometries available to meet the demands of the various test types available on the **TS 70**
- Upgradable to the **TS 75** next-generation **TriboScope**

Transducer specifications

- **Load**
  Resolution: <1 nN
  Noise Floor: 100 nN
- **Displacement**
  Resolution: 0.0004 nm
  Noise Floor: 0.2 nm
  Drift: <0.05 nm/sec



Multiple indentation experiments showing the high data repeatability of the **TS 70**.

*Covered under US patents: 5,553,486; 5,576,483; 5,661,235; 5,869,751; 6,026,677; 7,107,694

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