

TI Premier MultiScale

Connecting Nanoscale and Microscale Mechanical Characterization



The **TI Premier Series** has been developed to provide quantitative nanomechanical characterization for dedicated applications. Built upon Hysitron's industry-leading and trusted technology, the TI Premier Series offers a variety of application-specific configurations to meet your rigorous testing needs. From essential nanomechanical and nanotribological characterization tools to advanced high temperature and powerful dynamic characterization techniques, the TI Premier is a solution for your current and future research requirements.

The variety of testing methods enabled by the TI Premier Series utilizing Hysitron's exclusive technology sets the standard for reliability in small scale mechanical characterization. All TI Premier systems offer *in situ* SPM imaging and industry-leading, high-resolution capacitive transducer technology. Combined with high-precision staging, anti-vibration system, environmental enclosure, top-down color optics, flexible control software and automated testing routines, the TI Premier Series streamlines the process to reliable nanomechanical and nanotribological results.

TI Premier MultiScale

The **TI Premier MultiScale** is a depth-sensing indenter specifically designed for mechanical property measurements over the micro and nano scales. This versatile instrument has a usable force range covering 9 decades (70 nN to 10 N) and a displacement range covering 5 (2 Å to 80 μm), making the TI Premier MultiScale well suited for investigating the mechanical property continuum from the microscale into the lower nanoscale. In addition to mechanical property measurements, the range of forces supplied by the TI Premier MultiScale also enables cohesive and interfacial fracture studies over multiple length scales.

The TI Premier MultiScale provides both quasi-static and dynamic mechanical testing capabilities over the micro and nano scales. Hysitron's Dynamic Mechanical Analysis (**nanoDMA® III**) with *CMX* algorithms provides a continuous measurement of mechanical properties as a function of indentation depth. This dynamic technique utilizes force modulation and is optimized for small scale characterization for both hard and soft materials. The effective force and displacement range of the instrument combined with the depth-profiling capabilities of nanoDMA III makes the TI Premier MultiScale a powerful tool for labs interested in mechanical characterization over multiple length scales.

Highlights

- Wide force range from 70 nN to 10 N provides investigation of the mechanical property continuum from the microscale into the nanoscale
- Flexible system configuration can be tailored to test multiple length scales on a broad variety of materials
- *In situ* SPM imaging provides surface topography mapping and nanometer precision test positioning for reliable and repeatable results
- Quasi-static indentation and powerful dynamic mechanical analysis routines provide quantitative measurement of mechanical properties as a function of indentation depth
- Easy upgradability to accommodate future testing needs

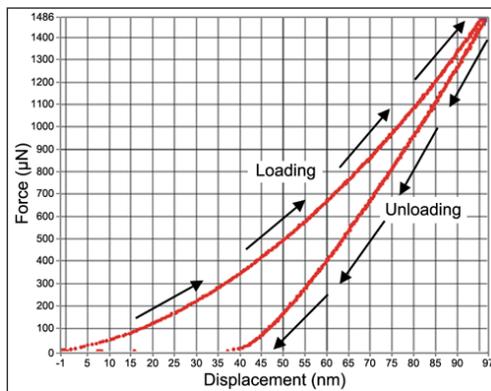
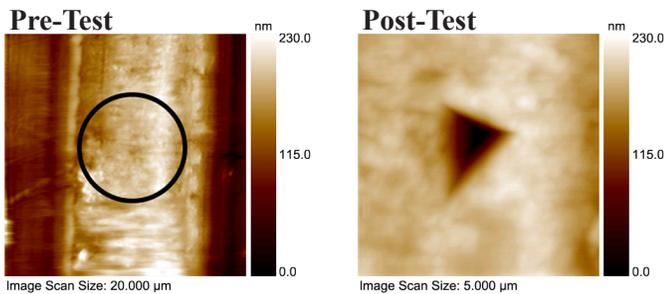
Applications

- Study of mechanical properties as well as fracture and delamination
- Various application of hard materials
- Hard Coatings | Composites | Metals | Alloys
- Scale-dependent materials

Example Application on a Hard Film

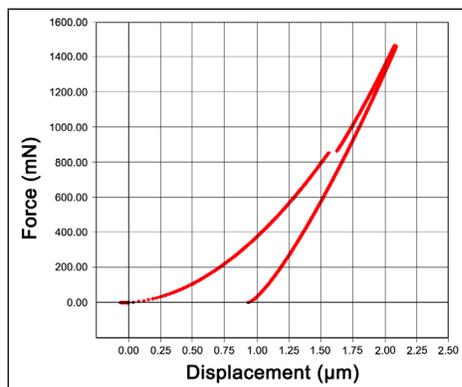
Nanoindentation

- *In situ* SPM imaging capability allowed for precise positioning of the nanoindentation test
- Post-experiment observation provides additional information on the deformation process such as pile-up, sink-in, crack, etc.



High Load Indentation

- High load indentation resulted in film delamination at approximately 850 mN



Specifications

Indentation

- Normal Load Range: 70 nN to 10 N*
- Normal Displacement Range: 2 Å to 80 μm

*The flexibility to select maximum load of the transducer head from 500 mN to 10 N

Nanowear

- Maximum Load: 100 μN

Dynamic Mechanical Analysis (nanoDMA® III)

- Continuous measurement of mechanical properties (CMX)
- Force Modulation
- Reference Frequency Technique
- Dynamic measurements based on the lock-in technology allowing for truly dynamic mechanical analysis at the nanoscale

Integrated *In Situ* SPM Imaging

- Performed with same probe as mechanical characterization
- Imaging Force: <70 nN

Controller

- Digital

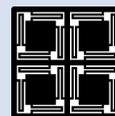
Optics

- Magnification: 10X
- Top-Down Optics

Upgrade Options

- **Modulus Mapping™** - Quantitative map of the storage/loss stiffness and moduli using the SPM scanning function
- **Scratch Testing** - Quantify scratch resistance, critical delamination forces, friction coefficients, and more with simultaneous normal and lateral force and displacement monitoring
- **Thermal Control**- Heating or heating/cooling stages can be added for investigation of mechanical properties at non-ambient temperatures
- **nanoECR®** - Conductive nanoindentation system capable of providing simultaneous in situ electrical and mechanical measurements for investigating material deformation and stress induced
- **Active Vibration Isolation** - Piezoelectric driven active vibration dampening for faster stabilization time and optimum results

TI Premier MultiScale SS r1.f



HYSITRON®