

# TI Premier Dynamic

Ultimate Solution for Dynamic Nanomechanical Testing

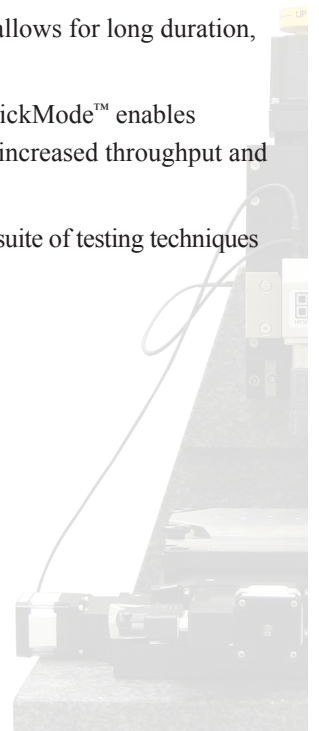


## Highlights

- Quantitative dynamic and quasi-static nanoindentation combined on a single platform for characterizing viscoelastic and elastic-plastic properties of materials
- Flexible and versatile configuration for a wide range of applications, capable of reliably testing the broadest range of materials; from ultra-soft hydrogels to hard thin films
- Enhanced dynamic testing range of 0.1 Hz to 300 Hz with *in situ* drift compensation capabilities to accurately test a wide range of materials
- Industry leading force and displacement noise floors due to superior instrument architecture and control algorithms
- Integrated *in situ* SPM imaging provides pre- and post-test surface topography information along with nanometer accuracy test positioning
- *CMX* algorithms with force modulation provides a continuous measurement of mechanical properties as a function of indentation depth, frequency, and time
- Reference Frequency technique allows for long duration, drift free measurements
- Automated test routines using ClickMode™ enables unattended system operation for increased throughput and minimized operator time
- Easily upgradable with Hysitron's suite of testing techniques

## Applications

- Soft & Hard Films/Coatings
- Soft, time sensitive materials
- Composites
- Polymers
- Hydrogels



## TI Premier Dynamic

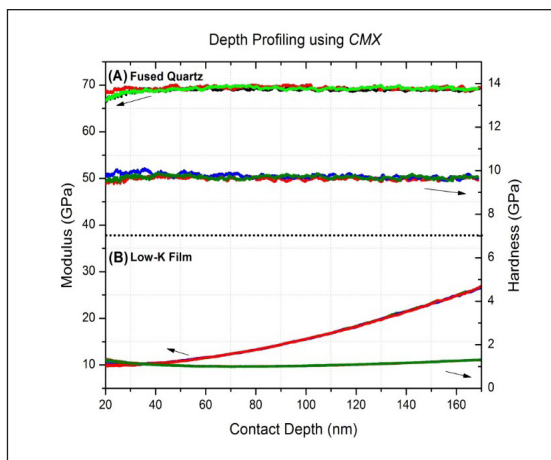
The **TI Premier Dynamic** is a versatile nanomechanical test instrument that has been optimized for both dynamic and quasi-static materials characterization. The system features **nanoDMA® III**, a versatile **nanoscale Dynamic Mechanical Analysis** technique applicable to a broad range of materials.

The TI Premier Dynamic utilizes Hysitron's exclusive transducer and control technology for exceptional test resolution and reliability on both soft viscoelastic and hard elastic-plastic materials. The TI Premier Dynamic provides a quantitative measurement of mechanical properties as a function of frequency, contact depth, and time. Standard analyses for viscoelastic materials include the storage modulus, loss modulus, and tan delta. The TI Premier Dynamic also deploys powerful Continuous Measurement of Mechanical Properties (**CMX**) algorithms that provide the ability to obtain depth profiles of mechanical properties with a high spatial resolution. **CMX** is extremely useful when evaluating near-surface mechanical property gradients and inhomogeneous thin films.

The TI Premier Dynamic with nanoDMA III utilizes coupled DC/AC force modulation for maximum applicability on all classes of material. Force modulation combined with ultra-fast feedback control algorithms prevent intermittent contact that can be experienced with other nanoscale dynamic machines. The TI Premier Dynamic additionally applies a reference frequency technique to minimize the adverse effects of thermal drift during long time duration measurements. The reference frequency approach makes reliable measurements at low oscillation frequencies and long duration nanoscale creep measurements possible.

### Example Application Using **CMX**

Fast Depth Profiling Using **Continuous Measurement of  $X =$  Mechanical Properties (**CMX**)**



Each of these graphs is constructed from 3000 individual data points taken over 150 nm displacement. As a result, a depth profile of hardness and reduced modulus has been obtained.

## Specifications

### Nanoindentation

- Normal Load Range: 70 nN to 10 mN (30 mN)
- Normal Displacement Range: 2 Å to 5 µm

### Dynamic Mechanical Analysis (nanoDMA® III)

- Frequency Range: 0.1 to 300 Hz
- Force Modulation
- Continuous Measurement of Mechanical Properties (**CMX**)
- Reference Frequency Technique
- Dynamic measurements based on the lock-in technology allowing for truly dynamic mechanical analysis at the nanoscale

### Nanowear

- Maximum Load: 100 µN

### Integrated *In Situ* SPM Imaging

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

### Controller

- Digital

### Optics

- Magnification: 10X
- Top-Down Optics

## Upgrade Options

- **Scratch Testing** - Quantify scratch resistance, critical delamination forces, friction coefficients, and more with simultaneous normal and lateral force/displacement monitoring
- **Next Generation Controller** - *performech*®
- **Optical Microscope** - up to 50X
- **Environmental/Heating System** - xSol™ 400 and xSol™ 600 for investigation at non-ambient conditions
- ***In Situ* Electrical Measurement (nanoECR®)** - Simultaneous mechanical and electrical measurements for investigating material deformation and stress induced events
- **Extended Displacement Capability (Extended 500 µm Z Stage)** - For investigation of particularly soft materials
- **Active Vibration Isolation** - Piezoelectric driven active vibration dampening for faster stabilization time and optimum results

TI Premier Dynamic SS r1.f



**TI Premier Dynamic Allows for Full Dynamic Mechanical Characterization at the Nanoscale**