

*Seeing is Believing®*

## Hysitron PI 85E SEM PicoIndenter

### ● Extended Range In-Situ Nanomechanical Testing Instrument

The Hysitron PI 85E SEM PicoIndenter extends the range of your in-situ mechanical testing, bridging the gap between nanoscale and microscale characterization. This depth-sensing nanomechanical test system is specifically designed to leverage the advanced imaging capabilities of scanning electron microscopes (SEM, FIB/SEM, PFIB) while simultaneously performing quantitative nanomechanical testing. Its extended force range enables researchers to accurately test dimensionally large and/or hard structures that require larger loads to induce failure and/or fracture. The PI 85E instrument offers indentation, compression, tension, and fatigue testing across the entire materials spectrum (from metals and alloys to ceramics, composites, and semiconductor materials). The compact, low-profile architecture of PI 85E makes it ideally suited for small-chamber SEMs, Raman and optical microscopes, beamlines, and more.

### Hysitron PI 85E Features

- Quantitative nanomechanical property measurements—hardness, elastic modulus, yield strength, fracture toughness, creep exponent, and stress relaxation
- Range of mechanical testing modes, including indentation, compression, bending, tension, and fatigue
- Max load of 250 mN; displacement up to 100  $\mu\text{m}$
- Multiple control modes, including closed-loop displacement, closed-loop load, and open-loop load
- High-bandwidth transducer and flexure with advanced control electronics
- Interchangeable probes in a variety of geometries
- Tribo iQ advanced data analysis software

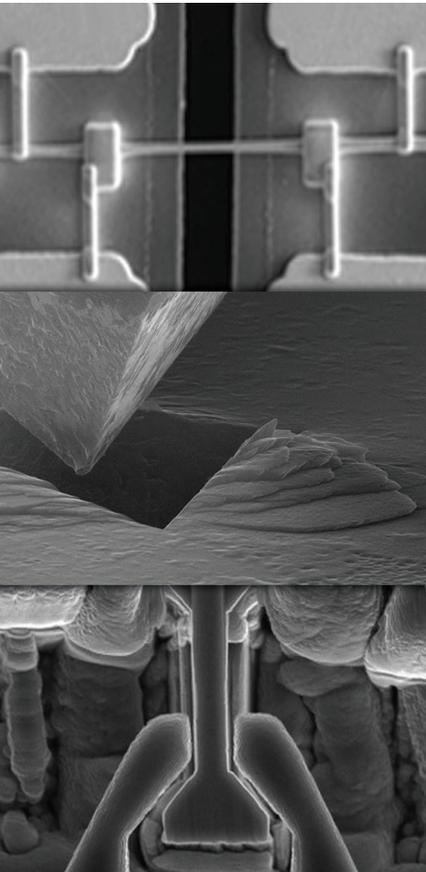
Nanomechanical Testing

Innovation with Integrity

## Seamless Integration with Your SEM

With the compact form of Bruker's capacitive transducer, Hysitron PI 85E can be mounted directly onto the SEM stage without being a permanent fixture in the microscope. The sample positioning stages accommodate samples up to 20 mm thick while providing precise sample positioning across more than 3 mm in all three directions (XYZ). In addition, the mechanical coupling of the sample

stage and the transducer provides a stable, rigid platform for nanomechanical testing. Overall, this low-profile instrument allows for maximum stage tilt and shorter working distance for optimal imaging during testing. The standard PI 85E configuration enables peak loads of 10 mN and displacements up to 5  $\mu\text{m}$ . An extended range option offers increased peak loads up to 250 mN and displacements up to 100  $\mu\text{m}$ . Both transducer options feature industry-leading noise floors for the upmost in sensitivity and accuracy.



## Extended Capabilities with Hysitron PI 85E Modes

**Nanoindentation:** Precise lateral positioning and nanoscale load and depth control allow quantitative determination of fundamental mechanical properties (e.g., hardness and elastic modulus) for a wide variety of materials.

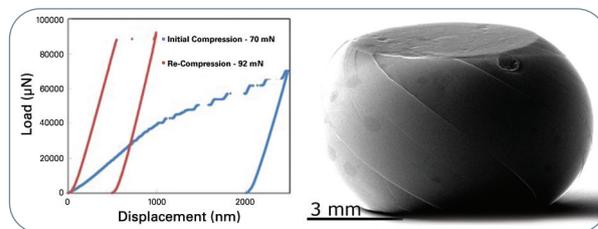
**Tension:** Direct-pull and push-to-pull (PTP) testing of dog-bone specimens, thin films, or nanowires provides in-situ measurements of stress-strain behavior in low dimensional materials not easily tested by traditional means.

**Bending:** Stiffness and fracture toughness measurements for single-phase, composite, or layered materials are a straightforward process, capitalizing on the SEM's precise imaging of loading alignment and specimen size.

**Compression:** Pillars, particles, and other small-scale structures can be compressed to measure stress-strain behavior and yield properties while observing deformation mechanisms in real-time. Proper tip alignment is verified using SEM imaging.

**Fatigue/nanoDynamic:** Powerful electronics and control algorithms obtain a truly continuous measurement of mechanical properties as a function of depth, frequency, and time. nanoDynamic is ideally suited for in-situ depth profiling, creep, and fatigue testing.

**Electrical Contact Measurement:** Electrical property changes of a sample under applied load can be characterized, which allows for in-situ testing of piezoelectrical materials, phase change memory, bulk metallic glasses, CNT composites, silicon, batteries, and energy storage materials.



Deformation of a BMG particle.

## Mechanical Property Insights at the Nanoscale

Simultaneous mechanical measurements and SEM imaging enables a complete understanding of material deformation behavior. The in-situ mechanical data acquired with the Hysitron PI 85E instrument is perfectly synchronized with SEM data and displayed in side-by-side video format for real-time analysis.

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