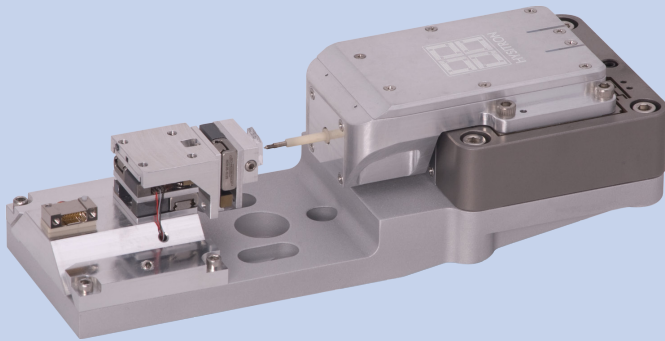


# PI 85xR SEM PicoIndenter®



## PI 85xR SEM PicoIndenter®

Extended Range Mechanical Testing That Bridges the Gap Between Nano- and Micro-Scale

Hysitron's **PI Series SEM PicoIndenter®** instruments are depth-sensing mechanical test systems designed to be interfaced with scanning electron microscopes (SEMs). With these systems it is possible to perform quantitative nanomechanical testing while simultaneously imaging with the SEM. Coupling these two techniques allows the researcher to position the probe extremely accurately and to image the deformation process throughout the test.

The **PI 85xR SEM PicoIndenter** offers higher maximum loads and displacements than the standard **PI 85** while maintaining industry-leading noise floors, effectively bridging the gap between nano- and micro-scale. The system features peak loads of **>100 mN** and displacements up to **150 µm**. The increased normal force range of the PI 85xR has been designed to accurately test dimensionally large and/or hard structures which require larger loads to induce failure, fracture, or yield. The larger displacement range also facilitates testing of compliant samples such as polymers or organic materials. With indentation probes available in an array of geometries, the system is versatile enough to be used for most high force/high displacement testing regimes.

## Highlights

- Quantitative measurement of nanomechanical properties including hardness, stiffness, and modulus
- Extended load and displacement range for inducing yield in large and/or hard structures
- Unique piezo loading/capacitive sensing system offers superior stability and low thermal drift
- Modes of mechanical testing include indentation, compression, bend, and tensile
- Proprietary Q-Control mode actively dampens transducer oscillations
- Transducer controlled using the *performech*® DSP-embedded controller operating at a 78 kHz feedback rate
- Optimized for SEM with vacuum compatible transducer and electrically conductive probe
- Interchangeable probes available in a variety of geometries to meet the demands of different test types
- Feedback control to allow testing techniques such as creep and stress relaxation measurement
- Compact platform for maximum stage tilt and minimum working distance

## Applications

- **High strength alloys and ceramics** – generate failure and observe how and when yielding occurs
- **Cantilevers/Beams** – achieve greater deflection distance through enhanced displacement range
- **Pillars/Particles** – higher force compression tests for hard materials such as SiC or TiN
- **Polymers/Organic materials** – extended displacement range facilitates testing of compliant materials
- **Interfaces** – identify and test across grain boundaries and other interfaces
- **Multi-phase materials** – SEM imaging facilitates accurate probe placement

## Extended Range

The PI 85xR utilizes a cutting-edge piezoelectric flexure stage in combination with Hysitron's trusted capacitive sensor technology to provide unparalleled results with an ultra-low noise floor. The unique arrangement of the piezoelectric actuator allows for a significant increase in the available forward displacement without the use of voice coils or permanent magnets which can produce additional noise, as well as effect electron imaging.

The design of the PI 85xR seamlessly incorporates sub- $\mu\text{N}$  and sub-nm capacitive force and displacement sensors for unsurpassed performance.

The PI 85xR is designed for exceptional performance in the electron microscope, with a vacuum-compatible transducer and an electrically conductive probe. The system mounts directly onto the SEM stage without being a permanent fixture in the microscope. The compact platform of the instrument allows for maximum stage tilt and minimum working distance for imaging during testing. XYZ translation stages provide precise sample positioning with  $>3$  mm range in three dimensions. The instrument is driven by the *performech*<sup>®</sup> DSP-embedded controller, which boasts an ultra-low noise floor and a 78 kHz digital feedback routine. In addition, the mechanical coupling of the sample stage and the transducer provides a stable, rigid platform for nanomechanical testing.

The system's included **TriboScan**<sup>™</sup> v.9 software package features integrated test setup, data analysis, sample positioning, and synchronization of mechanical data with SEM video. Automated routines are also incorporated for the tip/sample approach and for hands-off execution of indent arrays.

## Specifications

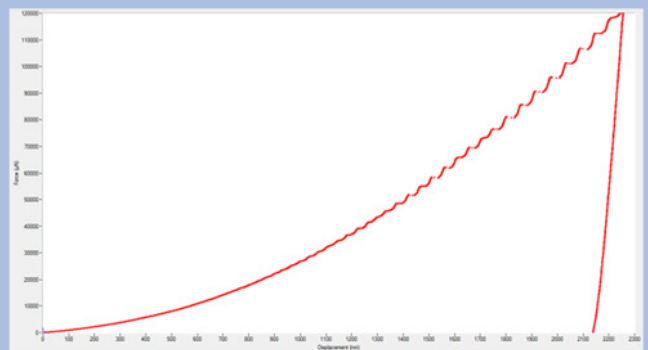
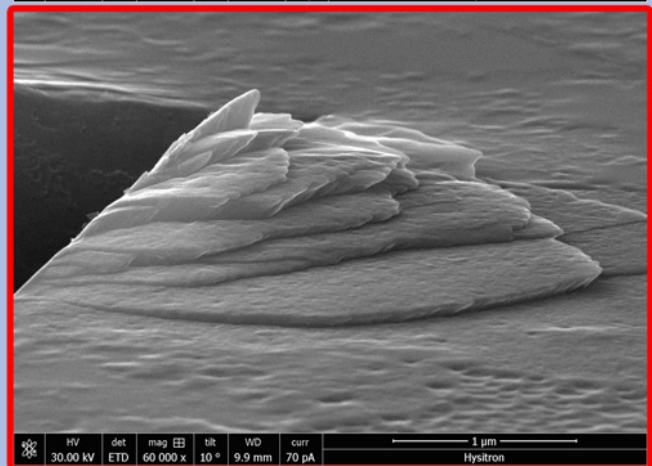
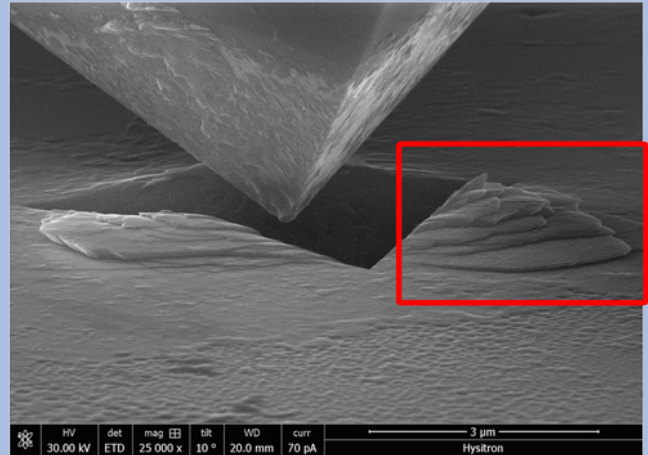
Maximum Load:  $>100$  mN

Load Resolution:  $\leq 3$  nN

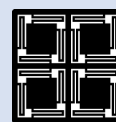
Maximum Displacement:  $150$   $\mu\text{m}$

Displacement Resolution:  $\leq 0.02$  nm

The example below shows a 120 mN indentation of a  $\text{Cu}_{45}\text{Zr}_{45}\text{Al}_{10}$  bulk metallic glass using a cube corner probe. Shear band formation is clearly visible at loads  $>50$  mN, both in the mechanical data as well as the pile-up observed at the edge of the indentation.



PI 85xR SEM PicoIndenter r1.f



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