Hysitron TI 950 TribolIndenter - Specifications

1.1 2D High Resolution Indenter Head Assembly

1.1.1 Normal Displacement
(a) Displacement resolution <0.006nm
(b) Displacement noise floor <0.2nm
(c) Total indenter travel in vertical direction ~50mm
(d) Maximum indentation depth >5μm
(e) Thermal drift 0.05nm/s

1.1.2 Normal Load
(a) Maximum load 10mN
(b) Load resolution <1 nN
(c) Minimum contact force <70nN
(d) Load noise floor ≤30nN
(d) Maximum Load rate >50mN/s

1.1.3 Lateral Displacement
(a) Displacement resolution <0.02nm
(b) Displacement noise floor <2nm
(c) Maximum Displacement 15μm
(d) Minimum lateral displacement 500nm
(e) Thermal drift 0.05nm/s

1.1.4 Lateral Load
(a) Maximum Load 2mN
(b) Load resolution <50nN
(c) Load noise floor <3.5μN

1.2 In-situ SPM Imaging
(a) Minimum imaging force <70nN
(b) Scan rate 0.01Hz-3.0Hz
(c) Scan resolution 256x256 lines per image
(d) Maximum scan volume 60x60x4μm
(e) Tip positioning accuracy +/- 10nm
(f) Automated imaging and indenting capability
(g) Piezo automation to allow point-and – click test location selection and setup of arrays for automated indentation patterns

1.3 Scanning Wear
(a) Wear track size Adjustable from <1μm to 60μm
(b) Scan velocity ≤ 180μm/s
(c) Normal load range 70nN - 1mN

2. Multi-Range Nanoprobe (High Load)
(a) Maximum Lateral Force: 5N
(b) Lateral Force Noise Floor: 40μN
(c) Maximum Scratch Length: Limited by circular sample stage (~25mm)
(d) Lateral Displacement Noise Floor: 100nm
(e) Maximum Normal Force: 2N
(f) Normal Force Noise Floor: 0.5nm
(g) Maximum Normal Displacement: 80μm
(h) Normal Displacement Noise Floor: 0.5nm

3. NanoDMA
(a) Frequency Range: 0.1Hz-300Hz
(b) Maximum Dynamic Force Amplitude: 5mN
(c) Maximum Quasi-Static Force: 10mN
(d) Force Noise Floor: <30nN
(e) Maximum Dynamic Displacement Amplitude: 2.5μm
(f) Maximum Quasi-Static Displacement: 5μm
(g) Displacement Noise Floor: <0.2nm

4. Electrical Contact Resistance (nanoECR)
(a) Current measurement noise floor: 20 pA
(b) Current measurement resolution: 5pA
(c) Voltage measurement noise floor: 10 μV
(d) Voltage measurement resolution: 5μV
(e) Maximum Current (software limited): 10mA
(f) Maximum Voltage (software limited): 10V
(g) Electrical measurement rate: Up to 4kHz
(h) Maximum load: 10 mN
(i) Load Resolution: <1nN
(j) Load noise floor: ≤30nN
(k) Displacement Resolution: 0.02nm
(l) Displacement noise floor: 0.2nm
(m) Shielded System Enclosure
(n) Auxiliary Data Channel Acquisition

5. X, Y, Z translation stage (coarse positioning)
(a) X-Y Travel 250mmx150mm
(b) Measured accuracy <1μm
(c) Measured positioning repeatability <1μm
(d) Micro step resolution X, Y axis 50nm
(e) Micro step resolution Z axis 3nm
(f) X-Y encoder resolution 100nm
(g) Maximum translation speed X, Y axis 30mm/s
(h) Maximum translation speed Z axis 1.9mm/s

6. Data Acquisition specifications
(a) Data acquisition rate (open and closed loop): up to 38,000 points/second
(b) Load time 0.1 – 2000 seconds.
(c) Maximum number of loading segments 2,000
(d) Feedback loop rate in closed loop operation: 78kHz

7. Optical Microscope specification
(a) Optical resolution 1μm
(b) Digital zoom 0.5X – 11X
(c) Optical Objective 20X
(d) Apparent magnification (monitor view) 220X-2200X
(e) Maximum field of view 772x588μm
(f) Minimum field of view 30x24μm

8. **Active Vibration Isolation**
   (a) Frequency range 1.0 – 200Hz active damping, >200Hz passive damping
   (b) Transmissibility <0.017 above 10Hz and decreasing rapidly beyond 100Hz
   (c) System noise <50ng per root Hz from 0.1 - 300Hz
   (d) Static Compliance 14.0μm/N vertical, 28μm/N horizontal
   (e) Correction Forces 16N vertical, 8N horizontal

9. **Acoustic and thermal isolation enclosure**
   (a) Multi-layered acoustic dampening Environmental acoustic noise should not be more than 75 dB.
   (b) Larger front door for improved sample access
   (c) Larger side windows for improved operator visibility
   (d) Sealed enclosure for atmospheric conditioning