

PICODENTOR® HM500

Automated Nanoindentation Measuring System
For Bulk Material and Coatings in the
Nanometer Range



Description

The PICODENTOR® HM500 is an automated nanoindentation measuring system and employs the instrumented indentation test method according to ISO 14577 and ASTM E2546. The instrument allows for sophisticated measuring applications with difficult positioning and is perfectly suitable for measurements in development, quality assurance, incoming inspection and process control.

Typical fields of application

- Hard material coatings and ultra-thin DLC coatings
- Dirt-repellent coatings (e.g., Sol-Gel coatings)
- Super-thin paint coatings
- Ion-implanted surfaces
- Nano-coatings on sensors
- Implants/medical applications
- Matrix effects in alloys
- Biological materials
- Ceramic materials
- Hardness determination on micro-sections
- Automated measurements on multiple samples
- Coatings on PC hard disks/CDs

Measurable characteristic material quantities

Material characteristics computed according to ISO 14577:

- Martens hardness HM
- Indentation hardness H_{IT} (convertible to HV)
- Modulus of indentation E_{IT}
- Percent elastic portion η_{IT} of the indentation work W_{elast}/W_{total}
- Indentation creep C_{IT}
- ESP – mode, partial load and unload measurements, for depth-dependant determination of quantities like E_{IT} , H_{IT}

Design

The measuring head contains the indenter, the test load generating unit, and the position measurement unit for determining the indentation depth, as well as the entire electronic system. The controlled touchdown of the measuring head leads to a very small machine compliance.

Features

- Quick measurements without extensive sample preparation, the HM500 requires only 60 sec for its travel to the measuring position and the zero point determination.
- In-situ zero point determination during the measurement
- Measurements even on the smallest structures due to a high-precision XY-stage with a re-positioning accuracy of $\pm 0.5 \mu m$
- User-friendly handling through auto lens recognition and motor-driven Z-axis with auto-focus
- Microscope with three different magnification settings for accurate positioning on the measurement location
- Natural stone base provides dimensional stability, prevents temperature swings and buffers against vibrations
- Active anti-vibration table and enclosed measurement chamber to further reduce the influence of vibrations
- Measurement of dark surfaces without sample pretreatment
- Intuitive handling with the software WIN-HCU®

The modular design allows for later upgrades with even higher quality optics, a measuring stage with greater repeatability precision, an Atomic Force Microscope (AFM) and a heated sample support for temperature dependent measurements.

General Specification

Intended use	Nanoindentation on lacquer coatings, electroplated coatings, hard material coatings, polymers, metals, glasses and much more
Design	Bench top unit with PC, measuring head, positioning device made of natural hard stone, programmable XY-stage, motorised z-axis, joystick for controlling the XY-stage and Z-axis.
Damper system	Active anti-vibration table

Measuring head

Hardness measurement range	0.001 – 120 000 N/mm ² : near diamond hardness
Test load range	0.005 – 500 mN
Load resolution	≤ 100 nN
Distance resolution	≤ 40 µm

Microscope Camera magnification

Objective	5x, 20x and 50x
Video picture (field of vision)	1400 µm x 1000 µm, 350 µm x 250 µm, 140 µm x 100 µm Auto lens recognition

Indenters

Design	Standard: Vickers, Optional: Berkovich, Knoop, hard metal spheres Ø 0.4 mm or Ø 2.0 mm, special shapes on request
Approach speed of the indenter	≤ 0.1 µm/sec
Maximum indentation depth	150 µm

Sample Stage

Design	Programmable XY-stage
Sample placement area	180 mm x 150 mm
Maximum Travel	170 mm x 140 mm
Repeatability precision X/Y	±0.5 µm (unidirectional)
Max. specimen height	130 mm
Max. specimen weight	2 kg

Options

Objective	100-fold with field of vision 70 µm x 50 µm
Base Frame	
Sample holders	Universal sample support incl. heating station and heat plate, universal vice, support for polished micro-section samples, foil clamping device
SHS200 Heating Stage	Heated sample support up to 200 °C, for temperature dependent measurements
Nanite AFM	Atomic force microscope (AFM) for visualising and quantifying structures in the nano-metre range

Electrical Data

Main voltage, mains frequency	100 to 240 V \pm 10 % 47 – 63 Hz, 360 VA
Power consumption	max. 120 W (without evaluation PC)
Protection class	IP40

Dimensions

External dimensions (Width x depth x height)	630 mm x 650 mm x 610 mm
Weight	Measurement system: 120 kg Measurement system including measurement chamber and active anti-vibration table: 220 kg

Environmental Conditions

Operating temperature	Climatic chamber class 2 10 °C – 40 °C / 50 °F – 104 °F
Storage/Transport temperature	0 °C – 50 °C / 32 °F – 122 °F
Admissible air humidity	\leq 95 %, non-condensing

Evaluation Unit

Software	WIN-HCU®
Operating system	Windows®

Standards

CE approval	EN 61010
Standards	DIN EN ISO 14577, ASTM E 2546

Order

PICODENTOR® HM500	604-749
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