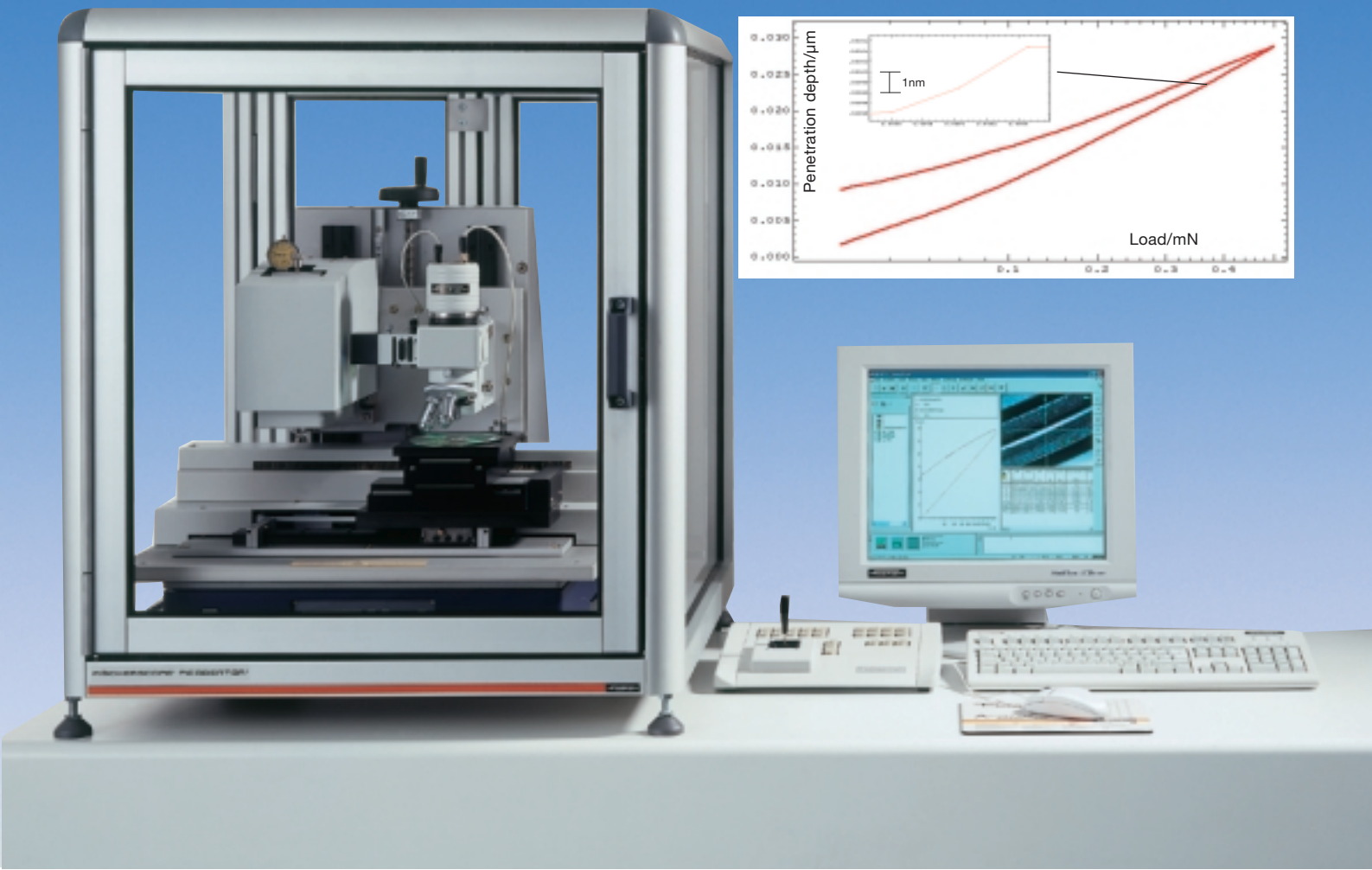
PICODENTOR® HM500

Researching the Mechanical Properties of Nanocoatings

with Depth Resolution in Picometer Accuracy

Coatings with thicknesses of only a few micrometers or even only a few tens or hundreds of nanometers are gaining in importance due to their excellent properties. Hard material coatings of TiN, TiC or diamond-like carbon with thicknesses of 1 to 4 micrometers are already common for tools and engine components. Highly complex coating systems in the nanometer range have been developed over the past years to achieve scratch-resistant, soil-resistant, antistatic, reflecting or storage-capable surfaces. The determination of the technological properties of such coatings is essential for their optimization. The PICODENTOR® HM500 is the ideal instrument for these measurements.

The PICODENTOR® HM500 can be used to determine the Martens hardness HM, characteristic elastic quantities and additional material parameters, even in the nanorange, using the instrumented indentation test according to DIN EN ISO 14577-1. The instrument distinguishes itself by its simple handling and its excellent price/performance ratio. The achieved resolution and accuracy for the load and distance measurement is in the same range as that of instruments with a much higher purchase price. Through its practical design with programmable XY stage and clear presentation of the measurement results, in comparison to other instruments, the PICODENTOR® HM500 is not only suitable for lab applications but also for the production area.



Measurement Principle, Technical Data, Applications

Measurement Principle

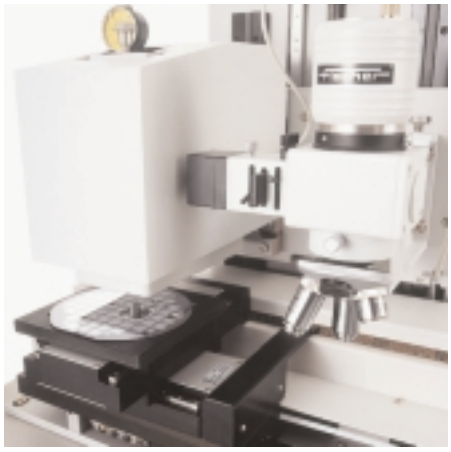
The PICODENTOR® HM500 utilizes the load/indentation depth method according to DIN EN ISO 14577-1. With this method, the indenter – typically a Vickers or Berkovich pyramid – is essentially continuously pressed into the material tested with an increasing test load, and then unloaded. The respective indentation depth is measured at the same time. Important characteristic technological quantities can be obtained from the resulting load/unload cycle.

Technical Data

- Maximum test load: 500 mN
- Maximum indentation depth: 150 µm
- Load resolution: <100 nN
- Distance resolution: <40 pm
- Software WIN-HCU® with calculation and presentation of the characteristic quantities according to DIN EN ISO 14577-1
- Video microscope with 40x, 200x and 400x magnification
- Programmable xy-stage with 100 x 100 mm travel

Applications

- Hard material coatings, general
- Ultra thin DLC coatings
- Protective coatings on glass
- Soil-resistant coatings (sol-gel coatings)
- Coatings of PC hard disks and CDs
- Very thin paint coatings
- Ion implanted surfaces
- Nanocoatings for sensors
- Medical technology (implants, etc.)
- Matrix effects in alloys
- Biological materials
- Ceramic materials



HM500 with a coated wafer as specimen.

Measurable Characteristic Material Quantities

- Martens hardness HM
- Indentation hardness H_{IT} (convertible to HV)
- Elastic indentation modulus E_{IT}
- Indentation creep C_{IT}
- Percent elastic portion η_{IT} of the indentation work W_{elast}/W_{total}

Vickers or Berkovich diamonds with certificates for the tip radius and the line of conjunction are shipped as indenters. A hardness reference block made of BK7 is available for calibrations.

The closed measuring chamber and the active anti-vibration table ensure very accurate measurements with an excellent repeatability precision.

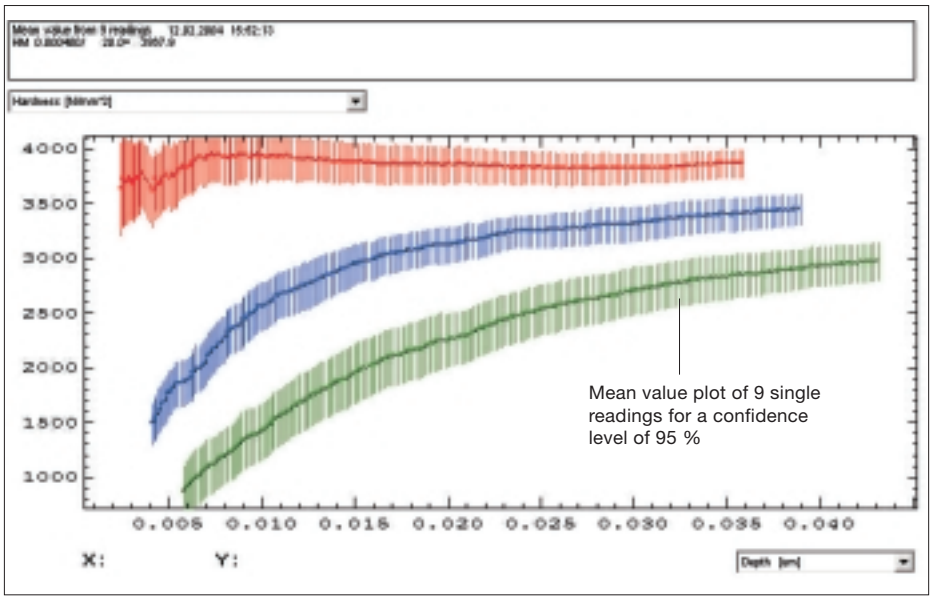


Image on right
Hardness profile for three samples with PVD coatings of different compositions with thicknesses of about 300 nm

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