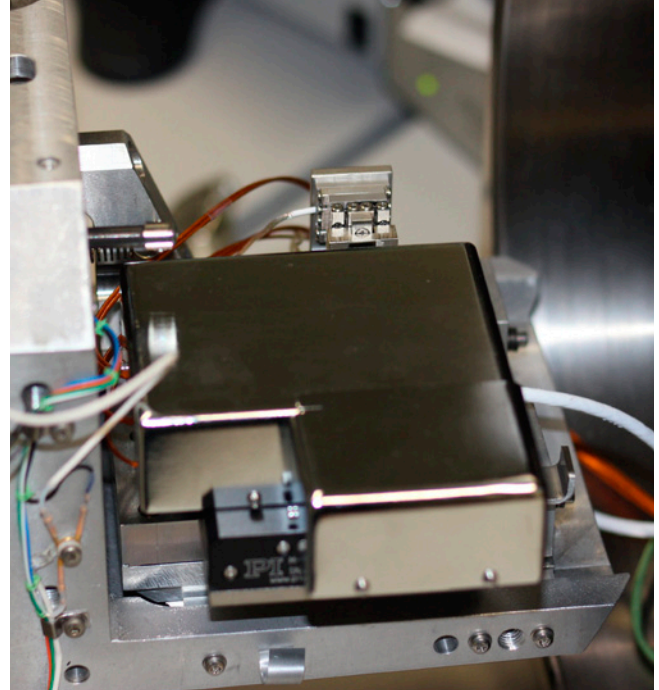
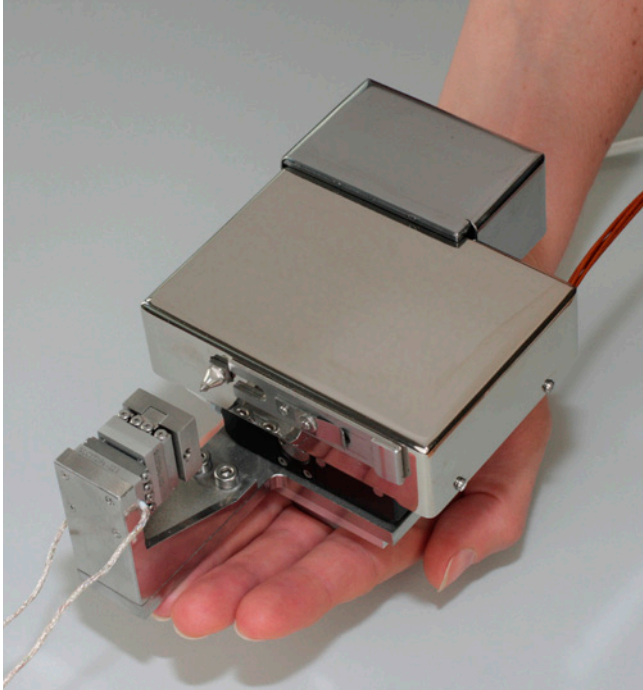


Product Information

ZHN/SEM - Nanoindenter for Scanning Electron Microscope



Range of application

The nanoindenter ZHN/SEM for installation in a scanning electron microscope is designed to carry out micromechanical experiments while simultaneously observing sample and tip with highest magnification. It offers the widest measurement range on the market with a maximum displacement of 200 μm and a maximum force of 200 mN. Simultaneously the force and displacement noise levels are highly competitive in a vibration free environment. Its internal stiffness is so high that conventional hardness tests can be carried out without problems.

The standard system is designed for the installation on the stage of a number of different SEMs but it can also be mounted on the chamber wall. The existing tilting and moving capabilities of the SEM stage can be used. The system consists of

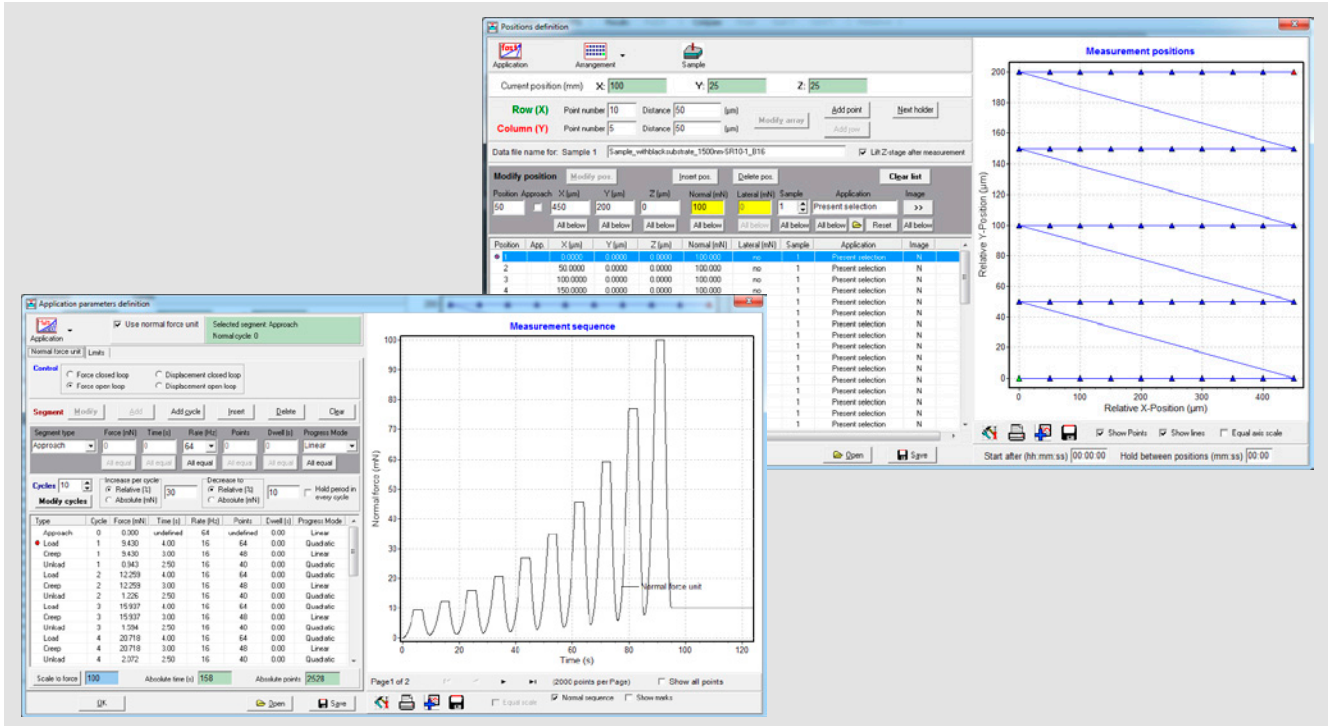
- The measuring head with sensors and actuator
- A Piezo stage system for sample movement in XY direction and optional rotation
- A stiff mechanical Z stage for moving the head towards the sample
- Computer and controller
- Easy-to-use and flexible software
- One or two flanges with feed through (adapted to the SEM type).

Advantages/features

- The indenter can be adapted to customer wishes over a wide range.
- Open and closed loop force or displacement control modes are available.
- A dynamic module with frequencies up to 100 Hz for fatigue and continuous stiffness measurements is also an option.
- A unique feature is the ability of the head to work in both directions (push and pull) over the complete measurement range.
- Video synchronization can be realized by transferring the measurement data into an additional window on the SEM screen over TCP-IP and capturing the screen.

Product Information

ZHN/SEM - Nanoindenter for Scanning Electron Microscope



The software gives easy access to a number of pre-defined applications which can be modified in a very flexible manner like:

- Indentation hardness and modulus measurement according to ISO 14577
- Purely elastic measurements using spherical indenters
- Dynamic mode for a fatigue tests or viscoelastic characterization

- Tensile test with dog bone specimens and adapted grips
- Measurements can be graphically presented, compared, averaged or exported (ASCII, EXCEL, BMP, JPG and more). Comprehensive correction routines are available
- A large number of test positions can be programmed with an accuracy of about 50 nm and run automatically

Technical data

Type	Item number
ZHN0.2/SEM	1020054
Maximum test force	± 200 mN (push and pull)
Maximum displacement	± 200 µm at 20 mN; ± 150 µm at 200 mN
Digital force resolution	≤ 0.02 µN
Digital displacement resolution	≤ 0.001 nm
RMS noise level force	≤ 0.5 µN
RMS noise level displacement	≤ 0.5 nm
X and Y-stage travel range	12 mm
X and Y-stage positioning accuracy	≤ 50 nm
X and Y-stage resolution of positioning system	1 nm
Z-stage travel range	15 mm (25 mm optional)
Z-stage positioning accuracy	≤ 0.1 µm
Z-stage resolution of positioning system	50 nm

Product Information

ZHN/SEM - Nanoindenter for Scanning Electron Microscope

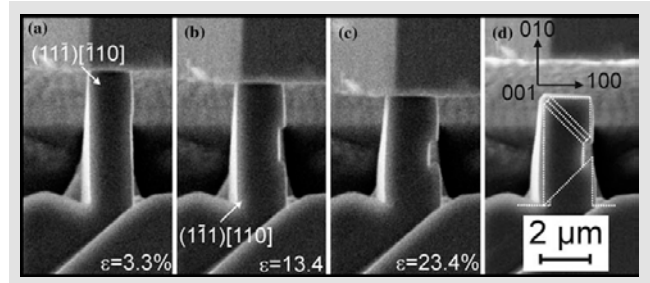
Application examples

Copper Single Crystal Compression Test

SEM images of a [1 0 0] copper column with a cross section of $2 \times 2 \mu\text{m}$ taken in situ after:

- (a) 3.3% compression
- (b) 13.4% compression
- (c) 23.4% compression
- (d) unloaded specimen

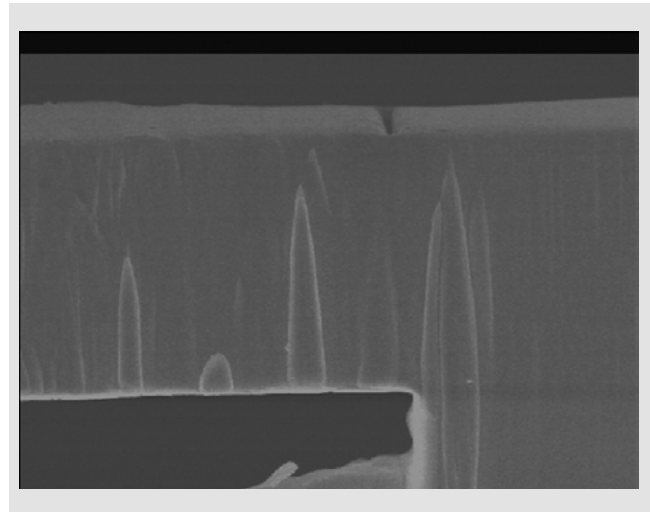
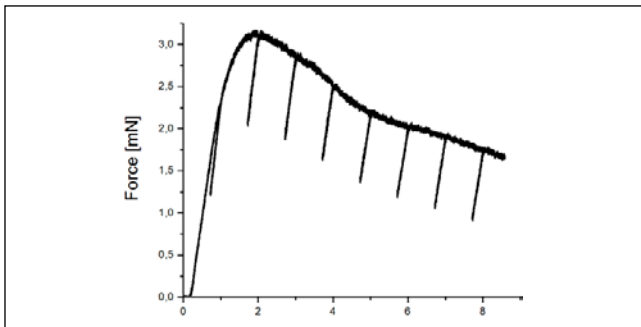
with a draft of initial crystal orientation and active glide planes.



© Dr. C. Motz, Universität des Saarlandes, Germany

Fracture Toughness Experiment on Tungsten

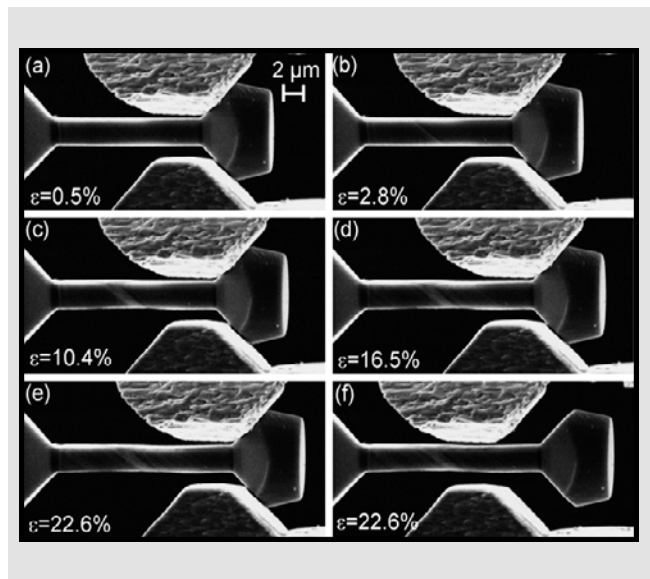
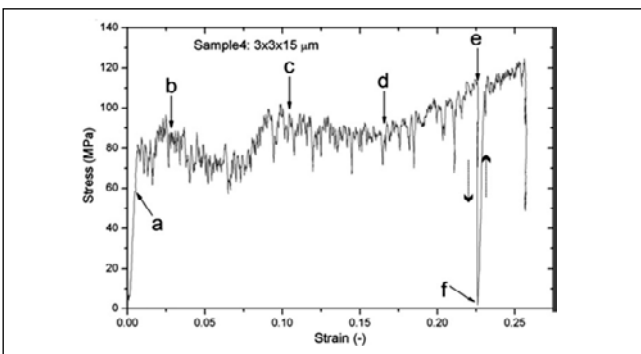
Cantilevers were loaded in-situ with a cube corner tip. Loading and unloading speed was set to 1 mm/min for all specimens. Stable crack growth was observed for all samples.



© Dr. Wurster, ESI Leoben, Austria

Determining size-dependent crystal plasticity

SEM images of a sample taken during in situ tensile testing (a - e) and after unloading (f). The corresponding positions along the stress-strain curve are indicated by arrows in the graph. A second loading step (indicated by arrows) was performed on the sample.

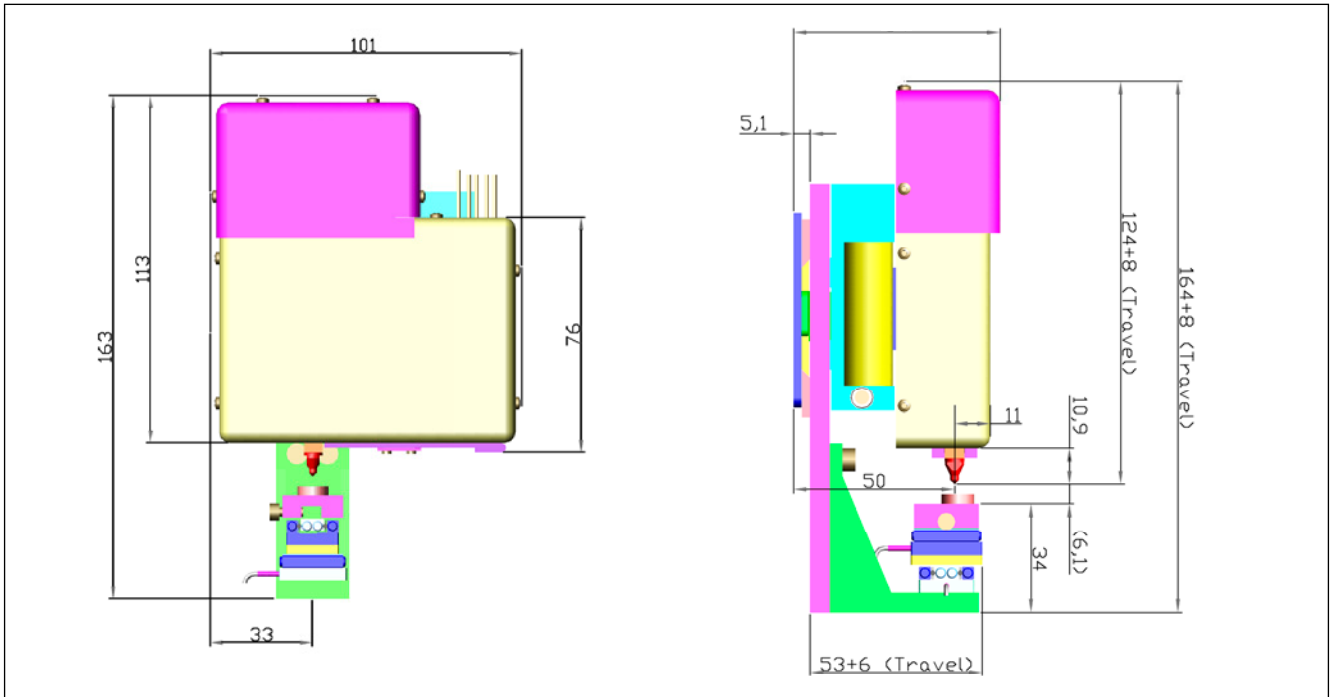


© Dr. Kiener, ESI Leoben, Austria

Product Information

ZHN/SEM - Nanoindenter for Scanning Electron Microscope

Dimensions



Option

Rotation table

- Rotatory positioner with integrated sensor
- HV compatible (10e-6 mbar)
- Limitation of movement range to 340°

