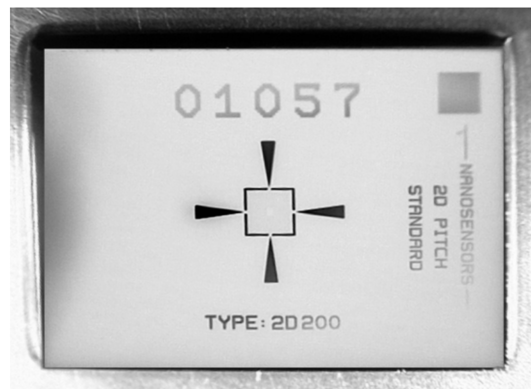
Transfer Standards

for Scanning Probe Microscopy

The demand for quantitative dimensional characterization of nano- and microstructures increases. This is driven for example by advances in semiconductor industry and many other fields of precision engineering. Manufacturing in these industries depends strongly on the performance of metrology equipment (e.g. SPM) to ensure and improve yield. Both suppliers and users of such equipment are in need of physical transfer standards to achieve quantitative measurement results. Traceability to the International System (SI) unit of length is an issue relevant to those who have to maintain ISO or other quality certifications.



Photograph of a 2-dimensional pitch standard exhibiting a 200 nm pitch at the center area.

Meet the Demand by Cooperation

In cooperation with National Metrology Institutes (NMI's) in Europe NANOSENSORS™ has developed a set of physical transfer standards for SPM applications. These standards allow the calibration of the X,Y and Z axis of SPM equipment. In addition, certain system induced limitations of this equipment can be revealed and compensated. The German Physikalisch-Technische Bundesanstalt (PTB), Great Britain's National Physical Laboratory (NPL) and the Danish Institute of Fundamental Metrology (DFM) participated not only in the product definition phase. Their main task was the development of measurement techniques for calibrating the transfer standards. These institutions ensure the traceability to national standards. Through European (EUROMET) and international cooperations (Metre Convention) traceability to other worldwide metrology standards is achieved.

Two-Dimensional Lateral (XY) Standard with 200 nm Pitch

This type of transfer standard is intended for a precise x-y-calibration of the SPM scanning mechanism. It consists of a 2-dimensional lattice of inverted square pyramids etched into Silicon. The available type offers a 200 nm pitch (order code: 2D200).

Step Height (Z) Standard with 8 nm Nominal Step Height

The step height standard (order code: H8) is used for a precise calibration of the Z-axis of the SPM's scanning mechanism. The standard consists of multiple areas of hole and stripe arrays. The depth these structures are etched into silicon is in the range of 8 nm.

As a service for the customer NANOSENSORS™ includes a reference measurement for each H8 standard. In close time correlation a reference H8 standard which has been calibrated by the German national authority for metrology (PTB) is measured on the same instrument. From the given results the absolute height value may be calculated. Thus traceability to the PTB is achieved.

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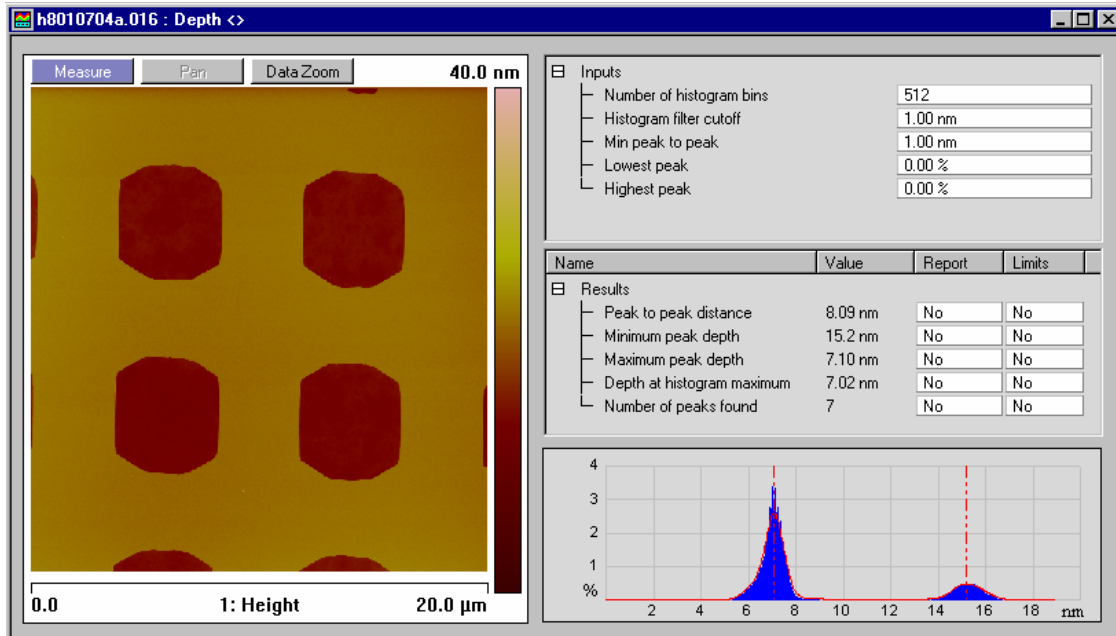
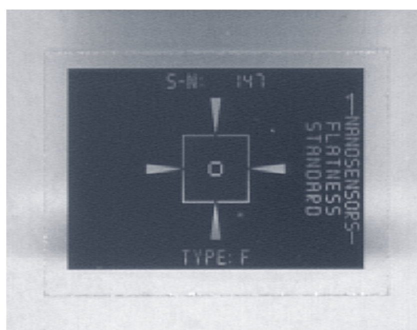


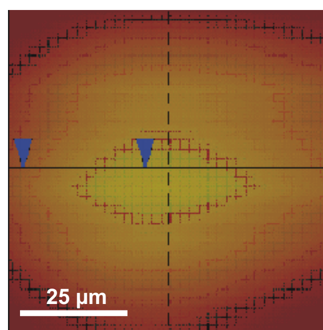
Z-height (depth) estimation by histogram evaluation of a 20 x 20 µm² area in the central pattern of the H8 standard. The step height equals the peak to peak distance of the spectrum.

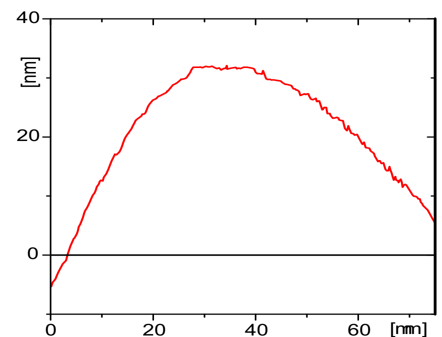
Flatness Standard

The flatness standard (order code: FLAT) consists of a super flat plane which is formed by a quartz substrate covered with a structured chromium layer. It is intended to be used to analyze and correct the scanner bow of the piezo scanner used in most Scanning Force Microscopes. The standard is specified to offer a maximum peak to valley distance of 10 nm on a 100 by 100 μm^2 area.



Photograph of the flatness standard.





The AFM image (left) of the flatness standard shows a bowl-like distortion due to scanner bow. The AFM line scan (right) of the flatness standard (red line) in comparison to an interferometrically generated line scan (black line).

For more details please refer to the product datasheet on our website
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