

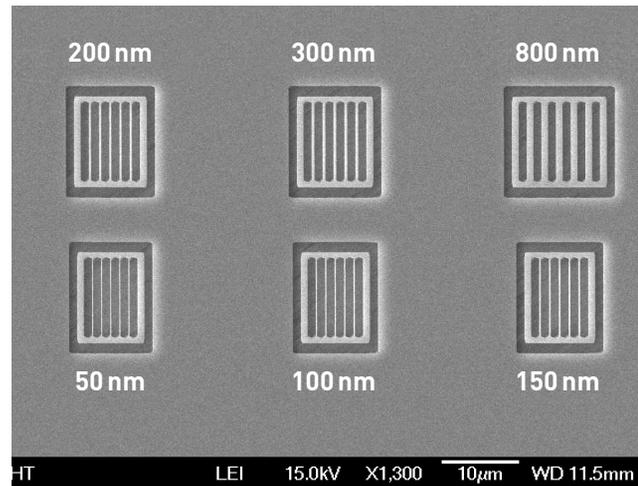
APPLICATION

The Nanoscale AFM-CD Standard (CD, critical dimension) contains patterns on the nanometer scale for the linewidth and also the pitch calibration of scanning probe microscopy methods (atomic force microscopy [AFM]).

DESCRIPTION

The structures for the Nanoscale AFM-CD-standard offer a series of very smooth and sharp etched line-space structures in silicon with vertical side-walls. The smallest lines are around 50 nm wide, 250 nm deep and extremely parallel with deviations of below 10 nm.

Each calibration chip has a size of 8 x 8 mm². In the centre of the calibration chip, where the two-stage finding structure ends, 6 groups of 5 line-space structures with different nominal widths (50, 100, 150, 200, 300 and 800 nm) are arranged. The space between the lines is about 1 μm. Each group is nominally 10 μm long. The structures are sharp-edged with edge radii of less than 15 nm. The edge roughness is well below 5 nm (3σ).

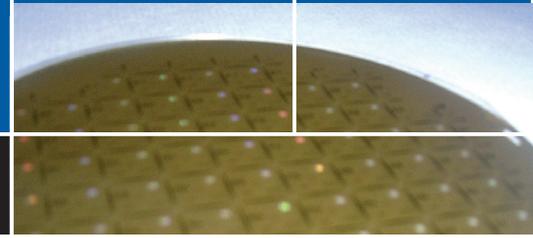


SEM-Micrograph of the calibration pattern with different CD-widths (from 50 nm to 800 nm).

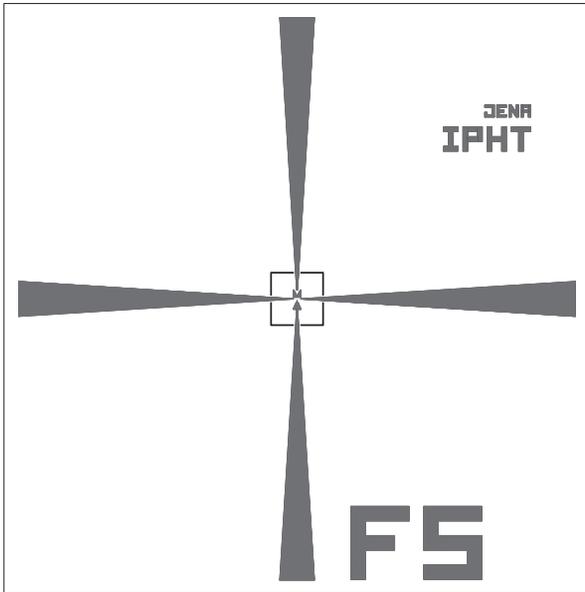
SPECIFICATIONS

Substrate	<ul style="list-style-type: none"> Material: <110> Si Chip dimension: 8 x 8 mm² Surface roughness: < 1 nm 	Pitches	<ul style="list-style-type: none"> 1 μm + CD value Uncertainty of mean pitch: 3 nm 1σ
Finding structures	<ul style="list-style-type: none"> Grooves in the Si-substrate Depth: 250 nm 	Structure depth	<ul style="list-style-type: none"> 250 nm
Types of grating	<ul style="list-style-type: none"> 1-dim 	Edge radius	<ul style="list-style-type: none"> < 15 nm
Size of grating	<ul style="list-style-type: none"> Normally 10 x 10 μm² 	Edge roughness	<ul style="list-style-type: none"> < 5 nm (p-p)
Linewidths (CD)	<ul style="list-style-type: none"> Nominal: 50 nm, 100 nm, 150 nm, 200 nm, 300 nm, 800 nm Linewidth variation along the lines (within a central part of 1 μm): < 3 nm 1σ 	Sidewall angle	<ul style="list-style-type: none"> 89°
		Traceability	<ul style="list-style-type: none"> CD & pitch-calibration made by the PTB Braunschweig on request.

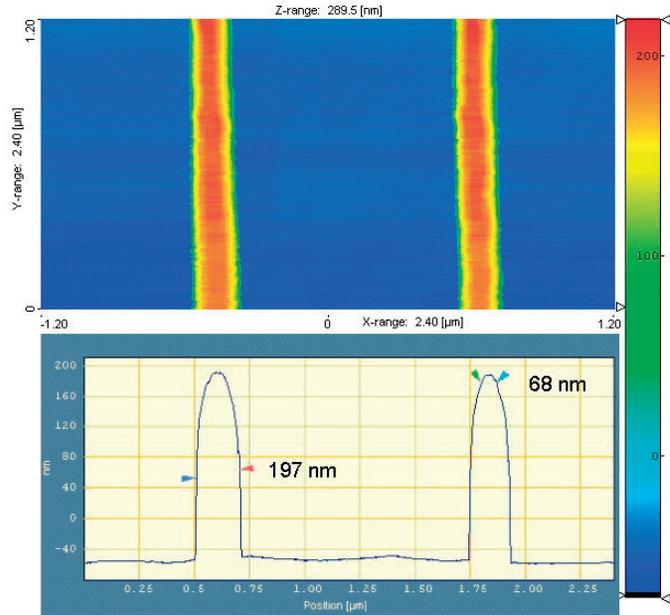
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CHIP AND PATTERN DESCRIPTION

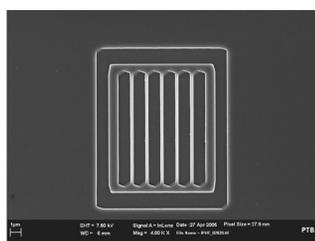


Sketch of the 8 x 8 mm² calibration-chip. The measurement area is placed in the centre of the chip.

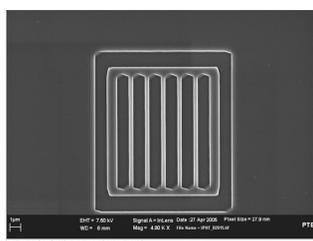


AFM-picture* and the profile of a centre part of the "Nominal 50nm"-structure measured using a super-sharp EBD-needle (dihedral angle = 3.6°, tip radius = 10 nm). The cross-section profile show the convolution between the tip-shape and the sharp-etched calibration structure.

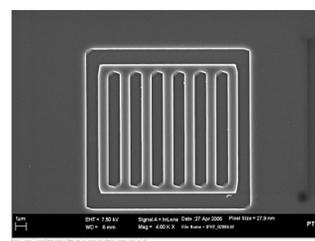
SEM MICROGRAPH'S* (ZEISS SUPRA 35 VP)



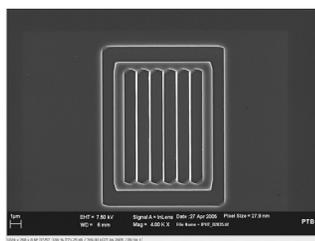
◀ Nominal 200 nm



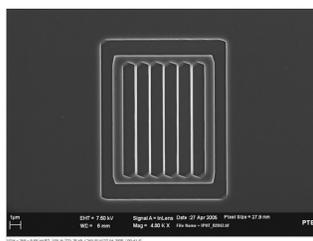
◀ Nominal 300 nm



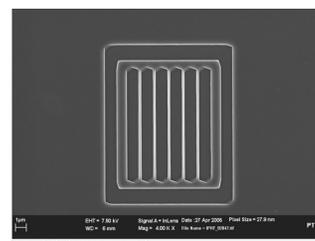
◀ Nominal 800 nm



◀ Nominal 50 nm



◀ Nominal 100 nm



◀ Nominal 150 nm

* Courtesy of Dr. Bosse, Dr. Buhr and Dr. Dziomba, PTB Braunschweig