



APPLICATION

The Nanoscale Linewidth/Pitch Standard contains patterns on the nanometer scale for the linewidth calibration and resolution-check of high-resolution optical microscopy techniques like deep ultraviolet microscopy (UVM) and confocal laser scanning microscopy (CLSM). It can be used for quick astigmatism testing of these instruments and also for scanning probe methods like atomic force microscopy (AFM).

DESCRIPTION

The Nanoscale Linewidth/Pitch Standard consists of different grating structures etched in nanocrystalline silicon on a quartz substrate. The optical contrast of the pattern in the UV wavelength makes it suitable for transmission and reflection UV and laser scanning microscopy. The types of grating are 1-dim (for both x and y), 2-dim (cross grating) and circular. An isolated single structure for CD determination is added on one side of the 1-dim grating. The pitch values are 160, 200, 230, 260, 300, 400, 500, 700 nm, 1 μm and 4 μm , i.e. the structure widths are between 80 nm and 2 μm . With the exception of the larger 4 μm -structures each grating has an area of around 10 x 10 μm^2 .



SEM-micrographs of the calibration pattern

SPECIFICATIONS

Substrate	<ul style="list-style-type: none"> Material: quartz Chip dimension: 8 x 8 mm² 	Size of grating	<ul style="list-style-type: none"> Normally 10 x 10 μm^2
Film	<ul style="list-style-type: none"> Nanocrystalline silicon Thickness: 25 nm 	Linewidths of the CD-structure	<ul style="list-style-type: none"> Nominal: 80 nm, 100 nm, 115 nm, 130 nm, 200 nm, 250 nm, 350 nm, 500 nm, 2 μm Linewidth variation along the lines (within a central part of 6 μm): 8 nm 1σ
Chip holder	<ul style="list-style-type: none"> Size: 76 x 26 x 2 mm Material: aluminium alloy, anodized 	Pitches	<ul style="list-style-type: none"> 160 nm, 200 nm, 230 nm, 260 nm, 300 nm, 400 nm, 500 nm, 700 nm, 1000 nm, 4 μm Uncertainty of mean pitch: 3 nm 1σ
Finding structures	<ul style="list-style-type: none"> Au Thickness: 100 nm 	Circularity of the circular gratings	<ul style="list-style-type: none"> $\pm 0.6\%$ deviation of mean pitch in x- and y-direction (± 1 nm for 160 nm grating)
Types of grating	<ul style="list-style-type: none"> 1-dim (for both x and y) 2-dim (cross grating) Circular grating An isolated single structure for CD determination is added on one side of the 1-dim grating 	Traceability	<ul style="list-style-type: none"> CD & pitch-calibration made by the PTB Braunschweig on request.

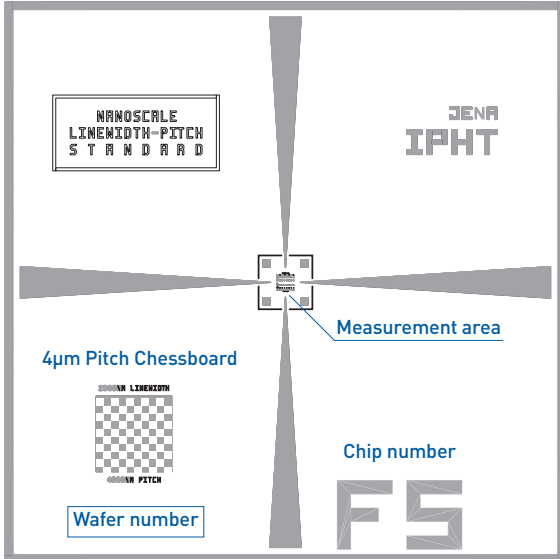
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Nanoscale Linewidth/Pitch Standard

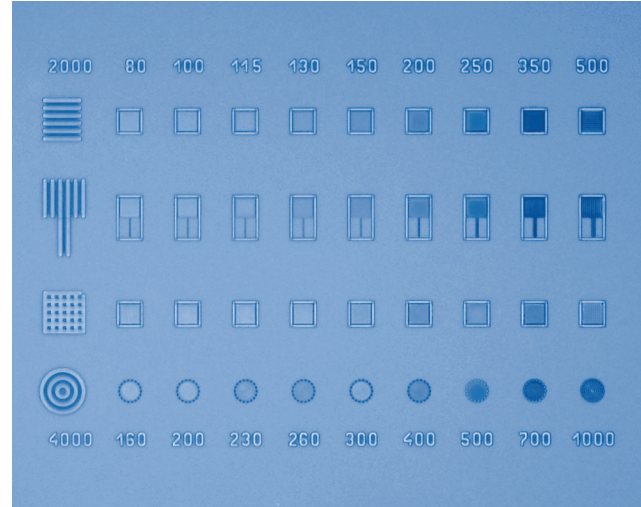
UVM / CLSM / AFM



CHIP AND PATTERN DESCRIPTION



Sketch of the 8x8 mm² calibration-chip.



Measurement area of the "Nanoscale Linewidth/Pitch Standard", the column numbers show the pitch, below, and the CD-linewidth in nanometer, above.

DUV-MICROSCOPY IMAGES

		PITCH								
		160 nm	200 nm	230 nm	260 nm	300 nm	400 nm	1000 nm		
Leica INM 300 DUV ^a , $\lambda=248$ nm, NA=1.2 (wet)										
Leica INM 300 DUV ^a , $\lambda=248$ nm, NA=0.8										
Leica INM 300 DUV ^b , $\lambda=365$ nm, NA=0.9										

^a Courtesy of W. Vollrath, Leica Microsystems AG

^b Courtesy of D. Schelle, IAP Jena/E. Buhr, PTB Braunschweig

The picture shows DUV-images obtained from the structures of the Nanoscale Linewidth/Pitch Standard by using different kinds of optical lenses. The column numbers indicate the pitch in nanometers. Only the high resolution DUV-microscope ($\lambda=248$ nm) using an immersions objective (NA=1.2) is able to provide clear pictures of the 160 nm-gratings.

