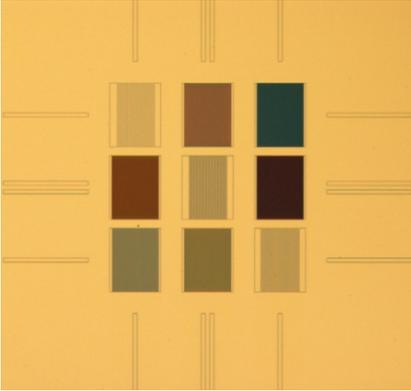
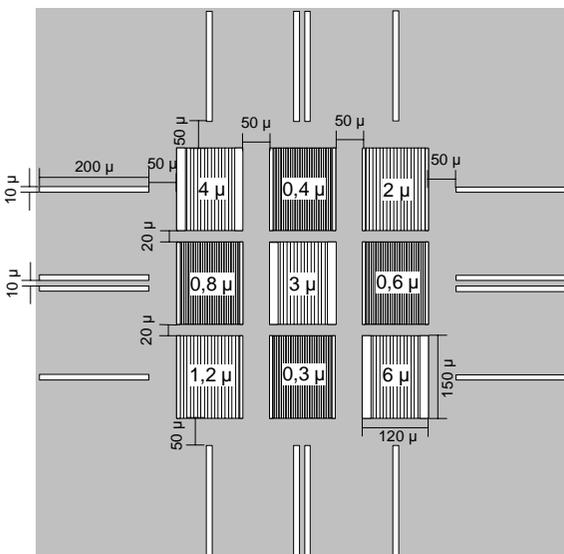


Resolution Standard Type RS-N



1. Structure

The standard can be used generally as a set of gratings. Especially it is developed as a resolution standard to serve the determination of the short wavelength cutoff of interferential and confocal microscopes allowing to compare results of these instruments with results of mechanical instruments.



The resolution standard of type RS-N consists of a set of 9 gratings, these are areas with different pitch values. The range of the pitch values lasts from 0.3 μm to 6 μm with the subdivision 0.4-0.6-0.8-1.2-2.0-3.0-4.0 μm . The widths of the grooves of the gratings are approximately equal to the space between the grooves.

Each grating is neighboured by two broader adjacent grooves for the comparison of the depth. To support the finding of the small field of the gratings (460 μm \times 490 μm) 8 grooves and 4 double grooves (each 4 resp. 2 horizontal and vertical) are realised.

The standards with a size of 10 mm \times 10 mm are made out of Si wafers of {100}-orientation (thickness 525 μm). All grooves of the resolution standard should have the same or a similar depth. They are dry etched up to the nominal depth of 190 nm. This process produces nearly vertical sidewalls. The depth is smaller in the narrow grooves (140 nm for pitch = 0.3 nm).

2. Operation procedure

2.1 Use for validating interference or confocal microscopes

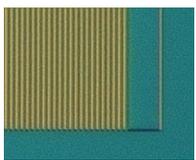
The short wavelength cutoff is an important parameter that needs to be considered when surface topography is evaluated. This especially holds true in cases when different measurement techniques are compared with each other. Within the field of different contact stylus instruments a certain degree of unification is achieved by the λ s-filter in the signal processing according to ISO 3274. However, among the optical topography measuring instruments (like interference microscopes, confocal microscopes, micro fringe projection) there is some confusion in the meaning of the short wavelength limitation.

The applications of the standard described here are derived from the guideline VDI 2655-1 (Optical measurement and micro topographies: Calibration of interference microscopes and depth measurement standards for roughness measurement, 2005).

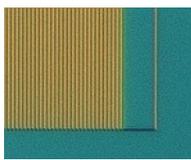
In a first step the user has to measure the depth of a groove for which the wavelength is well within the transfer band (e. g. in an adjacent groove about 190 nm). This is like the use of a depth measurement standard. In a second step that grating section has to be found out for which the measured depth is clearly smaller (e. g. the half, about 95 nm) than the long wavelength depth.

2.2 Use for validating the lateral resolution of optical microscopes

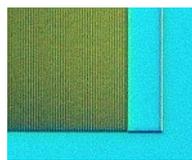
The magnitude of an object which can be observed in an optical microscope depends on the wavelength λ of the light and the numerical aperture A of the objective. Commonly two points can be resolved if the distance between them is larger than λ . The pictures illustrate the resolution limit of about 400 nm of an objective with $A = 0.90$ (magnification 100x). The grooves with a pitch of 0.3 μm cannot be resolved.



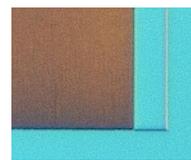
pitch 0.8 μm



pitch 0.6 μm



pitch 0.4 μm



pitch 0.3 μm

Concerning the depth and pitch values the standard is available with a calibration certificate of the PTB (PTB: Physikalisch-Technische Bundesanstalt, the national metrology institute of Germany). These values can be certificated within different regions.

3. Packaging, Handling and Cleaning

For a better handling the standards are mounted on borosilicate glass with a size of 5 cm x 5 cm as substrate. Further sizes are possible on request. The chips are mounted by an epoxy resin adhesive.

The standards are stored in a membrane box. The grating does not come into contact with the membrane.

Do not touch the standard especially the regions destined for measuring and calibration. Use suitable (plastic) tweezers for handling.

For cleaning the resolution standards please contact SiMETRICS for a cleaning process.

4. Assortment and Specification

Type	Nominal etch depth (nm)
RS-N	190

Pitch (µm)	Typical depth (nm)	Number of pitches	Field size of grating (µm x µm)	Width of adjacent grooves (µm)
0.3	140	366.67	110 x 150	5
0.4		275	110 x 150	5
0.6	160	183.3	110 x 150	5
0.8		137.5	110 x 150	5
1.2	192	91.67	110 x 150	5
2.0	192	55	110 x 150	5
3.0		30	90 x 150	15
4.0	192	22.5	90 x 150	15
6.0	192	15	90 x 150	15