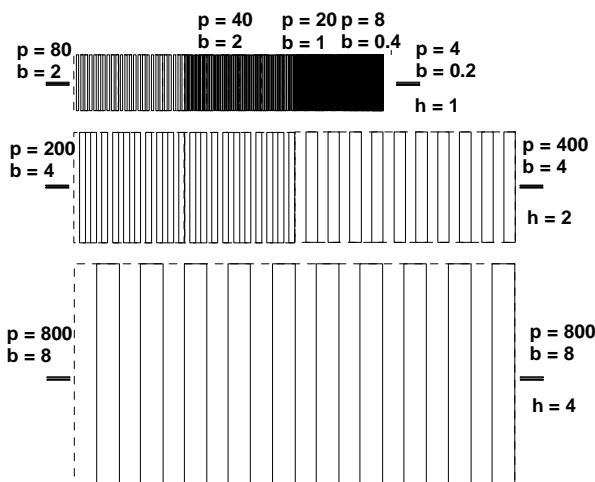


## Resolution Standard Type RS-M

### 1. Structure

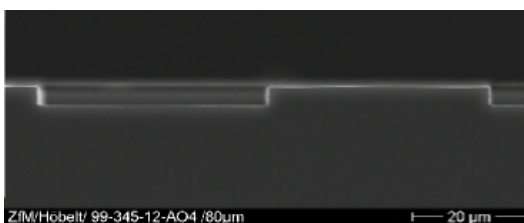
The standard can be generally used as a set of gratings. Especially it is developed as a resolution standard serving for the determination of the short wavelength cutoff of interferential and confocal microscopes. It allows the comparison of the results of these instruments with results of mechanical instruments.

This resolution standard consists of a set of gratings. The range of pitch values lasts from 4 to 800  $\mu\text{m}$ .



Pattern of the gratings,  $p$ : pitch /  $\mu\text{m}$ ,  $h$ : length of grooves / mm,  $b$ : length of grating section / mm. The virtual middle line through the gratings is marked by horizontal double grooves (width: 4  $\mu\text{m}$ , length: 0.2 mm, distance: 20  $\mu\text{m}$ ).

The standards with a size of 10 mm x 10 mm are made out of Si wafers of {100}-orientation (thickness 525  $\mu\text{m}$ ). All grooves of this standard have the same depth. Two different depths are available:  $d = \sim 3.0 \mu\text{m}$  and  $d = \sim 90 \text{ nm}$ . The different preparation processes of the two depths result in different sidewalls of the grooves:



Cross section of the grooves of the standards with a depth of 3.5  $\mu\text{m}$ : vertical sidewalls



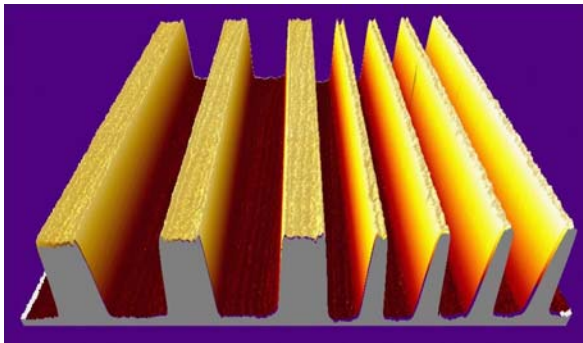
Cross sections of the grooves of the standards with a depth of 0.09  $\mu\text{m}$ : rounded sidewalls

## 2. Operation Procedure

The short wavelength cutoff is an important parameter that needs to be considered when surface topography is evaluated. This holds true especially 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  $\lambda$ s-filter in the signal processing according to ISO 3274. However, among the optical topography measuring instruments (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 microtopographies: Calibration of interference microscopes and depth measurement standards for roughness measurement, 2005).

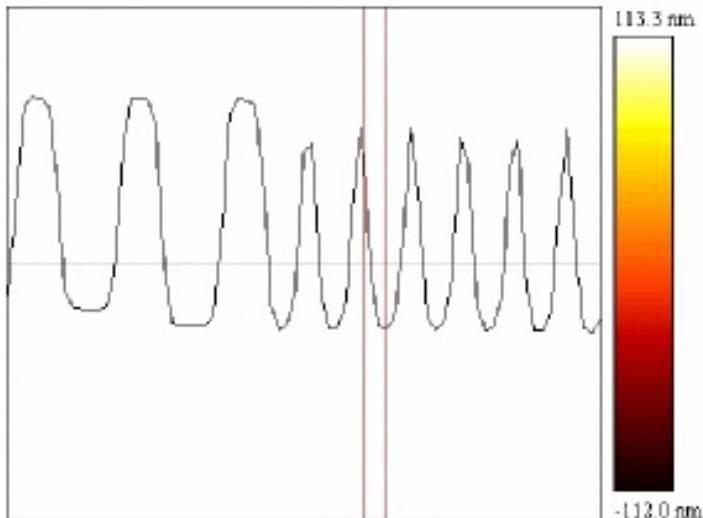
In the first step the user has to measure the depth of a groove for which the wavelength is well within the transfer band. This is like the use of a depth measurement standard. In the second step that grating section has to be found out for which the measured depth is clearly smaller (e. g. the half)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



AFM - measurements in the 8 and 4  $\mu\text{m}$  area of the grating with a depth of 90 nm

Pitch 8  $\mu\text{m}$

Pitch 4  $\mu\text{m}$



Resolution limit of an interference microscope

R. Krüger-Sehm, J. Frühauf, T. Dziomba: Determination of the Short Wavelength Cutoff of Interferential and Confocal Microscopes, Proc. 10th Int. Conf. Metrology and Properties of Eng. Surfaces, St. Etienne-France, 2005, p. 21

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<br>( $\mu\text{m}$ ) |
|------------------|---|
| <b>RS-M 3</b>    | 3                                       |
| <b>RS-M 0.09</b> | 0.09                                    |

| Pitch*<br>( $\mu\text{m}$ ) | Number<br>of pitches* | Field size*<br>(mm x mm) | Inclination angle of<br>sidewalls |           |
|-----------------------------|-----------------------|--------------------------|-----------------------------------|-----------|
|                             |                       |                          | RS-M 3                            | RS-M 0.09 |
| 4                           | 50                    | 1 x 0.2                  | 90°                               | rounded   |
| 8                           | 50                    | 1 x 0.4                  | 90°                               | rounded   |
| 20                          | 50                    | 1 x 1                    | 90°                               | rounded   |
| 40                          | 50                    | 1 x 2                    | 90°                               | rounded   |
| 80                          | 25                    | 1 x 2                    | 90°                               | rounded   |
| 200                         | 20                    | 2 x 4                    | 90°                               | rounded   |
| 400                         | 10                    | 2 x 4                    | 90°                               | rounded   |
| 800                         | 10                    | 4 x 8                    | 90°                               | rounded   |

\*valid for both depths



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**Resolution Standard  
RS-M**