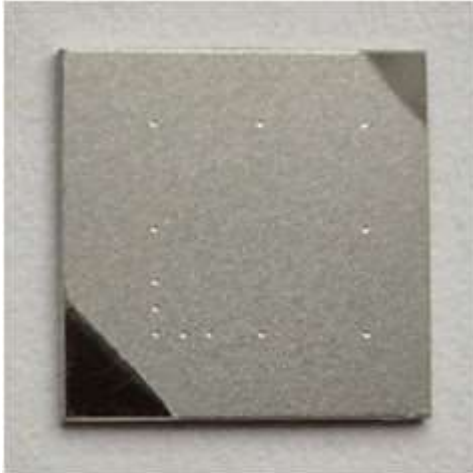




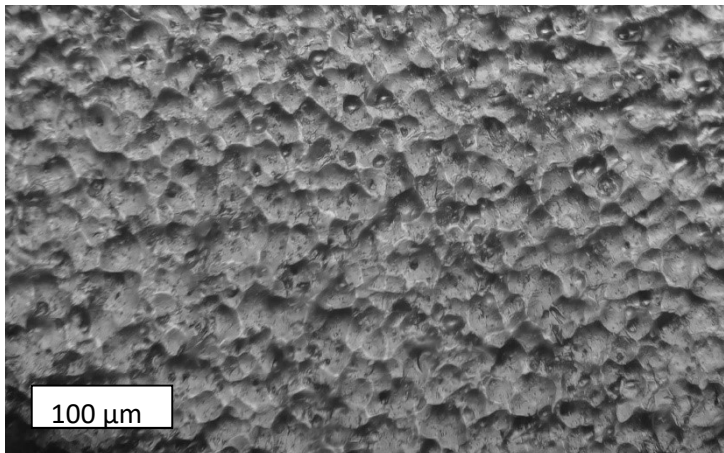
Roughness Standard RnS St-B

Type AIR
areal irregular

1. Type of Material Measure

In accordance with EN ISO 25178-70 a material measure for the surface roughness is offered with an irregular surface texture made by a stochastic process (sand blasting) on the surface of a stainless steel chip (ASTM 304, Nr. 1.4301, DIN/EN: XCrNi18-10).

2. Surface Texture and Roughness Characteristics



Surface of a
sandblasted stainless steel
chip (RnS-St-B-c)

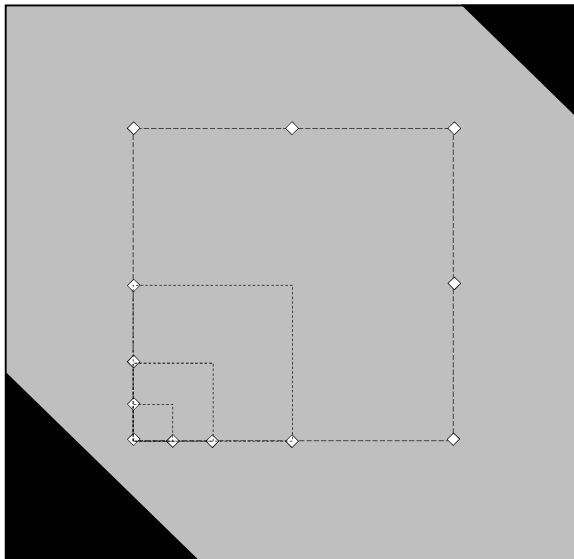
The rough surface is formed by a stochastic process (sandblasting). The resulting roughness mainly depends on the size and the shape of the used grains, the blasting pressure and the distance. The used SiO_2 - grains are of spherical shape with a mean diameter of about 50 μm .

The beam of spherical grains produces shallow crater-like valleys which are randomly distributed. Consequently the roughness is uniform and independent on the direction at the surface and therefore suitable as an isotropic areal roughness standard.

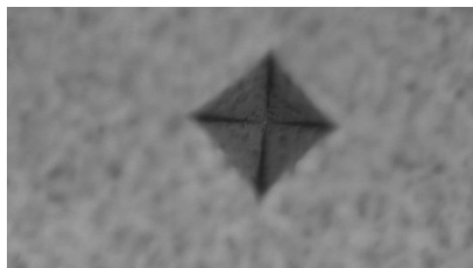
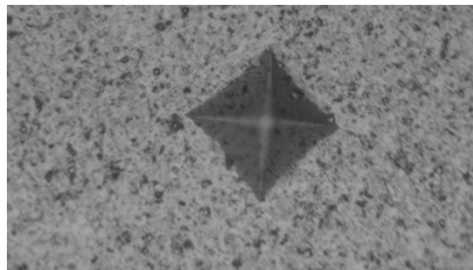
The standards were developed mainly for optical instruments having a problem to measure a surface topography with slopes larger than 40 deg. So the goal of the development was the preparation of a series of rough surfaces with a wide range of S_a but with $S_{dq95\%} < 40$ deg. By sandblasting it succeeded to produce such surfaces with $100 \text{ nm} < S_a < 750 \text{ nm}$. Except for the surface with the lowest S_a , the Skewness S_{sk} and the Kurtosis S_{ku} are nearby the theoretical values. The ratios $S_{pk} : S_k : S_{vk}$ amount to approx. 1 : 2 : 1, indicating an identical shape. S_{mr1} and S_{mr2} are near 10% resp. 90%. The lateral parameter S_{al} varies in a similar manner like the amplitude parameters, indicating as well a similar texture.

3. Chip Size and Markers

The chip has a size of $10 \text{ mm} \times 10 \text{ mm}$ with a thickness of 0.5 mm. In order to perform defined measurements the roughness standards contain a set of markers (impressions of a pyramidal Vickers - Diamond).



Sandblasted chip (schematic) with a system of marks (Vickers impressions). The distances of the dotted squares are 0.7, 1.4, 2.8 and 5.6 mm



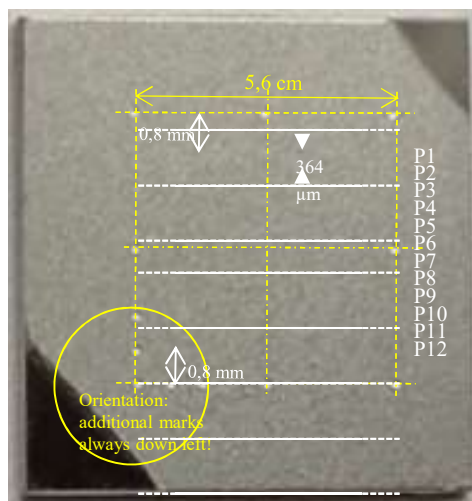
Vickers impressions
top: focused at the surface
bottom: focused at the pyramidal tip in the depth

In order to protect the chip surface from the beam of sand two triangular regions were created on the chip by a polymer mask. For a reproducible orientation of the chip, the larger triangle marks the corner "bottom left". The side of the quadratic arranged Vickers impressions has the length of 5.6 mm.

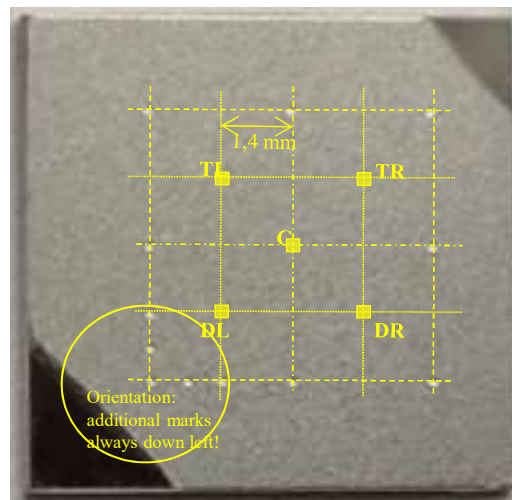
The diagonal of the Vickers impressions measures appr. $160 \mu\text{m}$. The impressions are clearly visible to the naked eye. The tip of the pyramids has a sharpness of about $1 - 2 \mu\text{m}$ and is consequently suitable as a reference point for the positioning of any measuring field.

3. Application - Operation Procedure

The RnS St-B can be used with tactile or optical instruments or AFM's.
Different procedures are possible:



Proposal for an arrangement of 12 scans for the measurement of roughness by a tactile instrument



Proposal for the positioning of 5 fields for the measurement of roughness by an optical instrument.

Tactile measurement of roughness

According to DIN EN ISO 4287 12 profiles must be performed: 12 (6) scans parallel to x-, 0 (6) scans parallel to y-direction inside the quadratic arrangement of the markers; the distance between the scans and to the marker grooves is λc .

According to DIN EN ISO 25178 an areal measurement can be performed using fields in definite positions relatively to the markers (Vickers impressions).

Optical measurement of roughness

According to DIN EN ISO 25178 an areal measurement can be performed using fields in definite positions relatively to the markers (Vickers impressions).

The RnS-St can be delivered

- with listed values of Ra, Rq, Rz according to DIN EN ISO 4287 measured by SiMETRICS with a tactile surface profiler (traceable to the PTB with PTB calibrated Vertical Standards VS).
(relative uncertainty of measurement ~5 %)
- with nominal values of Sa, Sq, Sz.
- with values measured under defined conditions and certified by the PTB according to DIN EN ISO 25178-70.

PTB = Physikalisch Technische Bundesanstalt, the National Metrology Institute of Germany

4. Packaging, Handling and Cleaning

For a better handling the standards are mounted on borosilicate glass as substrate. The chips are mounted by an epoxy resin adhesive.

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

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

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

5. Assortment and Specification

The areal roughness standards **RnS St-B** are available with **c** (coarse), **m** (medium) or **f** (fine) roughness: The standards can be also used for the examination of 2D profiles.

Type	Typical Regions*** of 2D-Roughness (Profile)*	Typical Regions*** of 3D-Roughness (Areal)**
	Ra*** (nm)	Sa*** (nm)
RnS-St-B-c	730 +/- 15	740 +/- 10
RnS-St-B-m	730 +/- 10	290 +/- 10
RnS-St-B-f	107 +/- 30	120 +/- 25

Typical values are measured with:

- * a tactile surface profiler (tip radius: 2µm; $l_c = 0,8 \mu\text{m}$; $l_s = 0,25 \mu\text{m}$)
- ** a confocal microscope (Obj. 50×; $258 \times 258 \mu\text{m}^2$; sampling distance: 250 nm; without filter)
- *** the +/- attached to the values of Ra and Sa describes the typical region