



DRAFT INTERNATIONAL STANDARD ISO/DIS 23519

ISO/TC 119/SC 3

Secretariat: DIN

Voting begins on:
2008-11-28

Voting terminates on:
2009-04-28

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Sintered metal materials, excluding hardmetals — Measurement of surface roughness

Matériaux métalliques frittés, à l'exclusion des métaux-durs — Mesurage de la rugosité de surface

ICS 77.160

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Foreword

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ISO 23519 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 3, *Sampling and testing methods for sintered metal materials (excluding hardmetals)*.

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Sintered metal materials, excluding hardmetals — Measurement of surface roughness

1 Scope

The International Standard specifies a method to determine the surface roughness of sintered parts. It also establishes principles for the use of the suitable units for measurement.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4287, *Geometrical Product Specification (GPS) — Surface texture: Profile method - Terms, definitions and surface texture parameters*

ISO 13565-1, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surface having stratified functional properties — Part 1: Filtering and general measurement conditions*

ISO 13565-2, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 2: Height characterization using the linear material ratio curve*

ISO 13565-3, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 3: Height characterization using the material probability curve*

3 Symbols and Units

For the purpose of this document, the following symbols and units apply.

Symbol	Designation	Unit
R_{pk}	Reduced peak height	μm
R_p	Maximum profile peak height	μm
R_v	Maximum profile valley depth	μm
R_z	Maximum height of profile	μm
R_t	Total height of profile	μm
R_a	Arithmetic mean deviation of the assessed profile	μm
R_q	Root mean square deviation of the assessed profile	μm
R_s	Surface roughness	μm

Symbol	Designation	Unit
RSm	Mean width of the profile elements	μm
$Rmr(c)$	Material ratio of the profile	%
Rk	Core roughness depth	μm
Rvk	Reduced valley height	μm
d	Density	g/cm^3
c	Calibration Constant	-

4 Principle

The surface roughness is measured according to standard procedures. Because of the porosity and the nature of the surface of sintered materials, their surface roughness cannot be compared with the surface roughness of wrought materials. As most of the roughness units are defined by measuring the height of the surface peaks, porosity will negatively influence this value, because the depth of the pore will increase the value of the peak. This standard specifies the most suitable way to measure surface roughness and the correct units to use.

All the terminology and procedures defined in standards listed in Clause 2 are also applicable to the present standard.

5 Procedure

The surface roughness should be measured according to ISO 13565-1, ISO 13565-2 and ISO 13565-3, by using the following particular parameters:

- Use always a filtered profile (roughness profile), by applying the standard gaussian filter, with a Cut-Off of 0,8 mm.
- Use a total evaluation length of 4 mm, which is 5 times the Cut-Off value of 0,8 mm;

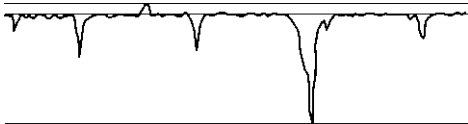
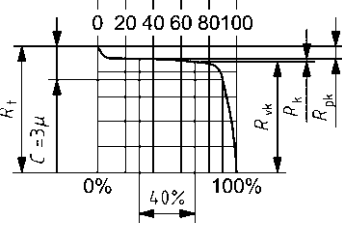
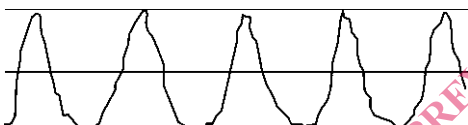
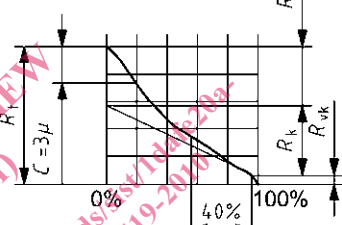
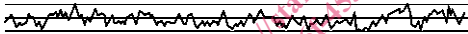
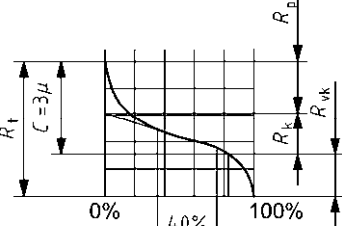
NOTE 1 Only in case of roughness higher than 4,0 Ra , the Cut-Off will be increased up to 2,5 mm, so the new evaluation length will be 12,5 mm. This is because the surface is so irregular that a longer evaluation length is necessary to obtain a real statistical approach.

- Use a probe of radius most requires 2 micrometres in order to define as well as possible the surface irregularities;
- Do not consider in the measurement the first 5% of depth;
- Express the results in unit Rk and Rpk .

Roughness units that are strongly affected by porosity, which are not really characterising the surface state, but rather the addition between the surface state and the size of the open porosity, shall not be used. This is the case for Rp , Rv , Rz , Rt , Ra , Rq , Rs , RSm shows sometimes too high peaks because filtering overemphasizes peaks after the probe has passed a deep pore, so it is also not a suitable unit.

In order to illustrate the convenience of Rpk and the inconvenience of other units typical from wrought materials, the next comparison between different surfaces and materials are shown in Table 1 and Table 2.

Table 1 — Example of roughness of sintered materials

Material	Surface profile	Bac Curve Supporting surface	Roughness
Sintered and Sized $d = 6.6 \text{ g/cm}^3$	 Figure 1 — Surface profile - Sintered and Sized	 Figure 2 — Bac Curve - Sintered and Sized	$Ra = 1,22$
			$Rt = 10,6$
			$Rmr(3) = 91\%$
			$Rpk = 0,8$
			$Rk = 0,6$
			$Rvk = 9,2$
Turned solid material	 Figure 3 — Surface profile - Turned solid material	 Figure 4 — Bac Curve - Turned solid material	$Ra = 1,28$
			$Rt = 10,7$
			$Rmr(3) = 20\%$
			$Rpk = 4,6$
			$Rk = 5,4$
			$Rvk = 0,7$
Ground solid material	 Figure 5 — Surface profile - Ground solid material	 Figure 6 — Bac Curve - Ground solid material	$Ra = 0,6$
			$Rt = 4,2$
			$Rmr(3) = 83\%$
			$Rpk = 1,5$
			$Rk = 1,4$
			$Rvk = 1,3$

NOTE The way to obtain the BAC curve and to determine the Rpk- and Rvk roughness units are described in ISO 4287 and ISO 13565-2.

6 Expression of results

The result is the surface roughness in Rpk .

The result should be reported to the nearest 0,1.

Bibliography

- [1] ISO 3274, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*
- [2] ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*
- [3] ISO 11562, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Metrological characteristics of phase correct filters*
- [4] ISO 12085, *Geometrical Product Specification (GPS) — Surface texture: Profile method — Motif parameters*

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