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Sintered metal materials, excluding hardmetals — Measurement of surface roughness

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

Reference number
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Contents

Page

Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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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)*.

Sintered metal materials, excluding hardmetals — Measurement of surface roughness

1 Scope

This International Standard specifies a method to determine the surface roughness of sintered parts of metal materials. It also establishes principles for the use of the suitable parameters 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 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4287 apply.

4 Symbols and units

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

Symbol	Quantity	Unit
Rpk	Reduced peak height	µm
Rp	Maximum profile peak height	µm
Rv	Maximum profile valley depth	µm
Rz	Maximum height of profile	µm
Rt	Total height of profile	µm
Ra	Arithmetic mean deviation of the assessed profile	µm
Rq	Root mean square deviation of the assessed profile	µm
Rs	Surface roughness	µm
RSm	Mean width of the profile elements	µm
Rmr(*c*)	Material ratio of the profile	%
Rk	Core roughness depth	µm
Rvk	Reduced valley depth	µm
d	Density	g/cm^3
c	Level	µm

5 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 parameters 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 International Standard specifies the most suitable way to measure surface roughness and the correct parameters to use.

6 Procedure

The surface roughness shall be measured in accordance with ISO 13565-1, ISO 13565-2 and ISO 13565-3, by using the following particular parameters:

a) always use a filtered profile (roughness profile), by applying the standard Gaussian filter, with a cut-off of 0,8 mm;

b) use a total evaluation length of 4 mm, which is five times the cut-off value of 0,8 mm;

NOTE Only in the case of a 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.

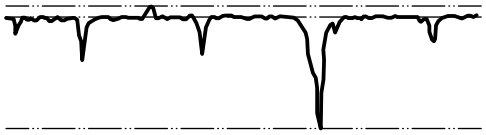
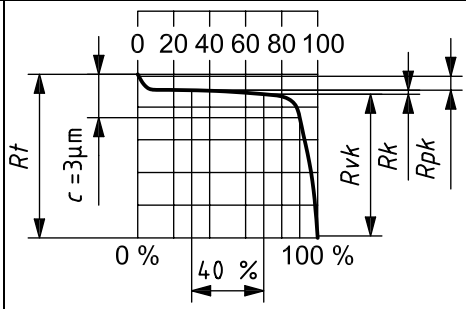
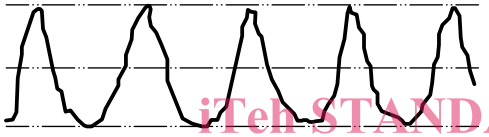
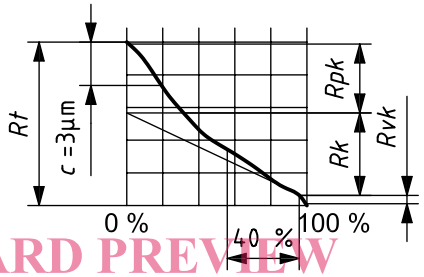
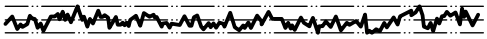
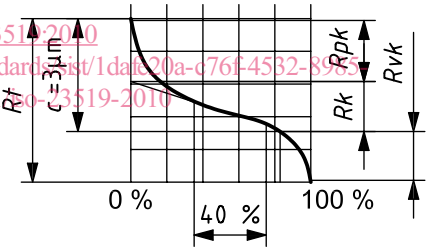
c) use a probe with a radius of 2 µm that will define the surface irregularities as well as possible;

d) express the results as parameters *Rk* and *Rpk*, in micrometres.

Roughness parameters that are strongly affected by porosity, which do not really characterize 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* and *RSm*.

In order to illustrate the convenience of *Rpk* and the inconvenience of other parameters typical for wrought materials, a comparison between different materials and surface conditions is shown in Table 1.

Table 1 — Comparison of roughness of powder metallurgy (PM) material with wrought materials

Material	Surface profile	BAC[a] curve supporting surface	Roughness
Sintered and sized d = 6,6 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* = 9,1
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* = 4,5 *Rk* = 5,4 *Rvk* = 0,6
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* = 1,3 *Rk* = 1,4 *Rvk* = 1,3

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

[a] BAC: Bearing area curve.

7 Expression of results

The result is the surface roughness, expressed as parameters *Rk* and *Rpk,* in micrometres.

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

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*