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Test method for surface roughness of carbon materials

炭素材料表面粗糙度试验方法

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Foreword

SAC/TC 183 is in charge of this translation. In case of any doubt about the content of English translation, the Chinese original shall be considered authoritative.

This document is drafted in accordance with the rules given in the GB/T 1.1-2020 Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The issuing body of this document shall not be held responsible for identifying any or all such patent rights.

This document was proposed by China Iron and Steel Association.

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1 Scope

China's national test method for the surface roughness of carbon and graphite materials, published with an official English translation. Machined graphite is used where the surface itself does the work: as EDM electrodes, as crucibles and moulds, as seals, and as the walls of parts that must not shed particles into a process. How rough that surface is decides

how well an electrode reproduces detail, how a seal beds in and how much dust a part gives off, so roughness is a routine acceptance measurement on carbon products. Measuring it is complicated by the material: graphite is porous and granular, so a stylus dropping into an open pore reads as a valley that has nothing to do with the machined finish, and the answer depends on how long a trace is taken and how many traces are averaged. This document describes the principle, the apparatus, the specimen, the procedure and the report for stylus profilometry on carbon materials with a particle size below 1.6 mm, typically reporting the arithmetic mean deviation of the profile R_a , with the maximum profile height R_z available where it is more useful. It sets sampling and evaluation lengths against the expected roughness, requires repeated measurements at different positions and orientations, and fixes the rounding of the result. For other carbon materials the method can be used for reference.

This document describes the principle, apparatus, specimen, procedure, and report of the surface roughness testing method for carbon materials.

This document is applicable to the evaluation of surface roughness of carbon material products with particle size less than 1.6 mm with the stylus profilometry method. The typical measurement parameter is the arithmetic mean deviation of the profile (R_a), but other parameters such as the maximum profile peak-to-valley height (R_z) may be selected as needed. For other carbon materials this method can be employed as a reference.

2 Normative references

The contents in the following documents constitute the essential clauses of this document through normative references in the text. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 6062, Geometrical product specification (GPS) - Surface texture: Profile method - Nominal characteristics of contact (stylus) instruments.

GB/T 8170, Rules of rounding off for numerical values and expression and judgement of limiting values.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Roughness profile

Profile formed by suppressing the long-wave components of the primary profile using a profile filter.

3.2 Sampling length

Length used to identify irregular features of the evaluated profile in the measurement direction.

3.3 Evaluation length

Segment of length required for the evaluated profile in the measurement direction.

NOTE: It may include one or several sampling lengths.

3.4 Arithmetical mean deviation of profile

Arithmetic mean value of the absolute deviations of the profile $Z(x)$ (i.e., the ordinate values) within one sampling length.

NOTE 1: See Figure 1.

NOTE 2: It is calculated by Formula (1).

3.5 Maximum height of profile

Sum of the maximum peak height and the maximum valley depth within one sampling length.

NOTE: See Figure 2.

4 Principle

As shown in Figure 3, the instrument sensor is equipped with a diamond stylus at one end of the measuring rod. When the driver drags the stylus gently across the surface of the specimen, the roughness profile of the tested surface causes vertical displacement of the stylus in the direction perpendicular to the surface contour. This displacement is measured by a displacement sensor, converted into an electrical signal. The signal is amplified and filtered then finally output as the surface roughness value or roughness profile curve.

5 Apparatus

5.1 Roughness gauge: Direct contact stylus-type instrument shall comply with GB/T 6062. Other devices that meet this requirement, such as handheld instruments, are also applicable.

5.2 Auxiliary equipment: Column (for fixing and adjusting the height of the driver or similar devices), fixture.

6 Specimen

6.1 The shape or size of the specimen (or workpiece) shall satisfy the fixture or instrument measurement requirements.

6.2 The specimen surface shall be free from visible cracks, protrusions, pits, holes, or any other surface defects that can affect the roughness testing.

7 Procedure

7.1 Assess the roughness range of the specimen in visual inspection or trial test (4.0 mm of evaluation length is recommended) and obtain the preliminary roughness value.

7.2 Based on the preliminary value obtained from 7.1, set the main testing parameters of the instrument according to Table 1 (or Table 2). Other parameters that meet the requirements of the instrument can also be applied. Table 1 gives the sampling length, the number of sampling lengths and the evaluation length for each range of the arithmetic mean deviation R_a , and Table 2 does the same for each range of the maximum height R_z .

7.3 If the surface roughness uniformity of the specimen is poor, the number of sampling length (i.e., the number of specimens) shall be greater than 5.

7.4 to 7.6 set out how the specimen is fixed on the fixture and the driver secured on the column, how the stylus is brought perpendicular to the surface under a specified vertical pressure with the probe parallel to it, how the measurement is repeated at several positions and orientations of the specimen and averaged, and the rounding of the results in compliance with GB/T 8170.

8 Report

The report shall include the following contents: a) applicant; b) specimen name, code and size; c) test conditions; d) test results; e) test lab; f) reviewers; g) test date; h) reference to this document.