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**NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC
OF CHINA**

中华人民共和国国家标准

GB/T 10561-2005/ISO 4967:1998 (E)

Replace GB/T 10561-1989

**Steel—Determination of content of nonmetallic
inclusions—Micrographic method using standards diagrams**

钢中非金属夹杂物含量的测定

标准评级图显微检验法

(ISO 4967: 1998, IDT)

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People's Republic of China and
National Standardization Administration Committee of China

Forward

This Standard is equivalent to adopt ISO 4967: 1998 (E) *Steel—Determination of content of nonmetallic inclusions—Micrographic method using standard diagrams*.

This Standard is replaced of GB/T 10561-1989 *Valuating Method of Emerging Occluded Foreign Nonmetallic Substance in Steel*;

This Standard is equal to ISO 4967: 1998 (E)

For convenient use, takes editing modification for ISO 4967: 1998 as following:

- a) Changed “This International Standard” as “This Standard”;
- b) The decimal point “.” Instead of comma “,”;
- c) The preface of international standard has been deleted;
- d) Added the Appendix NA.

In comparison with ISO 4967: 1998, main changes of this Standard as follows:

- a) Changed the Standard name which *Valuating Method of Emerging Occluded Foreign Nonmetallic Substance in Steel* into *Steel—Determination of content of nonmetallic inclusions—Micrographic method using standard diagrams*;
- b) Enlarge the application scope of Standard (see 1);
- c) Added the Article of principle (see 2);
- d) Added the image analysis method (see Appendix D);
- e) Changed for the ratings limit, width coefficient, sampling dimension, rating principle, shape and dimension of field of view of inclusion (see Table 1, Table 2, 3, 5.1 and 5.2.3);
- f) The standards diagrams which changed from JK diagram and ASTM diagram into ISO diagrams (see Appendix A);
- g) Changed the sampling method into Informative Appendix (Article 2.1.5 in 1993 and Figure 5, the Appendix NA)

Corrects the error in ISO 4967: 1998, as follows:

- a) The total length of Grade 2 type B inclusions in Table 1 which changed from 342 μm into 343 μm ;
- b) Added the symbol “>” into number of “minimum width” of thick in Table 2;
- c) Recombined for Figure 1, Figure 2, Figure 3 and Figure 6;
- d) Changed the B2S into B2.5s for examples of 6.2A method;
- e) Changed the original diameter from “>13 μm ~ 76 μm ” into “13 μm ~ 76 μm ” in top of Figure of DS inclusions in Appendix A;
- f) The type-A thick Grade “1” inclusions which series number of field of view is 8 changed into “—” in Table C.1 of Appendix C;
- g) The type-D thick “—” which series number of field of view is 12 changed into “1 s” in Table C.1 of Appendix C;
- h) The Grade “1” type-D thick inclusions which grade of field of view is 1 changed into “1 s” in Formula C.2 of Appendix C;
- i) The “(see Article 6.2)” is changed into “(see Article 6.3) in Table C3.1 of Appendix C”;

- j) The “ $C_i = \left[\sum_{i=0.5}^{3.5} f_i \times n_i \right] \frac{1000}{S}$ ” is changed into “ $C_i = \left[\sum_{i=0.5}^{3.0} f_i \times n_i \right] \frac{1000}{S}$ ” in Formula

C.4 of Appendix C

The Appendix A of this Standard is normative references, the Appendix B, Appendix C, Appendix D and Appendix NA is informative appendix.

This Standard is proposed by China Iron & Steel Association

This Standard is governed by National Steel Standardization Technical Committee

Main draft units of this Standard are Baosteel Group Shanghai No.5 Steel Co Ltd, China Metallurgical Information and Standardization Research Institute, Fushun Special Steel Co., Ltd and Dalian Jinniu Co., Ltd

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Steel—Determination of content of nonmetallic inclusions—Micrographic method using standards diagrams

1 Scope

This Standard specifies a micrographic method of determining the nonmetallic inclusions in rolled or forged steel products having a reduction ratio of at least 3 using standard diagrams. This method is widely used to assess the suitability of steel for a given use. However, since it is difficult to achieve reproducible results owing to the influence of the test operator, even with a large number of specimens, precautions should be taken when using the method.

Note: For certain types of steel (e.g., free cutting steel), the standardized diagrams described in this Standard may not be applicable

This Standard also provides for the determination of nonmetallic inclusions by image analysis technologies (see Appendix D)

2 Principle

The method consists of comparing the observed field to the chart diagrams defined in this Standard and taking in consideration separately each type of inclusion. In the case of image analysis, fields will be rated according to the relationships given in Appendix D.

The chart pictures correspond to square fields of view, each with an area of 0.50 mm², as obtained with a longitudinal plane-of-polish and as observed at 100×.

According to the shape and distribution of the inclusions, the standard diagrams are divided into five main groups, bearing the reference A, B, C, D and DS.

These five groups represent the most commonly observed inclusion types and morphologies:

- Group A (sulfide type): Highly malleable, individual grey particles with a wide range of aspect ratios (length/width) and generally rounded ends;
- Group B (alumina type): Numerous non deformable, angular, low aspect ratio (generally < 3), black or bluish particles (at least three) aligned in the deformation direction;
- Group C (silicate type): Highly malleable, individual black or dark grey particles with a wide range of aspect ratios (generally ≥ 3) and generally sharp ends;
- Group D (globular oxide type): Non deformable, angular or circular, low aspect ratio (generally < 3), black or bluish, randomly distributed particles;
- Group DS (single globular type): Circular, or nearly circular, single particle with a diameter $\geq 13 \mu\text{m}$

Non-traditional inclusion types may also be rated based on their morphology compared to the above five types and a statement about their chemical nature. As an example, globular sulfides would be rated as a D type and a descriptive subscript (e.g., D_{sulf}) defined in the test report. D_{cas} would indicate globular calcium sulfide; D_{RES} would indicate globular rare earth sulfides; D_{Dup} would indicate globular duplex inclusions, such as calcium sulfide surrounding an alumina.

Types of precipitate such as borides, carbides, carbonitrides or nitrides may also be rated based on their morphology compared to the above five types and a statement about their chemical nature as described in the previous subclause.

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