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Replacing GB/T 4335-1984

**Determination of ferrite grain size for cold rolled low
carbon steel sheets**

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Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard is a revision of GB/T 4335-1984, Cold rolled low-carbon steel sheet - Ferrite grain size - Test methods.

Compared with GB/T 4335-1984, the major changes on technical contents of this Standard are as follows:

- a) Revise the English name of the standard;
- b) Expand the Scope of the standard;
- c) Add the Normative references;
- a) Modify Terms and definitions;
- e) Modify the determination method of the grain extensibility;
- f) Modify the data in Table 1; delete the relevant data of the number-2 and number-3 grain sizes in Table 1; add the relevant data of number-13, number-14, number-15 and the relevant data of each half grain level number;
- g) Modify the range of grain extensibility applicable to the third standard rating figure;
- h) Add the grain size conversion value between 500 times magnification and the reference magnification (100 times) in Table 2;
- i) Add the conversion formula for the grain size number of different magnifications and the reference magnification of 100 times;
- j) Change the “cutting method” into the “three-circle section method”;
- k) Add “6 Test report”;
- l) Add the standard rating figures of grain size number-9 for the three series;
- m) Adjust the position of the standard rating figure, which is given in the form of Appendix A (Normative);
- n) Add “Appendix B Various calculation formulas of micro-grain size (Informative)”.

This Standard was proposed by China Iron and Steel Industry Association.

Determination of ferrite grain size for cold rolled low carbon steel sheets

1 Scope

This Standard specifies the terms and definitions, samples and preparation, determination methods, test report and the like of ferrite grain size for cold rolled low carbon steel sheets.

This Standard is applicable to the determination of ferrite grain size for cold rolled low carbon steel sheets whose carbon content are less than 0.2%. The determination of grain size for other metal materials whose grain shape is similar to the rating figure of this standard series can also be carried out by reference to this Standard.

2 Normative references

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

GB/T 6394-2002, Metal - methods for estimating the average grain size

GB/T 13298, Inspection methods of microstructure for metals

GB/T 24177-2009, Standard test methods for characterizing duplex grain sizes

3 Terms and definitions

The following terms and definitions are applicable to this document.

3.1 Grain size

The measurement of the grain size, which can be expressed by the grain size number, the average grain diameter $\bar{d}$, the average intercept $\bar{l}$, and the average grain cross-sectional area $\bar{a}$.

3.2 Micro-grain size number G

The recommended sample size is:

The length is about 10 mm and the width is the thickness of the steel sheet.

4.5 Sample preparation

Prepare and etch the sample according to GB/T 13298.

5 Determination methods

There are two methods for the measurement of grain size: comparison method and section method. The comparison method is generally adopted; the section method is adopted in arbitration.

5.1 Comparison method

5.1.1 After the sample is prepared, observe it under a microscope of 100 times. In the measurement, fully observe the sample under the microscope; select a representative field of view; compare the grain structure image of the field of view with the standard rating figure in Appendix A; select the standard rating figure number that is closest to the measured image; record the results of the assessment.

5.1.2 The first standard rating figure in the standard rating figure is a figure of which the grain extensibility is approximately equal to 1; the second standard rating figure is a figure of which the grain extensibility is approximately equal to 2; the third standard rating figure is a figure of which the grain extensibility is approximately equal to 3, which are respectively denoted by I, II, and III. In the assessment, the serial number and grain size number of the figure shall be noted. For example, when the grain of the observed sample is equivalent to number-6 in the third standard rating figure, it is recorded as III - Number-6, which indicates that the extensibility is approximately equal to 3 and the grain size is number 6. If the grain extensibility is between two series of standard rating figures, it can be expressed as I~II or II~III.

5.1.3 If the observed grain size is between two adjacent grain size numbers, it can be expressed in half.

5.1.4 When the reference magnification (100 times) is not sufficient, it can be assessed by other magnifications. If a magnification M is used for assessment, compare the image of the to-be-measured grain of the magnification M with the rating image of the reference magnification of 100 times; the assessed grain size number is G', of which the grain size number G is calculated according to Formula (3):

Appendix B

(Informative)

Various calculation formulas of micro-grain size

B.1 Calculation formula of micro-grain size in the area method:

$$G = 3.321\,928 \lg n - 2.954 \quad \dots\dots\dots (B.1)$$

Where:

G -- micro-grain size number;

n -- the number of grains per square millimeter at 1×.

B.2 The number of grains per square millimeter at 1× is calculated according to Formula (B.2):

$$n = \frac{M^2 \cdot N}{A} \quad \dots\dots\dots (B.2)$$

Where:

M -- the used magnification;

N -- the number of grains in the measurement grid whose area is A when it is magnified for M times;

A -- the area of the used measurement grid, in square millimeters (mm²).

B.3 The average grain cross-sectional area is calculated according to Formula (B.3):

$$\bar{a} = \frac{1}{n} \quad \dots\dots\dots (B.3)$$

Where:

$\bar{a}$ -- the average grain cross-sectional area, in square millimeters (mm²).

B.4 The average diameter is calculated according to Formula (B.4):

$$\bar{d} = \sqrt{\bar{a}} \quad \dots\dots\dots (B.4)$$

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