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Inspection of non-metallic inclusions in steel - Blue fracture test method

钢中非金属夹杂物的检验

发蓝断口法

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Foreword

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

This Standard was proposed by China Iron and Steel Association.

This Standard shall be under the jurisdiction of National Technical Committee on Steels of Standardization Administration of China (SAC/TC 183).

The drafting organizations of this Standard: Northeast Special Steel Group Co., Ltd., Metallurgical Industry Information Standards Institute.

Main drafters of this Standard: Kang Ge, Cheng Lijie, Yan Chengming, Liu Yanjun, Wen Zhengmao, Cheng Yu.

Inspection of non-metallic inclusions in steel - Blue fracture test method

1 Scope

This Standard specifies to use blue fracture test method to inspect macro non-metallic inclusions in steel, including sample preparation, inspection method, inspection result and inspection report.

This Standard is applicable to inspect macro non-metallic inclusions in steel, of which length is not less than 1mm, width is not less than 0.1mm.

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.

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

GB/T 30067, *Standard Terminology Relating to Metallography*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 30067 as well as followings apply.

3.1 macro non-metallic inclusion

Strip-shaped non-metallic inclusion that is visible by using visual inspection or magnification device not more than 10 times

3.2 bluing

Heat treatment method that heat steel to a proper temperature to make it produce a very thin blue oxide film on its surface

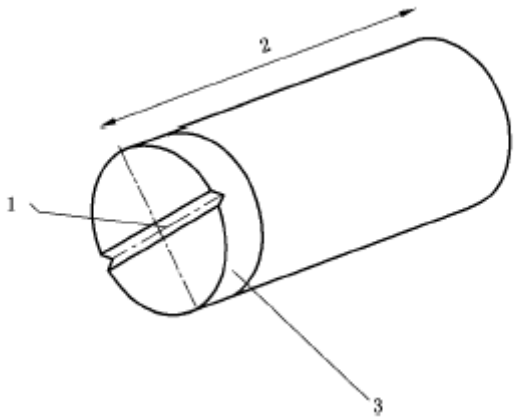
4 Principle

Under blue brittle temperature, make fractured metal substrate produce blue metal oxide film while non-metallic inclusion is not oxidized. Keep its original color. It usually is a gray, light yellow or yellowish green non-crystalline strip. Use visual inspection or a magnification device of no more than 10 times to observe the size, number and distribution of strip-shaped non-metallic inclusions visible on longitudinal fracture.

5 Sample preparation

5.1 Sampling method

Cut a transverse steel sample. It may use hot-sawing, cold-sawing, flame sawing and cutting to cut. Sample thickness is 15mm~20mm. See Figure 1 for fracture sampling diagram. It shall ensure that deformation and heat-affected zone caused by sampling outside the fracture. On centerline of cross section of sample, inscribe V-groove through shaft. Groove depth shall make remaining sample thickness not less than 10mm.



Keys:

1 - Slotting;

2 - Rolling direction;

3 - Slice.

Figure 1 -- Fracture sampling diagram

5.2 Sampling quantity

Sampling quantity and sampling site shall be specified in product standard or agreed by supplier and purchaser. If not specified, it shall extract two samples on steel.

5.3 Sample preparation

5.3.1 When preparing fracture, place sample face down on fracturing machine (or pressure testing machine) support table. Ensure that impact knife edge matches centerline of fracture sample groove. Then, under impact load (or pressure), break fracture sample once. Repeated stamping is prohibited. In order to ensure that the fracture is flush, it shall preheat sample.

5.3.2 In order to display non-metallic inclusion, perform bluing to sample according to one of the following methods:

a) Heat sample in furnace to blue brittle temperature (300°C ~ 350°C). Take it out and quickly break it off to make sample at break at blue brittle temperature.

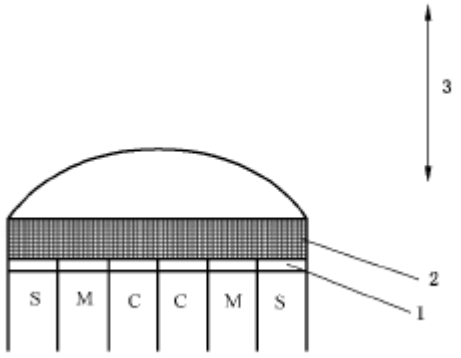
b) Heat broken sample to blue brittle temperature (300°C ~ 350°C), so as to make the fracture blue.

NOTE: For high-alloy steel, it may appropriately increase blue brittle temperature. But it shall not exceed 530°C.

6 Inspection method

6.1 On a fracture surface of dual fracture (usually selecting severe surface of defect), visually inspect or use a magnification device not more than 10 times to observe the seize, quantity or distribution of non-metallic inclusion.

6.2 Equally divide fracture surface into three zones: surface zone, middle zone, central zone. Respectively use S, M, C to represent. See Figure 2 for fracture surface division.



Keys:

1 - Notch;

2 - Fracture;

3 - Rolling direction;

S - Surface zone;

M - Middle zone;

C - Central zone.

Figure 2 -- Fracture surface division

6.3 Determine fracture area. Measure length of each inclusion and inclusion quantity of each zone. Ferritic strips, carbide strips, segregation lines or loose lines are easily confused with non-metallic inclusions. Pay attention to distinguish.

7 Inspection result

7.1 Record length of each inclusion of each sample in different zone. Calculate the sum of lengths of inclusions on inspection area, that is, total length. Calculate ratio of total length to inspection area, i.e., average length. For inclusions of which length is less than 1.0mm, width is less than 0.1mm, record quantity in original record. Do not participate in calculating ratio of total length to inspection area. Refer to Annex A for record of original inspection results.

7.2 According to requirements of product's standard, record lengths, quantity of non-metallic inclusions or maximum length of non-metallic inclusion of each sample.

7.3 Testing and inspection results shall comply with provisions of GB/T 8170. Round values off to 0.1mm.

8 Inspection report

Inspection report shall contain the following information:

a) reference to this Standard;

b) steel number, furnace number, specification and sample number;

c) inspection result;

d) number, date of inspection report as well as inspector.

Annex A

(informative)

Record of original inspection results of blue fracture

See Table A.1 for record of original inspection results of blue fracture.

Table A.1 -- Record of original inspection results of blue fracture

Sample No.	Inspection area dm^2	Inclusion size / mm			Maximum length mm	Total number of strips Pieces	Total length mm	Average length mm/dm^2
		S	M	C				

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