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Non-destructive testing - Materials for magnetic particle testing

无损检测 磁粉检测用材料

(ISO 9934-2:2002, NEQ)

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Non-destructive testing - Materials for magnetic particle testing

1 Scope

This document specifies the classification, technical requirements and inspection methods for materials for magnetic particle testing (or testing medium, including magnetic suspension, dry magnetic particle, carrier liquid, contrast enhancer).

This Standard applies to type inspection and batch inspection of testing medium.

This Standard can also be used as the basis for acceptance of user orders.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 265, *Petroleum products - Determination of kinematic viscosity and calculation of dynamic viscosity*

GB/T 699, *Quality carbon structure steels*

GB/T 2007.7, *General rules for the sampling and sample preparation of minerals in bulk - The method for determination of size by manual sieving* (GB/T 2007.7-1987, neq ISO 2591:1982)

GB/T 5097, *Non-destructive testing - Penetrant testing and magnetic particle testing - Viewing conditions* (GB/T 5097-2005, ISO 3059:2001, IDT)

GB/T 6368, *Surface active agents - Determination of pH of aqueous solution - Potentiometric method* (GB/T 6368-1993, eqv lSO 4316:1977)

GB/T 8034, *Benzol products of coal carbonization - Corrosiveness to copper - Copper strip test* (GB/T 8034-1987, eqv ISO 2160:1972)

GB/T 12604.5, *Non-destructive testing terminology magnetic particle testing*

GB/T 15822 (all parts), *Non-destructive testing - Magnetic particle testing* (GB/T 15822.1~3-2005, ISO 9934-1, 2001, ISO 9934-2~3:2002, IDT)

JB/T 7523-2004, *Non-destructive testing - Materials for penetrant testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 12604.5 apply.

4 Safety precautions

Materials for magnetic particle testing and chemicals used for their testing may be hazardous, flammable and/or volatile. It is therefore advisable to observe the prescribed precautions. All national and local regulations on safety, health and environmental protection requirements shall be followed.

5 Classification

5.1 Overview

Magnetic particle testing materials covered by this Standard shall be classified as follows.

5.2 Magnetic suspension

The magnetic suspension shall be composed of colored magnetic particle or fluorescent magnetic particle and a suitable carrier liquid. It shall be in a uniform suspension when stirring.

Magnetic suspension can be prepared from the purchased concentrated products (including magnetic paste and dry magnetic particle) or can be used directly.

5.3 Dry magnetic particle

The dry magnetic particle used in the dry method shall be subdivided into color and/or fluorescent magnetic particle.

6 Inspection rules

6.1 Batching rules

Each batch consists of a number of magnetic particle material products with the same properties, and all marked with a specific symbol that is put into production at one time.

6.2 Inspection classification

6.2.1 Type inspection

Type inspection shall be carried out in one of the following situations:

a) When resuming production after new production, conversion or suspension of production;

b) When materials or workmanship change;

c) When the contract stipulates;

d) When it has been more than six months since the last type inspection.

The type inspection of magnetic particle materials shall be carried out in accordance with the requirements of GB/f 15822. Type inspection is carried out to demonstrate the suitability of the product for the intended use. This inspection shall be performed by an independent laboratory[1].

The independent laboratory shall issue an inspection report for the implementation of this Standard.

6.2.2 Batch inspection (or exit-factory inspection)

The batch inspection required by this Standard shall be carried out in accordance with the requirements of GB/T 15822 for each batch of products. Batch inspection is performed to demonstrate the consistency of the batch characteristics with the approved type-inspected products.

If agreed at the time of ordering, the manufacturer or supplier of the magnetic particle testing material shall provide an inspection certificate, so as to indicate which methods have been used in accordance with this Standard. The certificate shall include the results obtained and the tolerances allowed.

[1] An independent laboratory is a professional organization that is certified or entrusted by the relevant competent authority, and understands and is familiar with the magnetic particle testing process. The list of qualified independent laboratories can be obtained from the Secretariat of the National Nondestructive Testing Standardization Technical Committee (http://www.ChinaNDT.org).

condition.

When visually compared, the color of the batch inspection sample shall not be different from that of the type inspection sample.

7.3 Magnetic particle size

7.3.1 Method

The determination method for magnetic particle size depends on the distribution range of magnetic particle size.

NOTE: The size distribution of the magnetic particle in suspension can be determined by one of the appropriate methods listed in the Bibliography.

7.3.2 Definition of magnetic particle size

The magnetic particle size range shall be as follows:

- Lower limit diameter d_l: The magnetic particle less than d_l shall not be more than 10%.

- Average diameter d_a: 50% of the magnetic particle shall be larger than d_a, 50% smaller than da.

- Upper diameter d_u: The magnetic particle greater than d_u shall not be more than 10%.

7.3.3 Requirements

d_l, d_a and d_u shall be reported. For the magnetic suspension, the size shall be within the range of $d_l \geq 1.5\mu m$ and $d_u \leq 40\mu m$.

NOTE: For dry magnetic particle, it is usually $d_l \geq 40\mu m$.

7.4 Heat resistance

The product shall show no performance degradation after heating for 5min at the maximum temperature specified by the supplier. This shall be verified by redoing the performance test specified in 7.1.1.

7.5 Fluorescence coefficient and fluorescence stability

Dry magnetic particle must be used for these inspections. For magnetic suspensions, the contained solids shall be used.

NOTE: It is recommended that a light meter with a range of 200cd/m^2 and a viewing angle (α) of 20° is placed 80mm above the surface of the magnetic particle with a diameter of 40mm. The UV-A lamp is placed at a position where the irradiance E_e on the surface of the magnetic particle is exactly between 10W/m^2~15W/m^2.

7.5.1.2 Requirements

Fluorescence coefficient (β) shall be greater than 1.5cd/W.

7.5.1.3 Fluorescence stability

The sample shall first be inspected in accordance with 7.5.1.1.

The sample shall then be irradiated for 30min under UV-A with an irradiance of 20W/m^2 (at least). Reinspect according to 7.5.1.1. The fluorescence coefficient shall not be reduced by 5%.

7.5.2 Batch inspection

Batch inspection shall be carried out in accordance with 7.5.1.1. The fluorescence coefficient shall not be lower than 90% of the type inspection value.

7.6 Fluorescence of carrier fluid

The fluorescence of the carrier solution shall be checked by visual comparison with quinine sulfate solutions under UV-A irradiation of at least 10W/m^2.

The concentration of quinine sulfate solution shall be 7×10^{-9}M (5.5ppm)/0.1N H_2SO_4.

The fluorescence of the tested carrier fluid shall not be greater than that of quinine sulfate.

7.7 Flash point

For magnetic suspensions (except water-based), the flash point of the carrier liquid shall be reported.

7.8 Corrosion caused by testing medium

7.8.1 Steel corrosion inspection

The corrosion effect of steel shall be inspected and reported in accordance with Annex C.

7.8.2 Copper corrosion inspection

The corrosion effect of copper shall be inspected and reported in accordance with GB/T 8034.

7.9 Carrier fluid viscosity

Viscosity shall be inspected according to GB/T 265.

The kinematic viscosity shall not be higher than 5mPa•s at 20°C (±2°C).

7.10 Mechanical stability

7.10.1 Long-term inspection (durability inspection)

The manufacturer shall show that the testing medium will operate for more than 120h on a typical magnetic particle testing bed without impact.

This can be confirmed on a magnetic particle testing bed or with a similar arrangement. Recommended devices are as follows:

A 40L testing medium sample shall be placed in a suitable anti-corrosion reservoir with a centrifugal pump[2]. The testing medium shall be able to circulate and shut off through the valve.

Cycle time:

- Open the valve for 5s;

- Close the valve for 5s.

Before use and after 120h, the testing medium shall be inspected with reference test block (see 7.1.1).

Any discernible change in the quality displayed shall be rejected.

7.10.2 Short-term inspection

7.10.2.1 Equipment

A stirring device similar to Figure 2 shall be used.

a) Stirring paddle speed: (3000^{0}_{-300}) r/min;

b) Blender jar with a capacity of 2L:

[2] For reference, sump pump type: EN12157-T160-270-1 or similar; return pipe diameter: R1 No. 1 NB pipe or similar.

8 Marks and labels

8.1 The mark or label for magnetic particle material shall contain at least:

a) Manufacturer's name, trademark or identification mark, full address;

b) Product name, model and specification, product standard number, origin;

c) Product category, sensitivity level, flash point (type inspection), safety tips or warnings;

d) Sulfur and halogen content (applicable only to products marked "low sulfur and halogen");

e) Traceable product number or lot number;

f) Production date and expiration date.

8.2 The mark or label shall appear on the packaging.

9 Packaging, transportation and storage

9.1 Product packaging shall meet the requirements of Chapter 4. The packaging container shall be compatible with the testing medium. Those packaged in aerosol cans shall also meet the corresponding safety requirements and regulations.

9.2 The manufacturer shall state the transport and storage requirements on the packaging.

9.3 The accompanying documents when the product is delivered shall contain:

a) Product certification;

b) Instruction manual;

c) Type inspection report (when specified in the contract);

d) Exit-factory inspection certificate (when specified in the contract).

Annex A

(normative)

Type and batch inspection procedures

A.1 Preparation of testing medium

Testing medium shall be prepared according to the manufacturer's instructions.

A.2 Cleaning of reference block

The reference block shall be cleaned by an appropriate method, so as to make sure it is free of fluorescent materials, oxides, dirt and grease and has a water wettable surface.

A.3 Application of testing medium

The testing medium shall be applied to the Type 1 and Type 2 reference test blocks described in Annex B according to GB/T 15822.

Spray: 3s~5s.

Sample inclination: 45°±10°.

Spray direction: 90°±10° with the surface to be inspected.

A.4 Inspection and explanation

A.4.1 Inspection

The test piece shall be inspected under the observation conditions required by GB/T 5097.

A.4.2 Explanation

A.4.2.1 Type and batch inspection

Inspection shall be carried out three times. Take the average value of these results. Visual inspection or equivalent measurement methods shall be used to evaluate the display.

A.4.2.1.1 Type 1 reference test block

Annex B

(normative)

Reference test blocks

B.1 Type 1 reference test block

B.1.1 Brief description

The reference test block is a round block with two types of natural cracks on the surface, as shown in Figure B.1. It shall contain thick line cracks and fine cracks caused by grinding and stress corrosion. The test block is permanently magnetized with a perforated center conductor. Visually inspect or use other suitable methods to compare, so as to evaluate the testing medium[3].

B.1.2 Manufacture

Material preparation: The surface of the used steel (90MnCrV8 or equivalent) shall be ground to 9.80mm ± 0.05mm. Then harden at 860°C ±10°C for 2h. Conduct oil quenching. Make the surface hardness 63HRC~70HRC.

Processing: Grind at a speed of 35m/s. The grit size used is 46J7 or equivalent. The increment of each surface is 0.05mm. The displacement is 2.0mm. Blacken for 1.5h at a temperature of 145°C~150°C.

Magnetization: Magnetization shall be accomplished with a center conductor of 1000A (peak) DC.

B.1.3 Verification

Initial evaluation: fluorescent testing medium shall be used. Record the results.

Identification: Each reference block shall have a unique identification. A certificate declaring compliance with this Standard (or GB/T 15822.2) is provided with the reference test block.

[3] Type I test blocks are described in German patent G0IN27/84 Auslegeschrift 2357220. The patent expired in 1990.

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