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General technical regulations of cathode electro-coating

阴极电泳涂装通用技术规范

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General technical regulations of cathode electro-coating

1 Scope

This Standard specifies the terms and definitions of cathodic electrophoresis, the classification and selection of cathode electro-coating, the construction and management of cathode electro-coating, the requirements for equipment, safety and environmental protection of cathode electro-coating, etc.

This Standard applies to cathode electro-coating of metal workpieces.

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 1724, *Methods of test for fineness of grind of paints*

GB/T 1725, *Paints, varnishes and plastics -- Determination of non-volatile-matter content*

GB/T 1731, *Paints, varnishes and plastics -- Determination of non-volatile-matter content*

GB/T 1732, *Paints, varnishes and plastics -- Determination of non-volatile-matter content*

GB/T 1733, *Determination of resistance to water of films*

GB/T 1747.2, *Paints and varnishes -- Determination of pigment content -- Part 2: Ashing method*

GB/T 1771, *Paints and Varnishes -- Determination of resistance to neutral salt spray (fog)*

GB/T 1865, *Paints and varnishes -- Artificial weathering and exposure to artificial radiation -- Exposure to filtered xenon-arc radiation*

GB/T 6739, *Paints and varnishes -- Determination of film hardness by pencil test*

GB/T 6750, *Paints and varnishes -- Determination of density -- Pycnometer method*

GB/T 6753.3, *Methods of test for package stability of paints*

GB 7691-2003, *Safety code for painting -- Safety management general rule*

GB 7692-1999, *Safety code for painting -- Safety, ventilation and air clean-up for pretreatment process of painting*

GB/T 8264, *Glossary of painting terms*

GB 8978-1996, *Integrated wastewater discharge standard*

GB/T 9274, *Paints and varnishes -- Determination of resistance to liquids*

GB/T 9286, *Paints and varnishes -- Cross cut test for films*

GB/T 9751.1, *Paints and varnishes -- Determination of viscosity using rotary viscometers -- Part 1: Cone-and-plate viscometer operated at a high rate of shear*

GB/T 9754, *Paints and varnishes -- Determination of gloss value at 20-degree, 60-degree and 85-degree*

GB/T 13452.1, *Paints and varnishes. Determination of total lead. Flame atomic absorption spectrometric method*

GB/T 13452.2, *Paints and varnishes -- Determination of film thickness*

GB 16297-1996, *Integrated emission standard of air pollutants*

HG/T 3335, *Determination Method for Conductivity of Electrophoretic Paint*

HG/T 3337, *Determination Method for Coulombic Efficiency of Electrophoretic Paint*

ISO 15880, *Paint, varnishes and binders -- Determination of MEQ value of water-based coating materials and binders*

ISO 20567-1, *Paints and varnishes -- Determination of stone-chip resistance of coating -- Part 1:Multi-impact testing*）

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 8264 as well as the followings apply.

3.1 L-effect

The effect of electrophoretic coating on horizontal and vertical surfaces.

3.2 neutralizer MEQ

Millimoles of neutralizer consumed per 100 g solids of electrophoretic coating.

3.3 redissolving

The ability of the electrophoretic wet film to dissolve again in the electrophoretic tank solution. It is expressed as the percentage of the film thickness dissolved within a specified time to the total film thickness.

3.4 loss on heating

The weight loss of the coating film caused by thermal decomposition of low molecular weight compounds during the process of further heating the electrophoretic coating film, which has evaporated water and solvent at 105℃~120℃, to the drying temperature to achieve complete drying.

3.5 gel fraction

The ratio of the mass of the electrophoretic coating after curing, which is immersed in a specified mixed solvent for a certain period of time and then taken out and dried to the mass of the electrophoretic coating before immersion in the solvent.

4 Classification of cathode electro-coating

Cathode electro-coating is divided into three categories according to its use:

a) Cathode electro-coating that is mainly used to improve corrosion resistance. It is used for housings and some related parts of automobiles, refrigerators, washing machines, etc.

b) Cathodic electrophoretic bottom-to-top coating that has both corrosion resistance and weather resistance requirements. For example, for automobile frames, wheels and other related parts.

c) Cathode electro-coating that is mainly used for decorative purposes, such as decorative coating protection and decorative metal protection. For example, decorative hardware products, household appliances, building materials, metal eyeglass frames, watches, etc.

5 Technical requirements for cathode electro-coating

5.1 Principles for selecting coatings

5.1.1 The category of electrophoretic coating shall be determined based on the requirements of the product to be coated (see Chapter 4).

ultrafiltration (UF) device, anode tank liquid circulation system, temperature control system, DC power supply and power supply system, paint supply device, post-electrophoretic cleaning device, electrophoretic coating room (dust cover), electrical control cabinet, etc. For typical requirements of cathode electro-coating equipment, please refer to Annex K.

8 Safety and environmental protection

8.1 Power supply grounding: the workpiece should be powered using a separate power rail.

8.2 The anode system of the electrophoretic tank should ensure good conductivity to prevent electric shock.

8.3 For the wastewater treatment of the cathode electrophoretic system, the cathode electrophoretic paint manufacturer should provide the composition and displacement of the wastewater to ensure centralized and unified treatment at the wastewater treatment site of the coating workshop. After treatment, it should comply with the provisions of GB 8978-1996.

8.4 The exhaust gas discharged from the cathode electrophoretic drying system should be treated. The paint manufacturer should provide the composition and displacement of the exhaust gas. According to the data, the corresponding catalytic combustion exhaust gas treatment device or direct combustion device should be set on the drying tunnel. The treated emissions should comply with the provisions of GB 16297-1996.

8.5 The rectifier system of the cathode electrophoretic coating should be separately set up in the enclosed facility and managed by a dedicated person.

8.6 The process safety and labor hygiene of cathode electro-coating shall comply with the requirements of GB 7692-1999 and GB 7691-2003.

Annex A

(normative)

Method for determining the performance of cathode electro-coating – Determination of voltage/film thickness

A.1 Principle

Perform electrophoretic coating by changing the voltage. Measure the film thickness. Draw a voltage/film thickness curve. Find the voltage corresponding to the best film thickness.

A.2 Test instruments and materials

Voltage/film thickness measuring instruments and material requirements are as follows:

a) One set of electrophoretic coating equipment (including electrophoretic tank, rectifier, drying box, etc., the same below):

- Electrophoresis tank: made of PVC plastic; inner wall dimensions are 120 mm× 200 mm× 350 mm.

- Electrode plate: made of acid-resistant stainless steel plate; dimensions are 1/4 to 1/2 of the coated cathode area.

- Rectifier: 0 V~450 V, 0 A~20 A adjustable.

b) The test plate is a phosphated plate of the same material as the products on the production line, with specifications of 70 mm× 150 mm× 0.8 mm.

A.3 Operation steps

The steps for voltage/film thickness measurement are as follows:

a) Select a few voltage points in advance;

b) At the selected voltage, perform electrophoretic coating and drying according to the process parameters specified for the electrophoretic coating to be tested;

c) After drying, measure the film thickness of each test plate and make the following voltage/film thickness relationship curve (see Figure A.1).

Annex B

(normative)

Method for determining the performance of cathode electro-coating - Determination of redissolution rate

B.1 Principle

After the test plate is electrophoretically coated under specified conditions, the lower half of the wet coating is immersed in the electrophoresis tank for a specified time and then taken out. After drying, the film thickness of the upper and lower coatings is measured. The film thickness of the lower and upper parts is compared. The re-dissolution rate (%) is calculated.

B.2 Test instruments and materials

Instruments and materials for re-dissolution rate determination:

a) One set of electrophoretic coating equipment;

b) Coating thickness gauge (measuring range of 0 μm to 50 μm);

c) The test plate is a phosphated plate of the same material as the products on the production line, with a specification of 70 mm× 150 mm× 0.8 mm.

B.3 Operation steps

The steps for determining the re-dissolution rate are as follows:

a) The test plate is electrophoretically coated in the electrophoretic bath to be tested under the specified conditions. After washing with water, the lower half of the coating is immediately immersed in the stirred electrophoretic bath;

b) After 10 min, the test plate is taken out and washed and dried under the specified conditions of the electrophoretic coating to be tested;

c) The coating thickness of the upper and lower parts of the test plate is measured separately according to GB/T 13452.2;

d) The above operation is repeated three times. Take the average value.

Annex C

(normative)

Method for determining the performance of cathode electro-coating - Determination of the destruction voltage of electrophoretic coatings

C.1 Principle

Electrophoretic coating is performed with the paint to be tested. The voltage is gradually increased in 10 V intervals to obtain the voltage at which the coating film is destroyed. This voltage is also called the breakdown voltage.

C.2 Test instruments and materials

Electrophoretic coating breakdown voltage measuring instruments and materials:

a) A set of electrophoretic coating equipment and constant temperature device;

b) The test plate is a phosphating plate of the same material as the products on the production line, with a specification of 70 mm× 150 mm× 0.8 mm.

C.3 Operation steps

Electrophoretic coating is performed at the voltage specified for the electrophoretic coating to be tested. The voltage is increased by 10 V above the normal electrophoretic voltage until the coating film is destroyed. With the destruction of the coating film, the current and temperature of the bath liquid will rise sharply, so a constant temperature device is required. The bath liquid temperature is controlled at 28℃±1℃.

The test is repeated twice. Except for the voltage, other coating conditions should be the same.

When the coating film is damaged, the test should be repeated twice or more, with stirring for more than 10 min between the two times.

C.4 Result evaluation

The lowest primary destruction voltage is taken as the "destruction voltage" of the electrophoretic coating. The coating film within 5 mm of the immersion line is not evaluated.

Annex D

(normative)

Method for determining the performance of cathode electro-coating - Determination of the throwing power of electrophoretic coatings

D.1 Principle

This method indirectly reflects the coating ability of cathode electro-coating on workpieces with inner cavity structure by measuring the throwing power of cathode electro-coating. This method includes two test methods.

Method One is used when selecting electrophoretic paint. Method Two is more convenient and quicker, and is used for material inspection of electrophoretic paint entering the factory.

D.2 Test methods

Method One: Voltaic cell method

1. Test instruments and materials

Voltaic box method test instruments and materials:

a) Test plate: phosphated steel plate, specification is (300 mm~350 mm) × 105 mm × 0.75 mm;

b) Spacer: made of PVC plastic, specification is (300 mm~350 mm) × 4 mm × 10 mm;

c) Waterproof tape: width is 20 mm and 38 mm;

d) Adjustable speed electric stirrer, or a suitable magnetic stirrer.

2. Operation steps

The operation steps of the Voltaic box method are as follows:

a) Preparation of the voltaic box (Voltaic box) (see Figure D.1 for the test device).

Annex G

(normative)

Method for determining the performance of cathode electro-coating - Determination of electrophoresis tank stability at ambient temperature

G.1 Principle

The stability of the bath solution is evaluated by the change in voltage required to prepare a coating of the same film thickness.

G.2 Test instruments and materials

Instruments and materials for determining the stability of electrophoresis tank liquid:

a) One set of electrophoretic coating equipment (electrophoretic tank size is 120 mm× 200 mm× 350 mm);

b) Electric heating blast drying oven;

c) pH meter;

d) Conductivity meter;

e) Thickness gauge;

f) Thermometer;

g) The test plate is a phosphated plate of the same material as the product on the production line; the specification is 70 mm× 150 mm× 0.8 mm.

G.3 Operation steps

The steps for determining the stability of the electrophoresis tank are as follows:

a) Place the electrophoretic bath solution in use in the electrophoretic bath of the electrophoretic coating device. Stir for 10 h~12 h at an ambient temperature of 23℃± 5℃;

b) Determine the bath solution temperature, pH value, conductivity, and solid content according to standard test methods;

c) Electrophoretically coat the phosphated standard test plate according to the

Annex H

(normative)

Method for determining the performance of cathode electro-coating - Determination of rust resistance on sharp edges

H.1 Principle

This method is applicable to the determination of the rust prevention ability of coatings on sharp edges of metal workpieces formed during the processing and forming process.

H.2 Test instruments and materials

Sharp edge rust resistance test instruments and materials:

a) Salt spray test chamber;

b) Coating thickness gauge (non-destructive thickness gauge);

c) Paper cutter blade (06Cr19Ni10 stainless steel).

H.3 Operation steps

The steps for determining the sharp edge rust resistance are as follows:

a) Phosphate the blades according to the paper cutting blades and phosphating agents approved by both parties.

b) Suspend the blades and immerse them in the electrophoresis tank. The inter-electrode distance is 150 mm. Fix the blades with the cutting edge facing the plate. Raise the voltage from 0 V to the specified voltage within 30 s in a soft start mode. Electrophoresis for 2.5 min.

c) Test 5 blades.

d) Wash the blades after electrophoresis coating with water. Dry according to the conditions specified for the coating.

e) The coating thickness should be 20 μm± 2 μm.

f) Fix the dried blades on the blade holder. Keep the blades facing up. The inter-electrode distance is more than 10 mm.

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