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Replacing GB/T 1839-2003 and GB/T 2973-2004

Test Method for Gravimetric Determination of the Mass per Unit Area of Galvanized Coatings on Steel Products

(ISO 1460:1992, Metallic Coatings - Hot Dip Galvanized Coatings on
Ferrous Materials - Gravimetric Determination of the Mass per Unit Area,
MOD)

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Forward

This Standard modifies and adopts the international standard ISO 1460:1992 "Metallic Coatings - Hot Dip Galvanized Coatings on Ferrous Materials - Gravimetric Determination of the Mass per Unit Area".

For the convenience of comparison, the serial number of the chapters and articles of this Standard and the serial number of chapters and articles of ISO 1460:1992 are listed in Appendix 8.

Modification was made when this Standard adopts ISO 1460:1992. These technical differences are marked with vertical single-line at the margin of the involved articles. Technical differences and their reasons are provided in Appendix C for reference.

Compared with ISO 1460:1992, the main differences in this Standard are as follows:

- Applicable categories of galvanized coatings were added; they are respectively pure galvanizing coating, zinc-iron alloy coating, zinc-iron alloy and aluminum coating (such as zinc -5% aluminum alloy coating and 55% aluminum -zinc alloy coating);
- Deionizer water was added as diluent;
- Requirements on sample areas were added;
- Accuracy of sample weighting by balance was specified; if the coating mass of samples is not less than 0.1g, the weighing shall be accurate to 0.001g;
- Appendix A "Fluorescence X Ray Measurement Methods for the Mass of Zinc Coating of Galvanized Steel Sheets" was added.

This Standard replaces GB/T 1839-2003 "Test Method for Gravimetric Determination of Mass per Unit Area of Galvanized Coatings Steel Products" and GB/T 2973-2004 "Zinc Coated Steel Wire Test Method for Gravimetric Determination of Zinc Coating".

Compared with GB/T 1839-2003 and GB/T 2973-2004, the main changes in this Standard are as follows:

- Applicable categories of galvanized coatings were added; they are respectively pure galvanizing coating, zinc-iron alloy coating, zinc-iron alloy and aluminum-zinc coating (such as zinc-5% aluminum alloy coating and 55% aluminum-zinc alloy coating);
- Accuracy of sample weighting by balance was specified; if the coating mass of samples is not less than 0.1g, the weighing shall be accurate to 0.001g;

Test Method for Gravimetric Determination of the Mass per Unit Area of Galvanized Coatings on Steel Products

1 Scope

This Standard specifies principle, test solution, samples, test procedure, result calculation, reproducibility and test methods for gravimetric determination of the mass per unit area of galvanized coatings on steel products.

The galvanized coatings stated in this Standard include pure galvanizing coating, zinc-iron alloy and aluminum-zinc coating (such as zinc -5% aluminum alloy coating and 55% aluminum-zinc alloy coating). This Standard is applicable to steel products such as hot dip galvanizing and electro-galvanizing which are easy for the determination.

Methods in Appendix A also may be adopted for the mass test for the zinc coating of galvanized steel sheets.

2 Normative References

The following standards contain provisions which, through reference in this Standard, constitute the provisions of this Standard. For dated reference, the subsequent amendments (excluding correction) or revisions of these publications do not apply. However, the parties who enter into agreement based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards. For undated references, the latest edition of the normative document applies.

GB/T 8170 Rules for Rounding off of Numerical Values

3 Principle

Galvanized coatings on already-known surface area are dissolved in the test solution with inhibition of corrosion; then the sample mass before-and-after the coatings are dissolved is weighed; finally mass of galvanized coatings per unit area is calculated according to the weighing difference and sample area.

6 Test Procedure

6.1 Clean up the oil stain, dust and water trace etc. on sample surface with cleaning fluid (4.1); dry samples fully.

6.2 Weigh samples by balance; the weighing accuracy shall be better than 1% of expected mass of sample coatings. When the mass of sample coatings is not less than 0.1g, the weighing shall be accurate to 0.001g.

6.3 Immerse samples in the test solution (4.2); the usage of the test solution is generally not less than 10mL per square cm of sample surface area.

6.4 At room temperature, immerse samples completely in the solution; samples may be turned, until coatings are completely dissolved; the obvious stopping of hydrogen deposition (boiling bubble) is judged as the termination of dissolution process. Then take out the samples; flush them in the running water; if necessary, brush away the loose attachments on the sample surface by nylon brush; and finally wash them with ethyl alcohol; dry them rapidly; absorbent paper may also be adopted to absorb the moisture; then dry them rapidly with hot air.

6.5 Weigh samples by balance with the same accuracy with that in 6.2.

6.6 After weighing, determine the exposed surface area after the zinc coatings of samples are dissolved; the accuracy shall achieve 1%. Measurement of steel plates, steel strips, sample diameter or side length shall be accurate to 0.1mm at least. Measurement of steel wire diameter shall be carried out once at each of the mutual vertical positions; then take the average, accurate to 0.1mm.

6.7 For the determination of the mass of single-side zinc coating for galvanized sheets, proper means shall be adopted to seal one side. After finishing the measurement, determine the second side.

7 Result Calculation

7.1 Galvanizing amount [mass (g) per square meter] on steel products (excluding steel wire) per unit area shall be calculated according to Formula (1). The calculation result shall be rounded according to those specified in GB/T 8170; the reserved digits shall be consistent with that indicated in the product standard.

$$M = \frac{m_1 - m_2}{A} \times 10^6 \dots\dots\dots (1)$$

Where,

M - mass of galvanized coatings per unit area (steel plates and steel strips shall be

Appendix A

(Informative)

Fluorescence X Ray Measurement Method for the Mass of Zinc Coating of Galvanized Steel Sheets

A.1 Scope of application

This measurement method specifies the principle, test instrument, calibration method and measurement procedures for mass measurement of the galvanized coatings on surfaces of steel plates by XRF.

This method is applicable to measure the mass of hot dipping galvanizing coat, zinc-iron alloy coating and aluminum-zinc coating (such as zinc -5% aluminum alloy coating and 55%aluminium-zinc alloy coating) as well as electro-galvanized zinc coating and zinc-nickel alloy coating.

A.2 Principle

A.2.1 Primary rays that are generated from the ray source (X ray tube or radioactive isotope) are utilized to illuminate the steel plated covered with metal coatings. Under certain conditions, ferric feature fluorescence X rays (secondary rays) are excited in the body of base steel. When the rays penetrate through metal coatings with different thickness, strength decrease with different degrees will occur. Strength of secondary rays is detected. When conditions for the generation of primary rays and detection of secondary rays are fixed, the detected fluorescence X-ray intensity is the function of coating thickness. Finally mass of coatings is obtained from the quantitative relation between strength and coating thickness.

A.2.2 The primary rays illuminate the steel plates with metal coating. Under certain conditions, the characteristic x ray, namely fluorescence X ray of coated metal, will be excited in the metal coating; strength of fluorescence X ray is detected. Finally, the mass of coatings may be obtained from the quantitative relation between strength and thickness of metal coatings.

A.3 Test instrument

A.3.1 X ray thickness tester or γ ray thickness tester are used for testing of metal coatings. Instruments are consisted of ray source, detector, electronic systems and other units. Ray source is the X ray tube or radioactive isotope that generates primary rays. Primary rays excite the secondary rays in the test sample; the secondary rays (fluorescence X ray) of samples are received from the testing unit; the electronic

systems convert the received rays into mass of coatings to control the instruments and process the data.

A.3.2 When the measurement method of fluorescence X ray for coating characteristics are adopted, the incident intensity of primary rays shall ensure that it is able to excite fluorescence X ray of characteristics of measured elements in the full-thickness of coatings, and be detected. If measurement method (absorption method) of fluorescence X ray for characteristics of base body is adopted, the incident intensity of primary rays shall ensure that the excited characteristic fluorescence X ray in the base steel body shall have sufficient emergent strength when penetrating through coatings.

A.3.3 Instruments shall have enough high-strength of ray source and testing sensitivity, and are able to complete the accurate measurement of thicker coating in shorter data gathering time.

A.3.4 The detector must be able to distinguish the fluorescence X ray generated from the coatings and base body.

A.3.5 Rays generated from the ray source must have adequate radiating area on samples.

A.3.6 Instruments shall be able to measure several elements and make compensation for the fluctuation of coating composition.

A.4 Calibration method

A.4.1 Standard sample shall be adopted to calibrate the measuring instrument and establish the accurate quantitative relation between characteristic fluorescence X-ray intensity and mass of coatings.

A.4.2 Coating mass of standard samples shall be determined accurately by gravimetric method.

A.4.3 Coatings and base steels of standard samples shall have the same chemical composition same coating process, and same X ray emission-absorption characteristics with that of samples to be tested.

A.4.4 The following recommended method may be adopted for the preparation of standard samples.

Use fluorescence X ray method; a piece of sample block with uniform coating is selected with the size of about 230mmX 230mm; 5 pieces of samples are prepared according to the cross-shape distribution shown in Figure A.1; coating mass (g/m²) of No.2, 3, 4 and 5 samples are determined by gravimetric method. No.1 is the center sample and the No.2, 3, 4 and 5 are "satellite" samples. If the reproducibility (ratio of extreme difference for four pieces of sample sheet TO the average value) of

Appendix C

(Informative)

Technical Differences and the Reasons between This Standard and ISO 1460:1992

List for technical differences and the reasons between this Standard and ISO 1460:1992 is detailed in Table C.1.

Table C.1 Technical differences and the Reasons between this Standard and ISO 1460:1992

Number of chapters and articles of this Standard	Technical differences	Reasons
1.1	Applicable categories of galvanized coatings were added and they are respectively pure galvanizing coating, zinc-iron alloy coating, zinc-iron alloy and aluminum-zinc coating (such as zinc -5% aluminum alloy coating and 55% aluminum -zinc alloy coating);	It adapts the current status of production technology and integrates requirements of standards such as EN, ASTM and JIS on the scope of application.
4.2	As for the dilution of dezincification solution, besides the distilled water may be adopted, deionize water was added as the diluent.	It enhances the operability of this test method.
5	Requirements on sample areas were added	It enhances the operability of this test method and integrates the requirements of EN, ASTM and JIS on the sample size.
6.2	"Where coating mass is not less than 0.1g, the weighing accuracy shall be 0.001g" was added.	It enhances the operability of this test method and guarantees the accuracy of the test.
6.6	As for the measurement of test surface area, specific size accuracy value was added (0.1mm for steel plates and 0.01mm for steel wires)	It enhances the operability of this test method.
7.1, 7.2	"Calculation result shall be rounded according to those specified in GB/T 8170 and the reserved digit shall be consistent with the digit indicated in the product standard." was added.	It normalizes the data processing and provides convenience for the product determination.
Appendix A	"Fluorescence X Ray Measurement Method for the Mass of Zinc Coating of Galvanized Steel Sheet" is listed in this Standard in the form of appendix.	It adapts the requirements of current status of product and testing technique.

END

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