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Zinc diffusion coatings on ferrous products — Sherardizing — Specification

Revêtements par diffusion de zinc sur les produits ferreux — Shérardisation — Spécification

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ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this documents informative given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword.-.Supplementary information

ISO 17668 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 4, *Hot dip coatings (galvanized, etc.)* and by Technical Committee CEN/TC 262, *Metallic and other inorganic coatings* in collaboration.

Introduction

Sherardizing is a thermal diffusion coating process in which ferrous articles are heated in the presence of a sherardizing mixture consisting of zinc dust with or without an inert material.

The process is commonly performed in closed slowly rotating or fixed containers at temperatures ranging from about 300 °C to 500 °C. The normal processing temperature is below the melting point of zinc (419 °C).

During the process, zinc is reacting with the surface to form inter-metallic layers on ferrous articles.
A coating thickness of 10 µm to 75 µm (and higher if required) can be achieved. The coating thickness is accurately controlled by the amount of zinc dust, the processing time and temperature. The coating closely follows the contours of the base material and uniform coating thicknesses are produced on articles, including those of irregular shape.

After sherardizing the container load is cooled down. A screening process separates the sherardized articles from the unused sherardizing mixture. The articles, with the zinc-iron inter-metallic layers, are eventually post-treated (by phosphating, chromating or another suitable passivation process) resulting in a clean and passivated surface.
It is common to use articles coated with zinc-iron inter-metallic layers as a primer or base-coat for duplex-systems.

Sherardizing (thermal diffusion coating) is also known as:
- Diffusion zinc plating (Germany)
- Thermal diffusion coating (Russia)
- Thermal diffusion galvanizing (Ukraine)
- Vapor galvanizing (UK)
- Zinc diffusion coating (USA)
- Zinc inter-metallic coating (Russia)
- Zinc thermo diffusion galvanizing (Israel)

In China, Europe and the USA the common name for the thermal diffusion coating process is Sherardizing.

Zinc diffusion coatings on ferrous products — Sherardizing — Specification

1 Scope

This ISO standard specifies minimum thickness requirements for six classes of zinc-diffusion layers applied to ferrous products by the sherardizing process for the purpose of protection against corrosion and wear.

This standard does not specify any requirements for the surface condition (finish or roughness) of the basis material before sherardizing.

Post-treatments (conversion coatings), after-treatments or organic over-coatings (Duplex) of sherardized articles are not in the scope of this standard.

NOTE See for general information about Post-treatments Annex C and Annex D.

This standard does not apply to sherardized products (e.g. fasteners, tubes) for which specific standards exist and which may include additional requirements or requirements which are different from those of this standard.

NOTE Individual product standards can incorporate this standard for the coating by quoting its number, or may incorporate it with modification specific to the product.

2 Normative references

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

ISO 1460, *Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area*

ISO 1463, Metallic and oxide coatings – Measurement of coating thickness – Microscopic method

ISO 2064, Metallic and other inorganic coatings – Definitions and conventions concerning the measurements of thickness

ISO 2178, *Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method*

ISO 2808, *Paint and varnishes – Determination of film thickness*

ISO 2859, *Sampling procedures for inspection by attributes.*
Part 1: Sample plans indexed by accepted quality levels (AQL) for lot-by-lot-inspection
Part 2: Sample plans indexed by limited quality (LQ) for isolated lot inspection.
Part 3: Skip-lot sampling procedures

ISO 3882, *Metallic and other inorganic coatings – Review of methods of measurements of thickness.*

ISO 10474, *Steel and steel products – Inspection documents*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1
sherardizing process
zinc-diffusion coating process in which articles are heated in close contact with a sherardizing mixture (see 3.3), commonly performed in a closed slowly rotating container or a fixed (non-rotating) container, to form sherardized layers.

3.2
sherardized layer (zinc diffusion layer)
zinc diffusion coating consisting of zinc/iron alloy layers obtained by sherardizing.

NOTE 1 'Sherardized layer' is referred to in this standard as 'coating'.

NOTE 2 The sherardized layer may eventual subsequently be post-treated by phosphating, chromating or another suitable passivation process (guidance for these post-treatments are given in Annex C and Annex D).

3.3
sherardizing mixture
mixture consisting of mainly zinc dust, with or without other process supporting ingredients and with or without an inert material, such as sand or aluminum oxide.

NOTE Zinc dust also known as zinc powder.

3.4
mass of the zinc diffusion layer
total mass of zinc/iron alloys per unit area of surface.

NOTE The mass of the zinc-diffusion layer is expressed in grams per square metre (g/m²).

3.5
thickness of the zinc-diffusion layer
total zinc-diffusion layer thickness consisting of zinc/iron alloys.

NOTE The thickness of the zinc-diffusion layer is expressed in micrometers (µm).

3.6
significant surface
part of the article covered or to be covered by the zinc-diffusion layer and for which these layer is essential for serviceability and/or appearance and where the layer must meet the specified requirements.

3.7
control sample
article, or group of articles, from a lot which is selected for testing.

3.8
reference area
area within which a specified number of single measurements is required to be made.

3.9
local thickness of the zinc-diffusion layer
mean value of zinc-diffusion layer thickness obtained from the specific number of measurements within a reference area for a magnetic or electro-magnetic test or the single value of a gravimetric test.

NOTE Guidance for the methods of measurement of the zinc diffusion layer thickness is given in 6.2.2 and in Annex B.

3.10
mean thickness of the zinc-diffusion layer
average value of the local zinc diffusion layer thicknesses of different reference areas, in case there is only one reference area, the mean zinc-diffusion layer thickness is the same as the local zinc-diffusion layer thickness.

3.11
mass of the zinc-diffusion layer
average value of the zinc-diffusion layer mass determined either by using a control sample selected in accordance with Clause 5, using tests in accordance with ISO 1460 or by conversion of the mean zinc-diffusion layer thickness (see 3.10).

3.12
inspection lot
one or more articles of the same type and size comprising either a single order or a single delivery load or the number of articles identified as a lot by the sherardizer.

3.13
acceptance inspection
inspection of an inspection lot at the sherardizers works (unless otherwise specified).

4 General requirements

4.1 General

This standard specifies the minimum coating thicknesses for six thickness classes (see 6.2).

The surface condition of the basis material, the mass of the parts and the sherardizing conditions may affect the appearance, the thickness, surface roughness and the physical and mechanical properties of the coating. This standard does not define any requirements regarding these properties.

NOTE Guidance on these parameters can be found in ISO 14713-3 [1].

4.2 Information to be supplied by the purchaser

Information shall be supplied by the purchaser in accordance with Annex A1 Essential information and Annex A2 Additional information.

5 Acceptance inspection and sampling

Acceptance inspection shall be undertaken before the products leave the sherardizers custody, unless otherwise specified at the time of ordering by the purchaser.

Acceptance inspection involves the assessment of appearance of the coated article and testing the thickness. The results of other tests of the coated article are normally not provided. Other tests will only be carried out by agreement between purchaser and sherardizer made at the time of ordering.

A control sample (3.7) tor thickness testing shall be taken randomly from each inspection lot (3.13) selected for testing. The minimum number of articles to form the control sample shall be taken in accordance with Table 1.

Alternatively, sampling procedures selected from ISO 2859 may be used.

Table 1 - Control sample size related to batch size

Number of articles in the batch	Minimum number of articles in the control sample
1 to 3	All
4 to 500	3
501 to 1 200	5
1 201 to3 200	8
3 201 to 10 000	13
Above 10 000	20

6 Coating properties

6.1 Appearance

The surface of the coating has a grey (matt or lustrous) appearance and may show scratches resulting from normal contact with other articles, during processing or storage. Such scratches are superficial and not detrimental to the corrosion resistance of the sherardized articles.

The coating shows a certain surface roughness which is characteristic for the zinc-iron alloy type of coating.

NOTE 1 For more guidance see ISO 14713-3 [1].

The development of (grey-)white corrosion products (white staining) – the formation of mainly basic zinc oxide during storage in humid conditions after sherardizing – shall not be cause for rejection.

NOTE 2 It should be noted that ‘surface roughness’ and ‘grey (matt or lustrous) appearance’ are relative terms. These appearance properties can be influenced by the composition of and surface conditions of the basis material. It is not possible to establish a definition of appearance and finish of the coating covering all requirements in practice.

Areas without a zinc-diffusion layer shall not be allowed, unless otherwise specified at the time of ordering by the purchaser and agreed upon with the sherardizer.

Rejected articles, regarding these areas, shall be re-sherardized and resubmitted for inspection in agreement with the purchaser.

An orange-brown coloring of the sherardized articles at the time of delivery is not allowed, unless otherwise specified at the time of ordering by the purchaser and agreed upon with the sherardizer.

Rejected articles, regarding this discoloring, shall be re-sherardized and resubmitted for inspection in agreement with the purchaser.