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Metallic and other inorganic coatings — Electroplated coatings of cadmium with supplementary treatments on iron or steel

Revêtements métalliques et autres revêtements inorganiques — Dépôts électrolytiques de cadmium avec traitements supplémentaires **iTeh ST**^{sur}ferou acier D PREVIEW

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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 document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 262, *Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys,* in collaboration with ISO Technical Committee TC 107, *Metallic and other inorganic coatings,* Subcommittee SC 3, *Electrodeposited coatings and related finishes,* in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 2082:2008), which has been technically revised.

Introduction

Electrodeposits of cadmium are used to protect iron and steel from corrosion. Cadmium is anodic and corrodes sacrificially, thus protecting ferrous basis metals even when exposed through pores or pits in the cadmium. Electrodeposited cadmium coatings have traditionally been applied to iron or steel from alkaline cyanide solutions, but in recent years, environmental concerns and regulations have led to increased use of acid sulfate, neutral chloride and acid fluoborate cadmium solutions.

Because the appearance and serviceability of electroplated cadmium coatings are influenced by the surface condition of the basis metal, agreement should be reached between the interested parties that the surface of the basis metal is satisfactory for electroplating.

Although concerns have been raised about the use of cadmium due to safety and environmental effects, there are critical applications, often aerospace-related, where the unique properties of electrodeposited cadmium coatings, for example, their corrosion resistance, intrinsic lubricity, ductility, electrical conductivity and low contact resistance, make continued use of cadmium coatings necessary.

The corrosion resistance of electroplated cadmium coatings and their tendency to tarnish when handled can be improved by applying chromate conversion and other supplementary coatings.

Chemical conversion coatings that do not contain hexavalent chromium are commercially available and their use is becoming more and more popular. The appearance of these substitutes may be different from those produced with hexavalent chromium. Due to the REACH Regulations, however, the use of hexavalent chromium compounds will be banned in Europe from September 2017 except where specifically authorized. Other conversion coatings that are chromium-free are also available. Substitutes are required to satisfy the corrosion requirements given in this document. (standards.iteh.ai)

> ISO 2082:2017 https://standards.iteh.ai/catalog/standards/sist/591cbd1f-2ba1-434d-8a40ad852adfcfa9/iso-2082-2017

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Metallic and other inorganic coatings — Electroplated coatings of cadmium with supplementary treatments on iron or steel

DANGER — Cadmium vapour is highly toxic by inhalation. During heat treatment, all precautions should be taken to ensure that no person is exposed to it. Attention is also drawn to the danger arising from welding, soldering or heating and other operations, in which the possibility that cadmium will be vaporised exists. Because of its toxicity, cadmium should not be employed as a coating for any article that will come in contact with food or beverages or containers in contact with these items or any household goods.

1 Scope

This document specifies the requirements of electroplated coatings of cadmium with supplementary treatments on iron and steel. It includes information that is to be supplied by the purchaser to the electroplater, and describes coating requirements, including those for heat treatment before and after electroplating.

It is not applicable to coatings applied

- to sheet, strip or wire in the non-fabricated form, PREVIEW
- to close-coiled springs, or (standards.iteh.ai)
- for purposes other than protective, <u>intrinsic_dub</u>ricity, ductility, electrical conductivity and low contact resistance usendards.iteh.ai/catalog/standards/sist/591cbd1f-2ba1-434d-8a40-

ad852adfcfa9/iso-2082-2017 This document does not specify requirements for the surface condition of the basis metal prior to electrodeposition with cadmium.

The coating thickness that can be applied to threaded components can be limited by dimensional requirements, including class or fit.

Additional information on corrosion resistance, rinsing and drying, processing parts in bulk and dyeing of chromate conversion coatings is given in <u>Annex C</u>.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 1463, Metallic and oxide coatings — Measurement of coating thickness — Microscopical method

ISO 2064, Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness

ISO 2080, Metallic and other inorganic coatings — Surface treatment, metallic and other inorganic coatings — Vocabulary

ISO 2177, Metallic coatings — Measurement of coating thickness — Coulometric method by anodic dissolution

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

ISO 2082:2017(E)

ISO 2819, Metallic coatings on metallic substrates — Electrodeposited and chemically deposited coatings — Review of methods available for testing adhesion

ISO 3497, Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods

ISO 3543, Metallic and non-metallic coatings — Measurement of thickness — Beta backscatter method

ISO 3613, Metallic and other inorganic coatings — Chromate conversion coatings on zinc, cadmium, aluminium-zinc alloys and zinc-aluminium alloys — Test methods

ISO 4518, Metallic coatings — Measurement of coating thickness — Profilometric method

ISO 4519:1980, *Electrodeposited metallic coatings and related finishes* — *Sampling procedures for inspection by attributes*

ISO 9227, Corrosion tests in artificial atmospheres — Salt spray tests

ISO 9587, Metallic and other inorganic coatings — Pretreatment of iron or steel to reduce the risk of hydrogen embrittlement

ISO 9588, Metallic and other inorganic coatings — Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement

ISO 10289, Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates — Rating of test specimens and manufactured articles subjected to corrosion tests

ISO 10587, Metallic and other inorganic coatings – Test for residual embrittlement in both metallic-coated and uncoated externally-threaded articles and rods – Inclined wedge method

ISO 15724, Metallic and other inorganic coatings — Electrochemical measurement of diffusible hydrogen in steels — Barnacle electrode method

ISO 2082:2017

https://standards.iteh.ai/catalog/standards/sist/591cbd1f-2ba1-434d-8a40-

3 Terms, definitions, abbreviated terms and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2064 and ISO 2080 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Abbreviated terms

- ER hydrogen-embrittlement-relief heat treatment
- SR stress relief heat treatment
- T2 organic sealant

3.3 Symbols

- Cd chemical symbol for cadmium
- Fe chemical symbol for iron

4 Information to be supplied by the purchaser to the electroplater

4.1 Essential information

The following information shall be supplied to the electroplater in writing, for example, in the contract or purchase order or on engineering drawings:

- a) a reference to this document, i.e. ISO 2082, and the designation (see <u>Clause 5</u>);
- b) the significant surface indicated, for example, by drawings or by the provision of suitably marked samples;
- c) the nature, condition and finish of the basis metal if they are likely to affect the serviceability and/or the appearance of the coating (see <u>Clause 1</u>);
- d) the position on the surface for unavoidable defects, such as rack marks (see <u>6.1</u>);
- e) the finish required, for example, bright, dull or other finish, preferably accompanied by approved samples of the finish (see <u>6.1</u>);
- f) the type of conversion coating or supplementary treatment (see <u>6.3</u> and according to <u>Annex A</u>); conversion coatings shall only be omitted, and alternative conversion coatings and/or other supplementary treatments (see <u>Table A.1</u>) or conformal coatings, such as lacquers, applied over the conversion coating, at the specific request of the purchaser;
- g) the requirements for thickness, adhesion and accelerated corrosion test requirements (see <u>6.2</u>, <u>6.4</u>, <u>6.5</u> and <u>Annex B</u>);
- h) the tensile strength of parts and the requirements for heat treatment before and/or after electrodeposition (see <u>6.6</u> and <u>6.7</u>); ISO 2082:2017
- i) sampling methods, acceptance levels of any other/inspection requirements if inspection is different from that given in ISO 4519:1980, Clause 79/iso-2082-2017

4.2 Additional information

The following additional information shall also be supplied to the electroplater:

- a) any special requirements for, or restrictions on, preparation of the article to be coated (see Bibliography);
- b) any other requirements, such as for articles of complex shape, an area for testing and rating.

5 Designation

5.1 General

The designation shall appear on engineering drawings, in the purchase order, in the contract or in the detailed product specification. The designation specifies, in the following order:

- a) the basis metal,
- b) stress relief requirements,
- c) the type and thickness of undercoats, if present,
- d) the thickness of the cadmium coating,
- e) heat treatment requirements after electroplating, and
- f) the type of conversion coating and/or supplementary treatment (see Bibliography).

5.2 Designation specification

The designation shall comprise the following:

- a) the term "Electrodeposited coating";
- b) a reference to this document, i.e. ISO 2082;
- c) a hyphen;
- d) the chemical symbol of the basis material, Fe, (iron or steel) followed by its standard designation;

e) a solidus (/);

- f) the SR designation, if necessary, followed by a solidus;
- g) the chemical symbol for cadmium, "Cd";
- h) a number indicating the minimum local thickness, in micrometres, of the cadmium coating followed by a solidus;
- i) the ER designation, if necessary, followed by a solidus;
- j) if appropriate, codes indicating the type of conversion coating (according to <u>Annex A</u>), followed by a solidus;
- k) if appropriate, codes designating any supplementary treatments (according to <u>Annex A</u>).

Solidi (/) shall be used to separate data fields in the designation corresponding to the different sequential processing steps.

If other supplementary treatments other than or in addition to chromate conversion coating are used, the designation for a coating thickness of 25 μ m of cadmium shall be the designation for a coating thickness of 25 μ m of cadmium shall be the design of the design

Fe/Cd25/A/Y

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where

- A represents a transparent conversion coating;
- Y represents one of the codes for other supplementary coatings given in <u>Table A.2</u>.

It is recommended that the specific alloy be identified by its standard designation following the chemical symbol of the basis metal; for example, its UNS number, or the national or regional equivalent, may be placed between the symbols: < >.

For example, Fe<G43400> is the UNS designation for one high-strength steel. (See Bibliography.)

The following are examples of coating designations.

EXAMPLE

1

Designation of an electrodeposited coating of 12 μm cadmium (Cd12) on iron or steel (Fe) which has had a transparent conversion coating (A) applied:

Electrodeposited coating ISO 2082 - Fe/Cd12/A

EXAMPLE 2

The same as Example 1 but, in addition, the articles are heat-treated prior to electroplating for stress relief purposes at 200 °C for a minimum of 4 h, designated as SR(200)4; the minimum thickness is 25 μ m (Cd25); and a sealant applied after plating is designated as T2.

Electrodeposited coating ISO 2082 – Fe/SR(200) \geq 4/Cd25/ER(190)8/A/T2

5.3 Designation of the basis material

The basis material shall be designated by its chemical symbol or its principal constituent if an alloy. For example,

- a) Fe for iron or steel,
- b) Cd for cadmium alloys, and
- c) Al for aluminium alloys.

5.4 Designation of heat treatment requirements

The heat treatment requirements shall be designated as follows:

- a) by the letters SR for stress relief heat treatment prior to electroplating, and/or the letters ER for hydrogen embrittlement-relief heat treatment after electroplating;
- b) the minimum temperature, expressed in degrees Celsius (°C) and given in parentheses;
- c) the duration of the heat treatment, expressed in hours (h).

For example, SR(210)1 designates stress relief heat treatment at 210 °C for 1 h.

6 Requirements iTeh STANDARD PREVIEW

6.1 Appearance

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Although this document does not specify the condition, finish or surface roughness of the basis material prior to electroplating, the appearance of electroplated coatings depends on the condition of the basis material (see the **Bibliography for surface preparation**). The electroplated article on its significant surface shall be free from clearly visible plating defects such as blisters, pits, roughness, cracks or non-plated areas other than those arising from defects in the basis metal. On articles where a contact mark is unavoidable, its position shall be the subject of agreement between the interested parties (see <u>4.1</u>). The articles shall be clean and free from damage.

Unless the purchaser specifies otherwise, the cadmium coating shall be bright. If necessary, a sample showing the required finish shall be supplied or approved by the purchaser [see 4.1 e)].

6.2 Thickness

The thickness of the cadmium coating specified in the designation shall be the minimum local thickness. The minimum local thickness of the coating shall be measured at any point on the significant surface that can be touched by a ball 20 mm in diameter, unless otherwise specified by the purchaser (see 4.1 and 4.2).

Methods for the measurement of the thickness of cadmium coatings on steel are specified in ISO 1463, ISO 2177, ISO 2178, ISO 3497, ISO 3543 and ISO 4518.

In case of dispute, the method specified in ISO 2177 shall be used for articles having a significant surface area greater than 100 mm². In the case of articles having a significant surface area less than 100 mm², the minimum local thickness shall be deemed to be the minimum value of the average thickness determined by the method specified in <u>Annex B</u>.

Prior to the use of the method specified in ISO 2177, it is essential that the chromate coating, other conversion coating or organic coating is removed using a very mild abrasive, for example, a paste of levigated alumina. In the case of heavy conversion coatings, the results will, therefore, be slightly lower.