
**Metallic coatings — Physical
vapour-deposited coatings of
aluminium — Specification and test
methods**

*Revêtements métalliques — Revêtements d'aluminium appliqués par
vide — Spécification et méthodes d'essai*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22779:2006

<https://standards.iteh.ai/catalog/standards/sist/d4550d9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22779:2006

<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>

© ISO 2006

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Information to be supplied by the purchaser to the processor	2
5 Designation	3
6 Requirements	5
7 Sampling.....	9
8 Rejection.....	9
Annex A (informative) Additional information concerning equipment, substrate preparation and process parameters.....	10
Annex B (normative) Determination of the average thickness of aluminium coatings	12
Annex C (normative) Adhesion test methods	13
Annex D (normative) Sampling	14
Bibliography	15

<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>

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.

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.

ISO 22779 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 3, *Electrodeposited coatings and related finishes*.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 22779:2006](https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006)

<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>

Introduction

Aluminium coatings may be applied to a variety of substrates by physical vapour-deposition techniques to improve resistance to corrosion, as an alternative to cadmium, and to provide dissimilar metal compatibility. The vapour-deposition process does not introduce hydrogen into the substrate and is, thus, especially useful for applying a corrosion-resistant aluminium coating to high-strength steels that are susceptible to hydrogen embrittlement. Hydrogen, however, may still be introduced into the substrate during fabrication, cleaning, pickling and other treatments, and care must be exercised to prevent hydrogen from being introduced prior to vapour deposition.

The corrosion resistance of physical vapour-deposited aluminium coated articles may be further enhanced by applying chromate conversion coatings, anodizing and other supplementary treatments.

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 22779:2006

<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22779:2006

<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>

Metallic coatings — Physical vapour-deposited coatings of aluminium — Specification and test methods

WARNING — The use of this International Standard may involve hazardous materials, operations and equipment. This standard does not address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies requirements for aluminium coatings applied by physical vapour-deposition techniques to mild steels, low-alloy steels, high-strength steels, corrosion-resisting steels, aluminium alloys, titanium alloys and other materials, as appropriate.

Physical vapour-deposited coatings of aluminium are not suitable for steels having tensile strengths greater than 1 400 MPa, because of the possibility of hydrogen embrittlement due to corrosion in service or storage, or as a result of excessive cathodic protection.

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.

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, *Electroplating and related processes — Vocabulary*

ISO 2360, *Non-conductive coatings on non-magnetic electrically conductive basis materials — Measurement of coating thickness — Amplitude-sensitive eddy-current method*

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

ISO 2859 (all parts), *Sampling procedures for inspection by attributes*

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 3882, *Metallic and other inorganic coatings — Review of methods of measurement of thickness*

ISO 3892, *Conversion coatings on metallic materials — Determination of coating mass per unit area — Gravimetric methods*

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

ISO 22779:2006(E)

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

ISO 9220, *Metallic coatings — Measurement of coating thickness — Scanning electron microscope method*

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

ISO 9587, *Metallic and other inorganic coatings — Pretreatments 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 10074, *Specification for hard anodic oxidation coatings on aluminium and its alloys*

ISO 10546, *Chemical conversion coatings — Rinsed and non-rinsed chromate conversion coatings on aluminium and aluminium alloys*

ISO 12686, *Metallic and other inorganic coatings — Automated controlled shot-peening of metallic articles prior to nickel, autocatalytic nickel or chromium plating, or as a final finish*

ISO 16348, *Metallic and other inorganic coatings — Definitions and conventions concerning appearance*

EN 12508, *Corrosion protection of metal and alloys — Surface treatment, metallic, and other inorganic coatings — Vocabulary*

IEC 60454, *Specifications for pressure-sensitive adhesive tapes for electrical purposes — Part 2: Methods of test*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 2064, ISO 2080, ISO 2859, ISO 4519 and EN 12508 apply.

4 Information to be supplied by the purchaser to the processor

When ordering articles for physical vapour deposition of aluminium in accordance with this International Standard, the purchaser shall provide the following information in writing in the contract or purchase order, or in the engineering drawing:

- a) the designation (see Clause 5);
- b) the specification and metallurgical condition of the basis metal, any process-temperature limitations [see 6.1.2 f)] and shot-peening requirements [see 6.1.3 c)];
- c) the significant surface, including the coating of holes, recesses and presence of rack marks (see 6.1 and 6.3.1);
- d) details of any sensitive material and whether ultra-high-purity argon is required (see 6.1.2);
- e) the requirement for any consolidation, for example, by glass-bead peening (see 6.4.1);
- f) the requirement for coating thickness (see 5.4 and Table 1) and for a chromate conversion coating (see 5.5 and 6.4.2);
- g) the requirement for abrasion-resistant anodic oxide coating (see 6.4.3)

- h) the requirement for a supplementary treatment, such as paint, and details of the specification for the organic finish (see 5.5 and 6.4.4);
- i) the requirement for coating adhesion (see 6.3.3 and Annex C).
- j) the requirement for special test specimens and for the type of test method, for example, destructive or non-destructive (see 6.6);
- k) sampling and inspection requirements (see Clause 7 and Annex D).

5 Designation

The designation shall appear on engineering drawings, in the purchase order, the contract or in the detailed product specification. The designation specifies the basis material, the requirements for stress relief before vapour deposition, the nominal composition and thickness of the vapour-deposited aluminium coating, the type of chromate conversion coating and other supplementary treatment, and the heat treatment to reduce susceptibility to hydrogen embrittlement.

5.1 General

The designation shall comprise the following:

- a) the term: vapour-deposited coating;
- b) the number of this International Standard, ISO 22779;
- c) a hyphen;
- d) the chemical symbol of the basis metal; ISO 22779:2006
<https://standards.iteh.ai/catalog/standards/sist/d4550df9-1d73-4cd2-a08c-19f0ff6f71ff/iso-22779-2006>
- e) a stroke (/);
- f) symbols for the aluminium coating, as well as any coatings that may be applied prior to and after deposition, separated by strokes for each stage in the coating sequence in the order of application. The coating designation shall include the thickness of the coating, in micrometres.

5.2 Basis metal

The basis metal shall be designated by its chemical symbol, or its principal constituent, if it is an alloy. For example:

- Fe for iron and steel;
- Zn for zinc alloys;
- Cu for copper and copper alloys,
- Al for aluminium and aluminium alloys;
- Ti for titanium and titanium alloys.

The specific alloy may be identified by its standard designation (for example, its UNS number, or its national or regional equivalent) placed between the symbols, < >, for example, Fe<G434000>. See Reference [4] in the Bibliography.

5.3 Pre-process stress-relief heat treatment

Stress-relief heat treatment prior to coating may be required for some basis materials. Brackets shall be placed around the letters SR, the temperature in degrees Celsius and the time in hours. The temperature shall be in parentheses after the letters SR; for example [SR(210)1].

5.4 Type and thickness of aluminium

The aluminium coating shall be designated by its chemical symbol, Al, followed by a number giving the minimum local thickness of the coating, in micrometres. For example, Al10, designates an aluminium coating that is 10 µm thick. The thickness of vapour-deposited aluminium coatings shall be in accordance with Table 1.

Allowances for the thickness of the aluminium coating should be made by adjusting the dimensional tolerances during the manufacture of threaded items, and those with close tolerances.

Table 1 — Minimum thickness requirements for physical vapour-deposited aluminium coatings

Application	Minimum local thickness µm
General-purpose coatings for corrosion protection and outdoor use.	25 and greater
Coatings for corrosion protection in indoor applications, or where dimensional tolerances will not allow the application of a coating with a minimum thickness of 25 µm.	13 to < 25
Coatings where dissimilar metal compatibility is required for close tolerances or on threaded items.	8 to < 10

5.5 Chromate conversion coatings and other supplementary treatments

The type of chromate conversion coating and other supplementary treatments shall be designated by the symbols given in Tables 2 and 3.

Table 2 — Symbols for chromate conversion coatings

Code	Type	Typical appearance	Coating mass per unit area g/m ²
	Name		
A ^a	Clear	Transparent, clear to bluish	≤ 0,5
B ^b	Bleached	Transparent with slight iridescence	≤ 1,0
C	Iridescent	Yellow iridescent	< 0,5 to < 1,5
D	Opaque	Olive-green	> 1,5
F	Black	Black	≤ 0,5 to ≤ 1,0

^a Chromium in hexavalent form may or may not be present.
^b B is a two-stage process.

Table 3 — Supplementary treatments other than conversion coatings

Code	Type of treatment
T1	Application of paints, varnishes, powder coatings or similar coating materials
T2	Application of organic or inorganic sealants.
T3	Dyeing
T4	Application of grease or oil, or other lubricants
T5	Application of wax
T6	Hard anodizing (see ISO 10074)

NOTE The function of chromate conversion coatings and other supplementary treatments is to retard or prevent the formation of white corrosion products on surfaces exposed to corrosive atmospheres, and to delay the appearance of red corrosion of aluminium coatings on steel. The iridescent yellow to olive drab chromate films are satisfactory for the application of subsequent paint coatings, but bleached or leached chromate films are not recommended as a supplementary finish with vapour-deposited aluminium coatings.

Chemical conversion coatings that do not contain hexavalent chromium are commercially available. Some contain trivalent chromium; others are chromium-free. Substitutes shall meet the corrosion requirements given in Table 4.

5.6 Post-coating heat treatment

Heat treatment to reduce the susceptibility of high-strength steels to hydrogen embrittlement may be required in some circumstances (see Clause 8). Brackets shall be placed around the letters ER, the temperature in degrees Celsius and the time in hours. The temperature shall be in parentheses after the letters ER; for example [ER(400)12].

5.7 Examples of coating designations

Example of a physical vapour-deposited aluminium coating 8 µm thick on steel (Fe), with a supplementary chromate conversion coating that is iridescent yellow (C):

Physical vapour-deposited coating ISO 22779 – Fe/Al8/C

Example of a coating 5 µm thick on steel, with a supplementary chromate conversion coating that is transparent or colourless (A) and that shall receive a subsequent organic sealant (T2):

Physical vapour-deposited coating ISO 22779 – Fe/Al5/A/T2

Example of a coating on high-strength steel that is to be stress relieved at 150 °C for 2 h before applying an aluminium coating 25 µm thick, that is to be hard anodized (T6):

Physical vapour-deposited coating ISO 22779 – Fe/[SR(150)2]/Al25/T6

6 Requirements

6.1 General

6.1.1 Basis metal

This International Standard does not specify requirements for the condition, finish and surface roughness of the basis metal prior to physical vapour deposition of aluminium. However, additional information concerning surface condition, equipment and process parameters for physical vapour deposition of aluminium is given in Annex A.