SLOVENSKI STANDARD
oSIST prEN ISO 2819:2016

01-november-2016

Kovinske prevleke na kovinskih podlagah - Galvansko in kemično nanesene prevleke - Pregled metod za preskus adhezivnosti (ISO/DIS 2819:1:2016)

Metallic coatings on metallic substrates - Electrodeposited and chemically deposited coatings - Review of methods available for testing adhesion (ISO/DIS 2819:1:2016)

Metallische Überzüge auf metallischen Grundwerkstoffen - Galvanische und chemische Überzüge - Überblick über Methoden der Haftfestigkeitsprüfung (ISO/DIS 2819:1:2016)

Revêtements métalliques sur bases métalliques -- Dépôts électrolytiques et dépôts par voie chimique -- Liste des différentes méthodes d_essai d_adhérence (ISO/DIS 2819:1:2016)

Ta slovenski standard je istoveten z: **prEN ISO 2819**

ICS:

25.220.40	Kovinske prevleke	Metallic coatings

oSIST prEN ISO 2819:2016 **en,fr,de**

DRAFT INTERNATIONAL STANDARD

ISO/DIS 2819

ISO/TC **107**

Secretariat: **KATS**

Voting begins on:
2016-09-16

Voting terminates on:
2016-12-08

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

Revêtements métalliques sur bases métalliques — Dépôts électrolytiques et dépôts par voie chimique — Liste des différentes méthodes d'essai d'adhérence

ICS: 25.220.40

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 2819:2016(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

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 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.

The committee responsible for this document is ISO/TC 107

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

1 Scope

This International Standard describes methods of checking the adhesion of electrodeposited and chemically deposited coatings. It is limited to tests of a qualitative nature. Table 2 indicates the suitability of each test for some of the most usual types of metallic coatings. Most of the tests described are capable of destroying both the coating and the article being tested, but some destroy the coating only. Even if the adhesion of the coating is found to be satisfactory on articles not destroyed in testing, it should not be assumed that the articles are undamaged. For example, the burnishing test (see 2.1) may render an article unacceptable and the thermal shock test (see 2.12) may produce unacceptable metallurgical changes.

This International Standard does not describe certain tests which have been developed at various times to give a quantitative measure of adhesion of metallic coating to a substrate since such tests require special apparatus and considerable skill in their performance which renders them unsuitable as quality control tests for production parts. Some of these quantitative tests may, however, be useful in research and development work.

WARNING — When particular methods of adhesion testing are included in International Standards for individual coatings, they should be used in preference to the methods described in this International Standard and should be agreed upon beforehand by the supplier and the purchaser.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Methods of test

4.1 Burnishing test

If plated parts are subjected to burnishing in a localized area, the deposit will tend to work-harden and absorb frictional heat. If the coating is thin, separation of the coating from the basis metal as blisters will occur under these conditions in areas of poor adhesion.

When the shape and size of the part permit, an area of not more than 6 cm^2 of the plated surface should be rubbed with a smooth implement for about 15 s. A suitable implement is a steel rod 6 mm in diameter with a smooth hemispherical end.

The pressure shall be sufficient to burnish the coating at every stroke but not so great as to cut the coating. Poor adhesion is indicated by the appearance of a blister which grows as the rubbing is continued.

If the mechanical properties of the coating are poor, the blister may crack and the coating will peel from the basis metal. This test shall be limited to relatively thin deposits.

4.2 Ball burnishing test

Ball burnishing is frequently used for polishing, but it can be used also to test adhesion. Using a barrel or vibratory burnisher with steel balls about 3 mm in diameter and soap solution as lubricant, it is possible to produce blisters when the adhesion is very poor. The method is suitable for relatively thin deposits.

4.3 Shot peening test

There are some variations of the principle by which the hammering action of iron or steel balls, allowed to fall by gravity or forced by means of a pressure air stream onto the surface to be tested, produces deformation of the deposit.

If the coating is poorly bonded, it will become blistered. Usually, the intensity of peening necessary to cause non-adherent coatings to blister varies with the coating thickness, thin coatings requiring less than thick coatings.

One test can be performed using a tube 150 mm long, 19 mm internal diameter, as the reservoir for round iron or steel shot (0,75 mm diameter approximately) connected to a nozzle. Compressed air is brought to the apparatus with a pressure of 0,07 to 0,21 MPa[1)] and the distances between nozzle and specimen are 3 to 12 mm.

Another test, that appears to be the most suitable for checking the adhesion of electroplated coatings of silver during production of coatings from 100 to 600 µm in thickness, is described in the annex and employs a standard air-operated cabinet of the type used for shot-peening steel parts.

If the silver is poorly bonded, it will extend or flow and become blistered.

4.4 Peel test

This test is suitable for coatings less than 125 µm thick on substantially flat surfaces. A strip of tinned mild steel or brass, approximately 75 mm long × 10 mm wide × 0,5 mm thick, is bent at right angles 10 mm from one end and the shorter limb soldered flat to the coated surface. A load is applied to the free limb and normal to the soldered surface. The coating will be detached from the substrate if the adhesion is weaker than the soldered joint. If the adhesion of the coating is greater than this, however, failure will occur in the soldered joint or within the thickness of the coating.

This method is not widely used because the temperature reached during the soldering operation might alter the adhesion. Alternatively, the test can be performed using an adhesive of hard-setting synthetic resin of adequate tensile strength in place of solder.

Another test (the tape test) employs an adhesive cellulose tape, with an adhesion value of approximately 8 N per 25 mm width, whose adhesive side is applied to the coating under test, using a fixed-weight roller, care being taken to exclude all air bubbles. After an interval of 10 s, the tape is removed by applying a steady pulling force to the tape, perpendicular to the surface of the coating. The adhesion of the coating shall be such that there is no evidence of detachment of the coating. This test is particularly used for testing adhesion of coatings on the conductors and contacts of printed circuits. Coated conductors shall be tested over an area of at least 30 mm^2.

1) 1 MPa = 1 MN/m^2

4.5 File test

A piece sawn off a coated article is held in a vice and a coarse mill file (one set of serrations only) is applied to the cut in such a manner as to attempt to raise the coating. The file is used in the direction from the basis metal to the coating at an angle of approximately 45° to the coated surface. No detachment of the coating shall occur. This test is not suitable for very thin coatings and for soft coatings such as zinc or cadmium.

4.6 Grinding and sawing tests

Grind an edge of the coated specimen with a grinding wheel with the direction of cutting from the basis metal to the deposit. If adhesion is poor, the deposit is torn from the base. A hacksaw can be substituted for the grinder. It is important to saw in such a direction that a force is applied that tends to separate the coating from the basis metal. Grinding and sawing tests are especially effective on harder coatings such as nickel and chromium.

4.7 Chisel test

The chisel test is normally used on coatings of considerable thickness (greater than 125 μm).

One variation of the test is to place a sharp chisel at the back of a coating overhang, and give it a sharp hammer blow. If the adhesion is good, the coating will break away or be cut through without the bond between basis metal and coating being affected.

Another type of “chisel test” is combined with the “saw test”. The test is made by sawing the specimen perpendicular to the coating; if the adhesion is not very good, failure immediately becomes evident. In cases where there appears to be no separation at the fracture, a sharp chisel is used to try to raise the coating at the edge. If the coating can be peeled from the edge for an appreciable distance, poor or weak adhesion is indicated. The cutting edge of the chisel shall be sharpened prior to each test.

Thinner coatings can be tested by substituting a knife for the chisel and light tapping with a hammer may or may not be used. The chisel test is not suitable for soft coatings such as zinc or cadmium.

4.8 Scribe and grid test

Using a hardened steel scribe which has been ground to a sharp 30° point, two parallel lines are scribed at a distance apart of about 2 mm. In scribing the two lines, enough pressure shall be applied to cut through the coating to the basis metal in a single stroke. If any part of the coating between the lines breaks away from the basis metal, the coating shall be deemed to have failed the test.

One variation of the test is to draw a square with a grid of 1 mm side and observe whether the coating peels from the basis metal within this area.

NOTE See also ISO 9211-4 cross-hatch test for optical coatings and ISO 2409 for varnishes

4.9 Bending test

The bend test consists in bending or flexing the coated products. The extent and nature of the distortion will vary with the basis metal, the shape, the nature of the coating and the relative thickness of the two layers.

The test is usually carried out by hand or with pliers, bending the specimen as sharply as possible first to one side then to the other, until the specimen breaks. The rate and the radius of bending can be controlled using suitable machines. The test produces a shearing stress between the basis metal and the deposit; if the deposit is ductile, the shearing force is much reduced because the coating flows and the basis metal can even break without the coating loosening.

A brittle deposit can crack but even so the test can give some information about the adhesion; the fracture must be inspected to determine whether the deposit peeled or can be removed with a knife or chisel.

Any sign of peeling, chipping or flaking is taken as indication of poor adhesion.

The coated specimen can be distorted with the coating on either the inside or the outside of the specimen. The behaviour of the coating is normally observed on the outside layer, although in some cases further information may be gained by examining the inside of the bend.

4.10 Twisting (winding) test

In this test the specimens (normally strips and wires) are twisted around a mandrel. Each part of the test can be standardized: the length and width of the strip, the rate of bending, the uniformity of bending movement and the diameter of the rod around which the piece is twisted.

Any sign of peeling, chipping or flaking is taken as indication of poor adhesion.

The coated specimen can be distorted with the coating on either the inside or the outside of the specimen. The behaviour of the coating is normally observed on the outside layer, although in some cases further information may be gained by examining the inside of the bend.

4.11 Tensile test

4.11.1 Tensile test as qualitative test as a measure of adhesion in terms of a classification:

This is suitable only for certain types of coated article. The article is stressed in tension until it breaks. Some cracking of the coating will normally be evident near to the fracture, but no detachment of the coating from the basis metal shall be visible. This type of test is carried out by means of a tensile testing machine and requires an appropriate two-sided clamping of the coated article.

4.11.2 Tensile test as quantitative test for the determination of adhesive strength in N/mm^2:

This is suitable only for certain planar coated articles, planar reference blocks or planar witness samples. A test stamp glued on the coated article, reference block or witness sample is pulled-off the coated substrate unless special adhesive-bonded coated joints are directly tested under tensile stress conditions. Given that the failure occurs at the coating-substrate interface, adhesive strength can be derived in N/mm^2. A macroscopic and/or microscopic inspection of the failure pattern is recommended. This test is carried out either as single-sample test by means of a tensile testing machine or as multiple-sample test by means of a centrifuge.

NOTE See also EN 13144, ISO 4624, EN 15780 for tensile test arrangements and ISO 10365 for failure pattern.

4.12 Thermal shock test

The adhesion of many deposits can be determined by heating the coated specimen and then suddenly cooling it. The principle involved in this test is the difference in coefficient of expansion between the coating and the basis metal.

It is therefore applicable when the coefficient of expansion of a coating is appreciably different from that of the basis metal. The test is performed by heating the specimen in an oven for a sufficient time to achieve the appropriate temperature shown in Table 1. The temperature shall be maintained within ± 10 °C. Metals that are sensitive to oxidation shall be heated in an inert or reducing atmosphere or in suitable liquids.

