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Metallic and other inorganic coatings — Definitions and conventions concerning porosity

Revêtements métalliques et autres revêtements inorganiques — Définitions et principes concernant la porosité

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Foreword

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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 18332 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 7, *Corrosion tests*.

Metallic and other inorganic coatings — Definitions and conventions concerning porosity

1 Scope

This International Standard defines porosity and its associated terms, and outlines the principles involved in porosity testing of metallic and related inorganic coatings. The purpose of porosity testing is also considered, thereby assisting the user to select the most suitable test for the product and its service application.

The porosity test cannot be used to establish corrosion-performance standards.

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 10308:2006, *Metallic coatings — Review of porosity tests*

3 Terms and definitions

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

3.1
porosity
holes, cracks or other **discontinuities** (3.3) in the coating that expose the underlying metal or substrate to the environment

3.2
pore in a coating
an essentially circular **discontinuity** (3.3) in the surface extending through to the underlying coating or to the basis metal

[ISO 2080:1981]

NOTE Types of pores are shown in ISO 10308.

3.3
discontinuity
opening in an otherwise continuous coating that exposes a different underlying metal

NOTE Typically, the openings are cracks, micro-holes, pores or pits in the coating. They can also be voids or breaks in the coating caused by mechanical damage, such as scratches or non-conductive inclusions in the basis metal (see ISO 10308).

3.4
corrosion product
substance formed as a result of corrosion

[ISO 8044:1999]

4 Purpose of porosity testing

The main purpose of porosity testing is to determine the quality of the coating and its freedom from porosity, particularly on those areas of the significant surface that demand a functional requirement, for example, as electrical contacts.

For the purpose of porosity testing of metallic and related inorganic coatings, there are two modes of corrosion that need to be considered, i.e. electrochemical and chemical. Either type of test can be used to identify the presence, distribution and extent of porosity. The test method selected will depend on the nature of the coating, the basis material and any undercoat.

In general, electrochemical tests are of an “accelerated nature”, with relatively short exposure times carried out under controlled chemical, electrical and physical conditions; these are ideal for process control purposes. Exposure tests (liquid immersion tests, solution-fog tests, gas atmosphere tests) are usually of long duration and can be either static or cyclic, depending on product requirements, and are particularly suitable for qualification purposes.

NOTE For a classification of porosity tests, see ISO 10308.

5 Principles

5.1 Electrochemical tests

In electrochemical testing, the basis metal/coating combination is generally used as the anode of an electrochemical cell; a stainless-steel plate or any inert but conductive material can be used as the cathode. An appropriate indicator responsive to the presence of basis-metal ions is incorporated in the electrolyte or conducting medium contained in a filter paper or gel.

The object of the test is to create dissolution of the basis metal by the direct application of a positive polarizing voltage. The resulting basis metal ions will then migrate under the applied electrical field towards the cathode through the conductive paper or gel. The indicator response and the resultant photographic image produced depends on the extent of the porosity in the coating.

NOTE In general, both the constant applied voltage and current can be used for electrochemical and gel techniques. Anodic dissolution of the coating, which will result in spurious results, is avoided by ensuring that certain maximum values are not exceeded.

5.2 Exposure tests

When coated articles are exposed to liquids or corrosive moist vapours, the tiny basis-metal areas at the bottom of the pores react chemically to form products which are either directly observable (corrosion products), visually or at low magnification, or which can be made observable by subsequent chemical development. Ideally, the chemical reaction products or “decorations” should remain at pore sites, so that the location, distribution and relative sizes of the pores can be easily evaluated.

Although porosity tests by exposure with gaseous reactants involves the same pore-corrosion mechanisms as those occurring in many polluted or corrosive service environments they shall not, however, be used as a measure of product performance.

6 Rating of test specimens

On completion of the exposure time, examination/inspection shall be carried out under the viewing conditions specified in the product standard. The specimens shall be assessed and rated in terms of one or more of the following:

— the number of pores and/or discontinuities per unit area of the significant surface;

— the percentage of the measurement area covered by the corrosion products or pore indications;

— the area of the largest marking or corrosion-product spot on the significant surface.

NOTE For more details see ISO 10308.

The product standard or engineering drawing shall specify the rating required.

7 Test report

The test report shall contain at least the following information:

a) type of test and/or specification number;

b) test conditions;

c) details of articles tested;

d) examination/inspection conditions;

e) rating;

f) any deviation from the product standard.

Bibliography

[1] ISO 2080:1981, *Electroplating and related processes — Vocabulary*

[2] ISO 8044:1999, *Corrosion of metals and alloys — Basic terms and definitions*

[3] ISO 10289:1999, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates — Rating of test specimens and manufactured articles subjected to corrosion tests*

[4] EN 12508:2000, *Corrosion protection of metals and alloys — Surface treatment, metallic, and other inorganic coatings — Vocabulary*