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

Revêtements métalliques et autres revêtements inorganiques — Définitions et principes concernant le mesurage de l'épaisseur



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Foreword

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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.

International Standard ISO 2064 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 2, *Methods of inspection and coordination of test methods*.

This third edition cancels and replaces the second edition (ISO 2064:1980), of which it constitutes a technical revision.

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Introduction

An important requirement of most coating specifications is that the coating have a thickness not less than a given value (and in a few cases not greater than a given value). The method to be used for measuring the thickness of a particular coating is laid down in the coating specification.

The main purpose of this International Standard is to define exactly what is meant by the term “minimum thickness” when used in specifications for metallic and related coatings. In this context, the minimum thickness is defined as a local thickness over a small area.

With some methods, for example the microscopical method, ISO 1463, it is possible to detect appreciable variations in thickness across extremely small areas (for example pits or cracks) which might be considered as places where the specified minimum thickness has not been achieved. However, with other test methods (for example the coulometric method, ISO 2177:1985, *Metallic coatings — Measurement of coating thickness — Coulometric method by anodic dissolution*, or various non-destructive methods), such minute local variations in thickness cannot be detected. Therefore, the only practicable definition of minimum thickness is one that allows comparable results to be obtained by any of the approved test methods. Hence the minimum thickness should be a local thickness over an area that is as small as practicable, but not too small to accommodate any of the specified test methods. These areas are termed “reference areas” and are often large enough to accommodate a number of separate measurements by the chosen method. In order to obtain consistent results, especially with non-destructive tests, the mean of the measurements of such tests on the reference area should be taken as the local thickness.

In practice, it is usually permissible to test the coating at any place on the significant surface in order to find the minimum thickness on an article. Articles are usually tested at areas where the coating may be expected to be thinnest and so the definition of minimum thickness is the lowest value of local thickness (as defined in clause 3) found by the chosen method.

In the case of some coatings, such as hot-dipped and sprayed metal coatings, the coating specifications may call for compliance with a minimum local or an average thickness, or both. These may differ from the parameters defined in this International Standard and the relevant product specifications should be consulted.

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

1 Scope

This International Standard defines terms concerning the measurement of the thickness of metallic and other inorganic coatings on any substrate. In addition, it specifies some general rules to be followed in the measurement of minimum thicknesses of coatings.

2 Normative references

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1463:1982, *Metallic and oxide coating — Measurement of coating thickness — Microscopical method*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 significant surface: The part of the article covered or to be covered by the coating and for which the coating is essential for serviceability and/or appearance and where the coating must meet all of the specified requirements.

3.2 measuring area: The area of the significant surface over which a single measurement is made.

“Measuring area” for the following methods is defined as

- a) for analytical methods, the area over which the coating is removed;
- b) for the anodic dissolution method, the area enclosed by the sealing ring of the cell;
- c) for the microscopical method, the field of view at a specified magnification (see ISO 1463);
- d) for non-destructive methods, the probe area or the area influencing the reading (see also the Introduction).

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

3.4 local thickness: The mean of the thickness measurements, of which a specified number is made within a reference area (see also the Introduction).

3.5 minimum local thickness: The lowest value of the local thicknesses found on the significant surface of a single article (see also the Introduction).

3.6 maximum local thickness: The highest value of the local thicknesses found on the significant surface of a single article.

3.7 average thickness: Either the value obtained by analytical methods (see 5.1) or the mean of a specified number of local thickness measurements that are evenly distributed over the significant surface (see 5.2 and also the Introduction).

NOTE — In the case of components coated in bulk, the product specification may require determination of the value of the average thickness of a bath. In such cases the standard deviation must be known to be able to estimate the proportion of the batch that is below the thickness in question.

4 Determination of local thickness

Average thickness measurements are usually made on small articles of limited total surface area.

4.1 Articles with significant surfaces less than 1 cm²

The normal reference area to be used for determining the local thickness shall be the whole of the significant surface of the article. The number of single measurements to be made within this reference area shall be agreed between the parties concerned. In special cases, however, smaller reference areas may be taken, but their sizes, number and location shall be agreed between the parties concerned.

4.2 Articles with significant surfaces greater than 1 cm²

The local thickness shall be determined within a reference area of approximately 1 cm² (where possible, a square of 1 cm side). Up to five distributed measurements may be made within this reference area (dependent upon the measuring method used) and the number to be made shall be agreed between the parties concerned.

4.3 Microscopical method

When using the microscopical method specified in ISO 1463, at least five distributed measurements shall be made along a length¹⁾ of a specified microsection.

5 Determination of average thickness

5.1 Analytical methods

When using mass-loss methods for determining average thickness, the selected measuring area shall be

large enough to provide a mass loss that can be determined with sufficient accuracy by the weighing method used.

If the area of the significant surface of the coated article is less than the required minimum measuring area, a number of individual articles shall be selected to provide the measuring area required for a single determination and the result shall be regarded as the average thickness.

If the area of the significant surface of the coated article does not greatly exceed the required minimum measuring area, a single determination on that article shall be regarded as the average thickness for the article. At least two articles shall be measured in order to verify the accuracy of the measurement.

If the area of the significant surface of the coated articles markedly exceeds the required minimum measuring area, a specified number of replicate determinations, distributed over the significant surface, shall be carried out and reported separately.

5.2 Other methods

If the area of the significant surface of the coated article does not greatly exceed the reference area for determining local thickness (see clause 4), the value of the local thickness shall be taken as the average thickness.

If the area of the significant surface of the coated article markedly exceeds the reference area for determining local thickness (see clause 4), the average thickness shall be taken as the mean of three to five local thickness determinations distributed over the significant surface.

1) For electroplated coatings this length may conveniently be 5 mm, but for coatings that tend to be more uniform in thickness, for example anodic oxide coatings, this length may be 20 mm.