INTERNATIONAL STANDARD

ISO 10216

Second edition
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Anodizing of aluminium and its alloys — Instrumental determination of image clarity of anodic oxidation coatings — Instrumental method

Anodisation de l'aluminium et de ses alliages — Détermination de la netteté d'image sur couches anodiques — Méthode instrumentale

Reference number
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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

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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.

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.

ISO 10216 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 2, *Organic and anodic oxidation coatings on aluminium.*

This second edition cancels and replaces the first edition (ISO 10216:1992), which has been technically revised.

Introduction

Estimation of the image clarity of anodic oxidation coatings on aluminium and its alloys is normally carried out visually by observing the clearness of an image on the surface. However, the image can be observed at various angles and be confused with the gloss level of a surface, and while the degree of image clarity is mainly influenced by the clearness of the coating, it is also affected by image distortion caused by surface irregularities and the haziness of the coating layer. Standardized methods of determining image clarity were therefore required.

This International Standard specifies the use of an instrumental method for measuring image clarity using an optical comb. A related International Standard (ISO 10215[2]) specifies the use of a chart scale also based on an optical comb together with a lightness scale to rank image clarity.

NOTE This instrumental method provides more accurate measurements of image clarity and can be used in cases of dispute.

Anodizing of aluminium and its alloys — Instrumental determination of image clarity of anodic oxidation coatings — Instrumental method

1 Scope

This International Standard specifies an instrumental method for determining the image clarity of anodic oxidation coatings on aluminium and aluminium alloys by measuring reflection from the surface with the help of a sliding combed shutter.

The test can only be applied to a flat surface which can reflect the image on the limited combed shutter and photo-receiver. This method can also measure the optical evenness of anodic oxidation coatings on aluminium and aluminium alloys.

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 2128, *Anodizing of aluminium and its alloys — Determination of thickness of anodic oxidation coatings — Non-destructive measurement by split-beam microscope*

3 Terms and definitions

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

3.1
image clarity
C_n
ability of the surface of an anodic oxidation coating to produce a clear image of an object facing the surface

NOTE Image clarity is expressed as a percentage.

3.2
optical evenness
E
overall uniformity of reflection diminished by the orientation of surface irregularities given by the ratio of the longitudinal and traverse values of the image clarity, because the values of image clarity are usually different in these directions

3.3
dispersion of light
D
change in image clarity produced by altering the comb width

4 Principle

Light comes through a first slit which serves as a light source and it is converted to parallel light through a first lens (collimator), reflected at the surface of the test piece, which is set at 45˚ to the light beam, and is then focussed at a combed shutter through a second lens (condensing lens). If the test piece has a completely flat and smooth surface, the reflected beam is concentrated as a sharp image of the first slit at the combed shutter when the shutter is slid laterally. When the centre of the comb space coincides with the image, the beam passes completely through the space of the comb and generates a signal maximum on the photo-receiver. Otherwise, the beam can not pass through the comb completely and generates a lower signal, depending on the degree of dispersion of the light. This signal corresponds to the image clarity. Optical evenness is shown by the ratio of the longitudinal and transverse values (see 8.4).

5 Apparatus

An example of the apparatus is shown in Figure 1. This instrument is constructed in a similar way to the split-beam microscope in ISO 2128. The reflected image is focussed at the combed shutter and the quantity of light coming through the space of the combed shutter is measured on the photo-receiver. The photo-receiver is connected to a recorder which shows the horizontal progression of the combed shutter on the X-axis and the quantity of light coming through the spaces of the combed shutter on the Y-axis. The general image clarity is thus illustrated exactly by the heights of the waves. A modern instrument which does not use a recorder, but measures the heights of the waves (M and m) of a test specimen for each comb, and when computing the stored values, directly reads the image clarity, may be used.

The essential characteristics of the apparatus are given in 5.1 to 5.7.

5.1 A flat test-piece surface, set at 45˚ to the incident light and with the reflected image measured at 45˚ in the specular direction.

5.2 Lenses, of good quality and with a focal length of 130 mm.

5.3 A light source, consisting of a lamp with a filament not larger than 0,05 mm and capable of providing a constant quantity of light during the measurement.

5.4 A slit, 0,02 mm ± 0,002 mm in width and about 20 mm in length.

5.5 A combed sliding shutter, consisting of a thin sheet with optical slits having a ratio of width of light portion to dark portion 1:1. Five different widths of 0,125 mm (see Note 1); 0,25 mm, 0,5 mm (see Note 2); 1,0 mm and 2,0 mm are incorporated, and the moving speed of the shutter is approximately 10 mm/min or 254 mm/min in the case of digital display.

NOTE 1 The slit forming the light source is 0,02 mm ± 0,002 mm in width and this is similar to the width of this combed shutter. Therefore it is only suitable for very flat products.

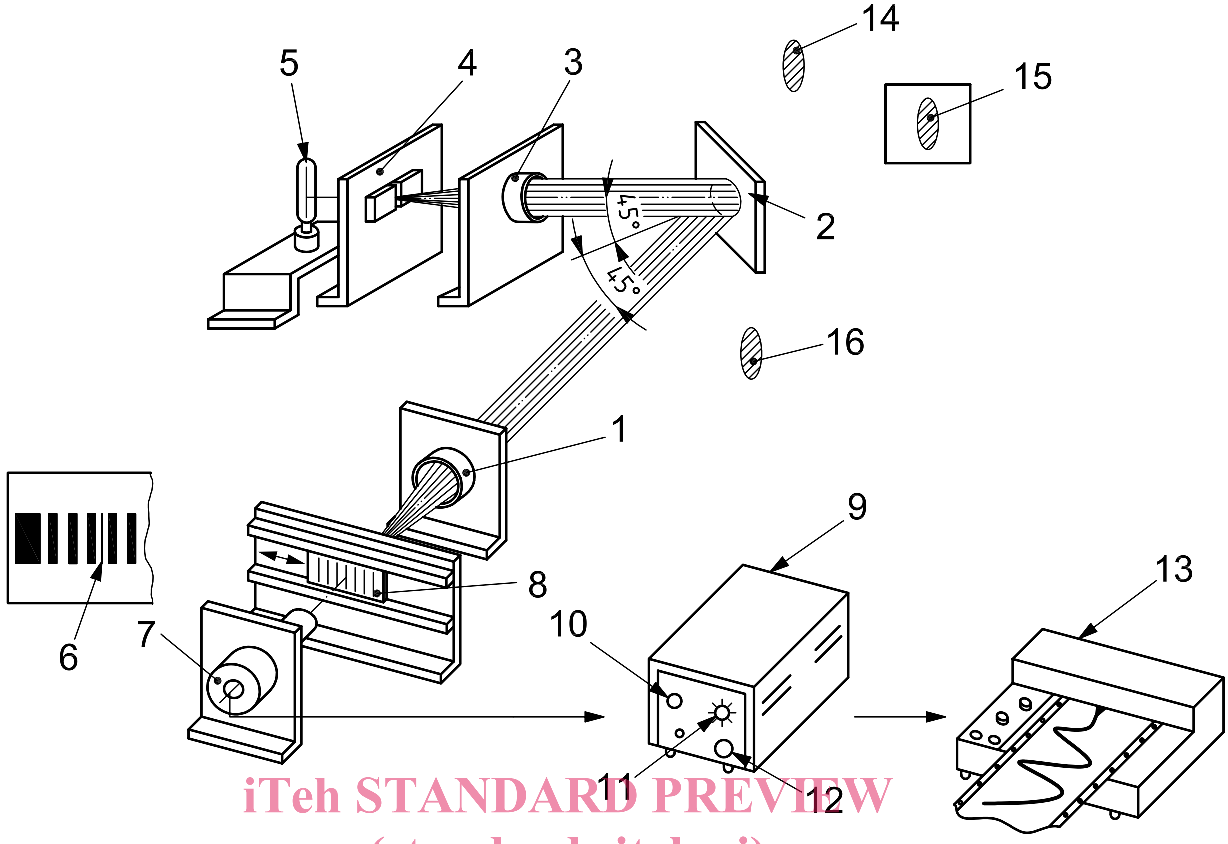
NOTE 2 The combed shutter used is about four times larger than the width of the light source and it is suitable for general use as described in Clause 7.

NOTE 3 The light transmittance of the dark lenses should be virtually zero.

5.6 A photo-receiver, the output of which is sufficiently adjustable to obtain a correct level of image clarity even when the test piece being examined gives a weak reflection.

5.7 Black-glass standard sample, which gives a constant wave height on the recorder when any of the five widths of the combed sliding shutter is used for passing light. The bottom level of the waves is defined as the standard zero level.

The black-glass standard surface used should conform to the specifications of ISO 7668[1].



Key

1 condensing lens
2 test piece
3 collimator
4 slit
5 light source
6 one slit of combed sliding shutter
7 photo receiver
8 optical comb
9 adjusting for sensitivity
10 zero-adjustment knob
11 knob for adjustment of sensitivity
12 knob for fine adjustment of sensitivity
13 light intensive recorder
14 cross-section of incident light
15 illuminated light spot on the test piece
16 cross-section of incident light

Figure 1 — Example of testing apparatus for image clarity measurement

6 Test piece

6.1 Sampling

The test piece shall be taken from a significant flat surface of the product. During sampling, care must be taken to avoid distortion or damage.

Where it is impossible to test the product itself, a test sample may be used. However, in this case, the test sample used shall be one which is representative of the product, and it shall be made from the same material (see the next paragraph) and prepared under the same conditions of finishing (see the last paragraph) as those used for the preparation of the product.

The composition of the basis material, the manufacturing conditions (kind and quality of the material), the surface condition before treatment and all other conditions should be the same as those of the product.

Pretreatment and anodizing should be performed in the same bath and under the same conditions as the treatment of the product.

6.2 Size

The standard size of the test piece should be about 50 mm x 50 mm.

6.3 Treatment before testing

The test piece shall be clean, free from dirt, stains and other foreign matter. Any deposits or stains shall be removed with a clean, soft cloth or similar material.

7 Procedure

7.1 Measurement on the black-glass standard

Mount the black-glass standard (5.7) on the mounting base and record the effect of the received light by moving the combed sliding shutter (5.5). Adjust the bottom of the waves to zero by operating the zero-adjustment knob.

7.2 Initial setting for measurement of the test piece

Mount the test piece on the mounting base, and observe the effect of the received light by moving the combed sliding shutter. Make any necessary adjustments, by operating the sensitivity-adjustment device of the apparatus, so that the value of the highest wave falls at an appropriate position on the recording paper, to facilitate the measurement in 7.3.

7.3 Measurement on the test piece

Carry out measurements on the test piece using each width of comb space. Measure at two different points on each surface tested. If the values are very different, make an additional measurement and record the two largest values. Perform the tests on the test piece turned through 90° to obtain the values in the longitudinal and transverse directions.

8 Expression of results

8.1 Image clarity, C_n

Calculate the image clarity value from the recorded wave heights using the following equation (see Figures 2 and 3):

$$C_n = \frac{M - m}{M + m} \times 100$$

where

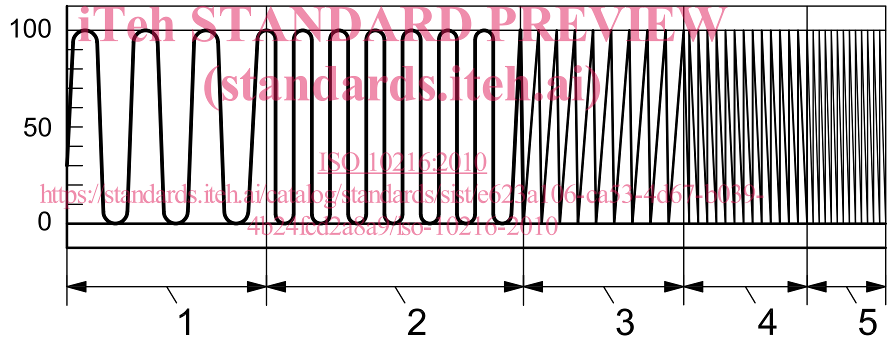
C_n is the image clarity value, expressed as a percentage;

M is the maximum wave height;

m is the minimum wave height;

n is the symbol for the width of the space of the comb.

The values of image clarity are characteristic for the respective optical comb widths.



Key

1 optical comb width 2 mm

2 comb width 1 mm

3 comb width 0,5 mm

4 comb width 0,25 mm

5 comb width 0,125 mm

Figure 2 — Recorded wave form of light received from black-glass standard sample