

Aluminium and aluminium alloys — Anodizing —

**Part 11: Measurement of specular
reflectance and specular gloss of anodic
oxidation coatings at angles of
20°, 45°, 60°, and 85°**

The European Standard EN 12373-11:2000 has the status of a
British Standard

ICS 25.220.20; 77.120.10

National foreword

This British Standard is the official English language version of EN 12373-11:2000. It supersedes BS 6161-12:1987 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee STI/32, Anodic oxidation coatings on aluminium, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 18, an inside back cover and a back cover.

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English version

**Aluminium and aluminium alloys — Anodizing — Part 11:
Measurement of specular reflectance and specular gloss of
anodic oxidation coatings at angles of 20°, 45°, 60° or 85°**

Aluminium et alliages d'aluminium — Anodisation — Partie
11: Mesurage des caractéristiques de réflectance et de
brillant spéculaires des couches anodiques à angles fixes
de 20°, 45°, 60° ou 85°

Aluminium und Aluminiumlegierungen — Anodisieren —
Teil 11: Messung des gerichteten Reflexionsgrades und
des Spiegelglanzes von anodisch erzeugten Oxidschichten
bei Winkeln von 20°, 45°, 60° oder 85°

This European Standard was approved by CEN on 27 July 2000.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 132, Aluminium and aluminium alloys, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2001, and conflicting national standards shall be withdrawn at the latest by February 2001.

It is based upon ISO 7668:1986.

In this standard, annex A is normative.

EN 12373, Aluminium and aluminium alloys — Anodizing, comprises the following parts:

- Part 1: Method for specifying decorative and protective anodic oxidation coatings on aluminium.
- Part 2: Determination of mass per unit area (surface density) of anodic oxidation coatings — Gravimetric method
- Part 3: Determination of thickness of anodic oxidation coatings — Non-destructive measurement by split beam microscope
- Part 4: Estimation of loss of absorptive power of anodic oxidation coatings after sealing by dye spot test with prior acid treatment
- Part 5: Assessment of quality of sealed anodic oxidation coatings by measurement of admittance
- Part 6: Assessment of quality of sealed anodic oxidation coatings by measurement of the loss in mass after immersion in phosphoric acid/chromic acid solution without prior acid treatment
- Part 7: Assessment of quality of sealed anodic oxidation coatings by measurement of the loss in mass after immersion in phosphoric acid/chromic acid solution with prior acid treatment
- Part 8: Determination of the comparative fastness to ultra-violet light and heat of coloured anodic oxidation coatings
- Part 9: Measurement of wear resistance and wear index of anodic oxidation coatings using an abrasive wheel wear test apparatus
- Part 10: Measurement of mean specific abrasion resistance of anodic oxidation coatings using an abrasive jet test apparatus
- Part 11: Measurement of specular reflectance and specular gloss of anodic oxidation coatings at angles of 20°, 45°, 60° or 85°
- Part 12: Measurement of reflectance characteristics of aluminium surfaces using integrating-sphere instruments
- Part 13: Measurement of reflectivity characteristics of aluminium surfaces using a goniophotometer or an abridged goniophotometer
- Part 14: Visual determination of image clarity of anodic oxidation coatings — Chart scale method
- Part 15: Assessment of resistance of anodic oxidation coatings to cracking by deformation
- Part 16: Check for continuity of thin anodic oxidation coatings — Copper sulfate test
- Part 17: Determination of electric breakdown potential
- Part 18: Rating system for the evaluation of pitting corrosion — Chart method
- Part 19: Rating system for the evaluation of pitting corrosion — Grid method

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Specular reflectance and specular gloss are not unique physical properties of a surface. They vary with the angle of measurement, and with the aperture dimensions that define the incident and the reflected beams, such that measurements of these properties are not independent of the apparatus being used.

The specular reflectance of most surfaces increases with the angle of measurement and accounts for the use of reflectometers with various angles as, for example, for painted surfaces. The specular reflectance characteristics of anodized aluminium, however, do not always behave in the normal manner and, because of its property of double reflection, reflected light comes partly from the film surface and partly from the underlying metal. It is advisable to measure the specular reflectance characteristics at 20°, 45°, 60° and 85° to obtain a complete understanding of the specular reflectance properties of the anodized surface, and careful thought should be given to which method or methods are most relevant in any particular situation. The specular reflectance of bright-anodized aluminium with a mirror finish is best measured using 45° or 20° geometry.

1 Scope

This part of this European Standard specifies methods for the measurement of specular reflectance and specular gloss of flat samples of anodized aluminium using geometries of 20° (Method A), 45° (Method B), 60° (Method C) and 85° (Method D), and of specular reflectance by an additional 45° method (Method E) employing a narrow acceptance angle.

The methods described are intended mainly for use with clear anodized surfaces. They can be used with colour-anodized aluminium, but only with similar colours.

2 Terms and definitions

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

2.1

specular reflectance

ratio of the luminous flux, reflected in the specular direction for a specified source and receptor angle, to the luminous flux of the incident light, normally expressed as a percentage

2.2

specular gloss

ratio of the luminous flux, reflected from an object in the specular direction for a specified source and receptor angle, to the luminous flux reflected from glass with a refractive index of 1,567 in the specular direction

NOTE To set the specular gloss scale, polished black glass with a refractive index of 1,567 is assigned the value of 100 for geometries of 20°, 45°, 60° and 85° (see Table 5). The phenomenon of light reflectance by anodized aluminium is very different to that of black glass and the choice of a black glass standard is arbitrary and made to allow comparison of different qualities of anodized aluminium.

3 Principle

The specular reflectance and specular gloss of anodized aluminium surfaces are measured under defined conditions using, as required, geometries of 20°, 45°, 60° or 85°.

4 Apparatus

4.1 Components

The apparatus consists of:

- a) a polychromatic light source and housing with a lens that directs a parallel, or very slightly converging, beam of light onto the surface under test;
- b) means for locating the specimen surface in the correct position for measurement;
- c) a receptor housing containing a lens, a receptor aperture and a photoelectric cell to receive the cone of reflected light;
- d) a sensitivity control for setting the photocell current to any desired value on the instrument scale or digital indicator.

NOTE Since specular reflection is in general spectrally non-selective, the spectral characteristics of the light source and the detector need not be critically controlled for the measurement of normal uncoloured anodized surfaces.

Approximate comparisons between surfaces of the same colour can be made, but an accurate measurement will require the combination of light source, photoelectric cell and associated colour filters to give a spectral sensitivity, approximating to the CIE photopic luminous efficiency function, weighted for CIE standard illuminant C (see CIE 38:1977).

4.2 Geometric conditions

The incident angle ε_1 , which is the angle between the axis of the incident beam and the perpendicular to the surface under test, shall have the following values and tolerances:

- for Method A: $20^\circ \pm 0,1^\circ$;
- for Method B: $45^\circ \pm 0,1^\circ$;
- for Method C: $60^\circ \pm 0,1^\circ$;
- for Method D: $85^\circ \pm 0,1^\circ$;
- for Method E: $45^\circ \pm 0,1^\circ$.