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Lastnosti odsevnih površin v svetilkah

Perfomance of reflecting surfaces for luminaires

Bewertung von Reflektoroberflächen für den Einsatz in Leuchten

Performance des surfaces réfléchissantes pour luminaires

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Perfomance of reflecting surfaces for luminaires

Performance des surfaces réfléchissantes pour luminaires

Bewertung von Reflektoroberflächen für den Einsatz in Leuchten

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 16268:2013) has been prepared by Technical Committee CEN/TC 169 “Light and lighting”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.

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1 Scope

This European standard is applicable to the optical performance of untreated or coated materials supplied in plane sheet or strip form for use as a plane or formed reflector as well as preformed reflectors both as originally produced and after prescribed tests to determine probable maintained performance in service. This includes:

a) untreated base materials, including:

   1) aluminium,

   2) steel,

   3) plastic,

   4) glass.

b) surface treated materials, including:

   1) polished materials,

   2) anodised materials,

   3) vacuum metallised materials,

   4) painted materials,

   5) multilayer systems.

This European Standard is not applicable to fluorescent materials.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12665, *Light and lighting — Basic terms and criteria for specifying lighting requirements*

EN ISO 4892-3:2006, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3:2006)*

EN ISO 6270-2:2005, *Paints and varnishes — Determination of resistance to humidity — Part 2: Procedure for exposing test specimens in condensation-water atmospheres (ISO 6270-2:2005)*

ISO 7668, *Anodizing of aluminium and its alloys — Measurement of specular reflectance and specular gloss of anodic oxidation coatings at angles of 20 degrees, 45 degrees, 60 degrees or 85 degrees*

ISO 9211-4:2012, *Optics and photonics — Optical coatings — Part 4: Specific test methods*

ISO 15184:2012, *Paints and varnishes — Determination of film hardness by pencil test*

CIE 15.3:2004, *Colorimetry*

CIE 130:1998, *Practical methods for the measurement of reflectance and transmittance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12665, CIE 130:1998 and the following apply.

3.1
light reflecting surface of a luminaire
all reflecting surfaces of a luminaire with the main task of reflecting light and therefore with a total reflectance of at least 50 %

3.2
reflection
process by which radiation is returned by a surface or a medium, without change of frequency of its monochromatic components

3.3
total reflectance
reflectance
ρ_{tot}
ratio of the whole reflected luminous flux to the incident flux:

$$\rho_{tot} = \phi_{tot} / \phi_i = \frac{\int_0^\infty S(\lambda) \cdot \rho(\lambda) \cdot V(\lambda) d\lambda}{\int_0^\infty S(\lambda) \cdot V(\lambda) d\lambda} \quad (1)$$

where

$\rho(\lambda)$ is the total spectral reflectance of the sample;

$S(\lambda)$ is the relative spectral power distribution of the incident radiation of standard illuminant A;

ϕ_{tot} is the total luminous flux reflected by the sample;

ϕ_i is the total incident luminous flux on the sample,

$V(\lambda)$ is the relative spectral weighting function of standard Observer at 2°.

3.4
diffuse reflectance
ρ_d
ratio of the diffuse reflected part of the reflected luminous flux to the incident flux:

$$\rho_d = \phi_d / \phi_i = \frac{\int_0^\infty S(\lambda) \cdot \rho_d(\lambda) \cdot V(\lambda) d\lambda}{\int_0^\infty S(\lambda) \cdot V(\lambda) d\lambda} \quad (2)$$

where

ρ_d is the diffuse spectral reflectance characteristic of the sample;

ϕ_d is the diffuse reflected luminous flux;

ϕ_i is the incident luminous flux;

$S(\lambda)$ is the relative spectral power distribution of the incident radiation of standard illuminant A;

$V(\lambda)$ is the relative spectral weighting function of standard Observer at 2°.

3.5
specular reflectance
regular reflectance
ρ_r
reflection in accordance with the laws of geometrical optics, without diffusion, expressed as the ratio of the regular reflected part of the reflected luminous flux to the incident luminous flux:

$$\rho_r = \phi_r / \phi_i = \frac{\int_0^\infty S(\lambda) \cdot \rho_r(\lambda) \cdot V(\lambda) d\lambda}{\int_0^\infty S(\lambda) \cdot V(\lambda) d\lambda} \quad (3)$$

where

$\rho_r(\lambda)$ is the regular spectral reflectance characteristic of the sample;

ϕ_r is the specular reflected luminous flux;

ϕ_i is the incident luminous flux;

$S(\lambda)$ is the relative spectral power distribution of the incident radiation;

$V(\lambda)$ is the relative spectral weighting function of standard Observer at 2°.

3.6
reflectance class
performance classification for reflecting materials determined from the total reflectance and expressed as a character from A+ to H indicating decreasing reflectance efficiency

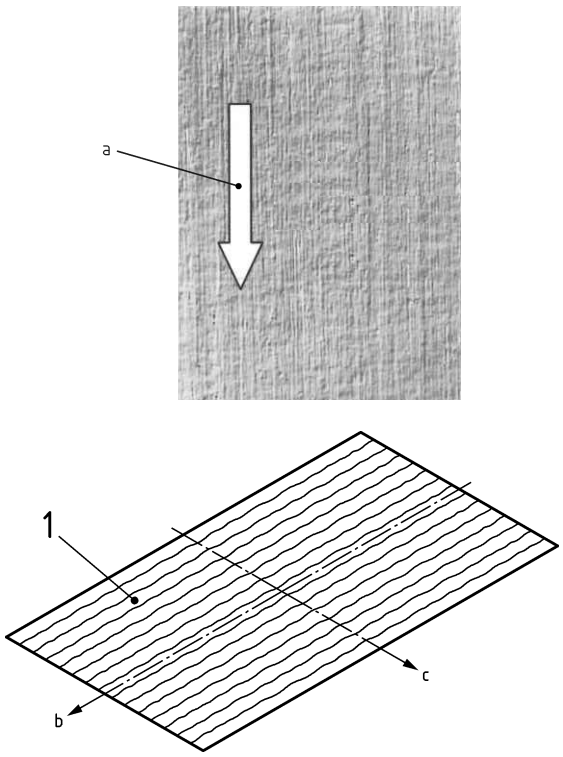
4 Measurement methods

4.1 General

The format of samples shall be plane and the minimum dimensions should be 100 mm x 100 mm.

For formed reflectors, a plane sample of the reflector should be taken or a plane sample of the same material should be produced in the same manner as the final reflector.

For materials manufactured by a linear process, measurements shall be made with the plane of incidence both parallel (i. e. longitudinal) to and perpendicular (i. e. transverse) to the linear process direction which shall be marked by the manufacturer on the samples, see Figure 1. The relevant symbols shall be marked by an index "L" for longitudinal direction and by "T" for transverse direction.



Key
1 sample
a rolling direction
b parallel direction
c perpendicular direction

Figure 1 — Illustration of measurement parallel and perpendicular to the linear process direction

For embossed structured surfaces, the width of the illuminated area on the sample inside the sphere according to Annex A shall be at least three times larger than the dimension of the structure. Depending on the kind of structure, measurements in three or four directions shall be considered. In Annex D, examples of structure are illustrated.

NOTE Due to the undulating surface of embossed materials, good contact between the sample and the rim of the sample port cannot be maintained at all points. The resulting light leakage can cause the results of measurements made on these materials to be lower than their actual total reflectance values.

4.2 Total reflectance ρ_{tot}

The measurement shall be made in accordance with Annex A and documented.

For materials manufactured by a linear process, measurements shall be made with the plane of incidence both parallel to and perpendicular to the linear process direction (see Figure 1). For all other materials measurement shall be done in two perpendicular directions.

Five measurements in each of these directions on different areas of the materials are required.

The mean longitudinal value and the mean transverse value across all samples shall be calculated.

The total reflectance shall be the higher value of the mean values.

The uncertainty of the measurement process shall be documented, stating the percentage of uncertainty and the method by which the value was determined.

4.3 Diffuse reflectance ρ_d

The diffuse reflectance ρ_d shall be measured according to Annex A and documented.

For materials manufactured by a linear process, measurements shall be made with the plane of incidence both parallel to and perpendicular to the linear process direction (see Figure 1). For all other materials, measurement shall be done in two perpendicular directions.

Five measurements in each of these directions on different areas of the materials are required.

The lowest longitudinal value and the lowest transverse value across all samples shall be recorded.

NOTE For diffuse reflectance measurement, the lowest value is taken in order to avoid errors due to sample distortion causing the specular reflected light to strike the edge of the sphere exit aperture.

The diffuse reflection shall be the mean of the two recorded values.

4.4 Specular reflectance ρ_r, ρ_{rL}, ρ_{rT}

Measurement shall be made according to Annex A in both longitudinal and transverse directions.

For nonlinear processed materials the measurements should be made in two perpendicular directions.

Five measurements in each of these directions on different areas of the materials are required.

The mean longitudinal value ρ_{rL} and the mean transverse value ρ_{rT} across all samples shall be calculated.

Values of transverse and longitudinal directions shall both be stated.

4.5 Colour

Colour shall be expressed in CIE L*a*b*-system using standard illuminant D65 (Daylight) (see CIE 15.3:2004).

Five measurements at different points of the surface shall be measured and the average values L, a*, b* shall be taken. Measurements made before and after the durability tests shall be made using the same instrument and the same method.

5 Durability test methods for evaluation of reflective materials based on maintained performance under different specified conditions

5.1 General

Different reflector materials show different rates of reflectance loss due to the effects of oxidation, humidity, UV exposure and abrasion. The durability tests used in this standard and described below are used to demonstrate within a short time of testing the likely relative deterioration of a reflector material in normal service and give an indication of the maintained performance.

It is the responsibility of the user of the material to perform suitable tests to determine the worst case operating condition (e.g. highest temperature reached on the reflector surface, etc.) within their application.

For each test on a batch of materials, a new sample with equal properties to the others is required.

Measurement of reflectance values shall be made according to Clause 4, Annex A and Annex B. All measurements before and after durability tests shall be made with the same instrument under the same measurement conditions.

The same panel shall be measured before and after each exposure.

Films and foils shall be tested on the proposed base material.

5.2 Temperature resistance

The test shall be carried out in air at one or more of the following temperatures T: 80 °C, 120 °C, 160 °C, 200 °C, 250 °C, 300 °C, 400 °C.

Temperature level T shall be recorded as shown in Table 2 and Table 3.

Test duration shall be 168 h without interruption.

The temperature resistance tests are carried out by placing test panels of the reflecting materials in an oven at the stated temperature. The temperature shall be maintained within +/- 5°C for the duration of the test.

The reflective surface shall not make contact with any other surface during the test.

The physical condition of the material shall be observed after the test and any deterioration shall be recorded (see Table 3).

5.3 Humidity resistance

The humidity test shall be carried out in a test cabinet with constant condensation at 40 °C for a duration of 168 h without interruption according to EN ISO 6270-2:2005, Table 1, code CH, using deionised water.

The reflective surface shall not make contact with any other surface during the test.

The physical condition of the material shall be observed after the test and any deterioration shall be recorded (see Table 3).

5.4 UV-Exposure resistance

Durability on exposure to UV- radiation shall be tested according to EN ISO 4892-3:2006, Table 4, cycle no. 5 for a duration of 504 h (three weeks).

The reflective surface shall not make contact with any other surface during the test.

The physical condition of the material shall be observed after the test and any deterioration shall be recorded (see Table 3).

5.5 Abrasion resistance

Measurements shall be made according to ISO 9211-4:2012 (see Annex B).

The physical condition of the material shall be observed after the test and any deterioration shall be recorded (see Table 3).

5.6 Scratch resistance

Measurements shall be made according to ISO 15184:2012 (see Annex B).

The physical condition of the material shall be observed after the test and any deterioration shall be recorded together with the hardness of the pencil causing the deterioration (see Table 3).

6 Classification

The Reflectance Class represents the total reflectance of the surface indicating the potential for energy efficiency of the material when used in a luminaire.