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Plastics — Determination of total luminous transmittance and reflectance

Plastiques — Détermination de la transmission lumineuse totale et de la réflectance

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Foreword

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This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies not only the total luminous transmittance of colourless and transparent plastics that have been covered by ISO 13468-1, but also specifies the transmittance of translucent materials such as opal sheets and the reflectance of materials such as translucent and/or opaque sheets or films.

Plastics — Determination of total luminous transmittance and reflectance

1 Scope

This document specifies the determination of total luminous transmittance and total luminous reflectance on clear, translucent or opaque plastics. Specimen shapes include moulded plaque or discs, films and sheets.

Fluorescent plastics and chromatic colour plastics are not covered by this document.

NOTE The scope of ISO 13468-1 shows that ISO 13468-1 covers planar transparent and substantially colourless plastics. The method in this document provide the way to trap diffused light and covers to measure translucent and opaque plastics.

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.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO/CIE 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
total luminous transmittance
τ_t
ratio of the transmitted luminous flux to the incident luminous flux when a collimated beam of light passes through a specimen

3.2
total luminous reflectance
ρ_t
ratio of the reflected luminous flux to the incident luminous flux when a collimated beam of light reflected on a specimen

4 Principle

When evaluating the total luminous transmittance of light diffusing material, the scattered light will go toward the edge of the specimen by its light diffusing property. This method intends to collect scattered

light from the edge of the specimen toward inside of the integrating sphere. This method is suitable for not only light diffusing materials but also clear materials.

This method can also evaluate total luminous reflectance of clear, translucent or opaque materials.

NOTE When evaluating the specimen which has almost zero absorption of light such as PMMA milky white, sum of total luminous transmittance and total luminous reflectance will be 100 % or around.

5 Apparatus

5.1 The apparatus shall consist of a stabilized light source, an associated optical system, an integrating sphere with ports, and a photometer comprising a photo-detector, signal processor and display unit or recorder (see Figure 1).

5.2 The light source and the photometer shall be used in conjunction with a filter to provide an output corresponding to the photopic standard luminous efficiency $V(\lambda)$ (as defined in ISO/CIE 11664-1), which is identical to the colour-matching function $\bar{y}(\lambda)$ specified in ISO/CIE 11664-1 under CIE standard illuminant D65 as specified in ISO 11664-2. The output of the photodetector shall be proportional to the incident flux, to within 1 % of the incident flux, over the range used. The spectral and photometric characteristics of the light source and photometer shall be kept constant during measurements.

5.3 The total port area (sum of area of the port a, b, c and d) shall not exceed 4,0 % of the internal reflecting area of the sphere. It is desirable for the diameter of integrating sphere to be not less than 150 mm to be big enough for a specimen to pull together the scatter light to the thickness direction of the specimen enough.

5.4 Ports a, b and c shall be centred on the same great circle of the sphere. The angle between line ac and line bc shall be 14 °. Where the line ac means the line which links the centre of port c to the centre of port a, and the line bc means the line which links the centre of port b to the centre of port c. Port d shall not be in the great circle on the sphere with port a, b and c.

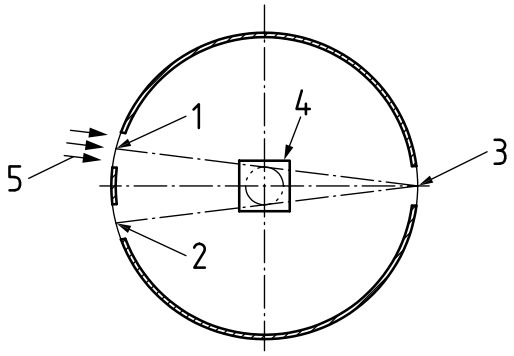
5.5 The light source and its associated optical system shall produce a collimated light beam, no ray of which makes an angle of more than 0,05 rad (3°) with the beam axis. The centre of light flux shall be matched up precisely with the centre of the port a. The cross-section of light flux shall be circular and have sharp image. The diameter of light flux at the port a shall be 0,5 to 0,6 times of specimen, excluding evaluation of reflectance for opaque specimen.

5.6 The white reference which is attached on the port c shall have the even high reflectance for all wavelengths of the visible ray. Barium sulfate and Polytetrafluoroethylene (PTFE) are suitable. The inner wall of the integrating sphere shall have a coating applied that has the same reflectance as a white reference.

5.7 The light trap which is attached on the port b or port c shall absorb light completely when port b or port c doesn't have specimen nor white reference attached.

5.8 When the specimen has higher haze and higher thickness, specimen shape shall be circular and loaded with specimen holder specified on the Figure 3. The inner surface of specimen holder shall have metallic luster. Because the specimen holder can collect scattering light which go toward the edge of the specimen.

5.9 The photometer is attached on the port d. The photometer shall be fitted with baffles to prevent light falling on it directly from the specimen.



Key

1 port a
2 port b
3 port c
4 port d: photometer
5 incident light

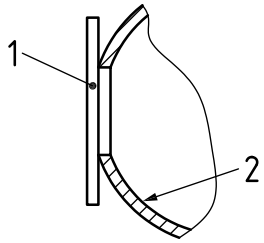
Figure 1 — Apparatus (integrating sphere and ports)

6 Specimen

6.1 Specimen shall be machined from film, sheet, injection moulded article or compression moulded article. Specimen shall be flat. The thickness of specimen shall be original thickness.

6.2 There are two types of the specimen.

6.2.1 For the test without specimen holder, see Figure 2.



Key

1 specimen
2 inner surface of integrating sphere

Figure 2 — Specimen without specimen holder

Diameter of the specimen shall be the range from 1,7 to 2,0 times of the diameter of the port.

This type covers the specimen which has thinner thickness than 10 % of the diameter of the port, or lower Haze than 30 %.