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Plastics — Determination of image clarity (degree of sharpness of reflected or transmitted image)

Plastiques — Détermination de la clarté de l'image (degré de netteté de l'image réfléchie ou transmise)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical chemical properties*.

Introduction

Visual assessment of the image clarity of plastics is carried out by evaluating the sharpness of an image reflected from a surface, using a specified incident angle, for reflection. For transmission, image sharpness is evaluated by viewing a suitable target through the plastic. The degree of image clarity is influenced by the clearness, surface irregularities and haziness of surfaces. Gloss meters and haze meters do not correctly access this phenomenon. Image clarity is not the same as and should not be confused with gloss or haze. Therefore, standardized methods for determining the optical parameter of image clarity are needed.

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Plastics — Determination of image clarity (degree of sharpness of reflected or transmitted image)

1   Scope

This International Standard specifies an instrumental method for determining the image clarity on plastics specimens by measuring reflection from the specimen surface or transmission through the specimen.

The method can be applied only to a flat surface.

NOTE   For same materials, different values of image clarity can be obtained depending on specimen preparation.

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 472, *Plastics — Vocabulary*

ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°*

ISO 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 terms and definitions given in ISO 472 and the following apply.

3.1
image clarity
degree of sharpness of an image reflected by a specimen or transmitted through a specimen

Note 1 to entry: Image clarity is expressed in percentage (%).

4   Principle

For the measurement of image clarity, a lamp illuminates the narrow source aperture-slit. The collimating lens projects a parallel beam upon the specimen. The image is either reflected from or transmitted through the specimen, as appropriate. The image is received by the de-collimating lens and focused upon the optical mask. The light passing through the optical mask is received by the light receptor. This resultant signal is processed yielding image clarity values.

5   Instrument

5.1   Light source sand spectral response. 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 $V(\lambda)$, which is identical to the colour-matching function $y(\lambda)$ specified in ISO 11664-1, under CIE standard illuminant A 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.

5.2 **Slit**, 0,03 mm ± 0,01 mm in width and not less than 20 mm in length.

5.3 **Optical mask**, consisting of opaque and transparent lines having the same width and spacing. Six different groups of lines having different widths are utilized. An optical mask is illustrated in Figure 1. Table 1 gives the dimension for the lines of the optical mask.
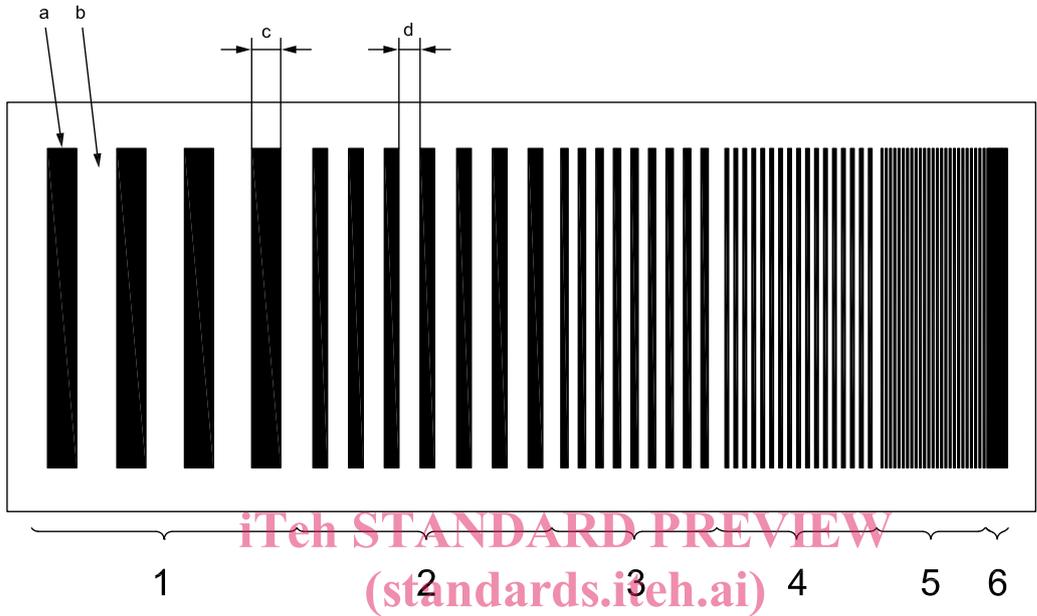
Key

a opaque area

b transparent area

c width of opaque area

d width of transparent area

Group 1 transparent and opaque lines each 2,0 mm in width

Group 2 transparent and opaque lines each 1,0 mm in width

Group 3 transparent and opaque lines each 0,5 mm in width

Group 4 transparent and opaque lines each 0,25 mm in width

Group 5 transparent and opaque lines each 0,125 mm in width

Group 6 opaque line 1,0 mm in width

Figure 1 — Optical mask of image clarity

Table 1 — Optical mask (dimensions)

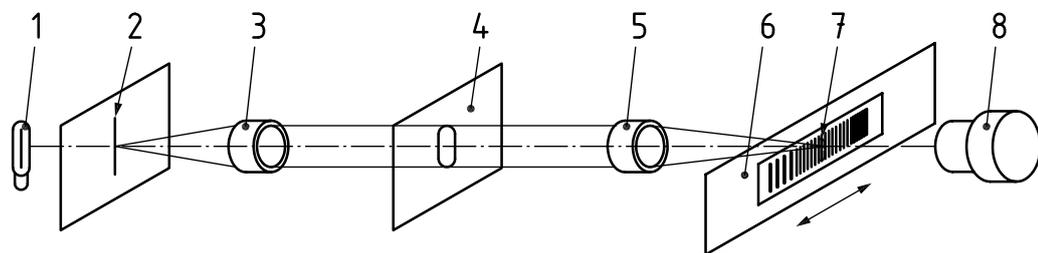| Group No.	Optical mask line width mm	Quantity	Tolerance mm	Group width mm
1	2,000	4	±0,200	16
2	1,000	6	±0,100	12
3	0,500	9	±0,050	9
4	0,250	16	±0,025	8
5	0,125	21	±0,013	5,25
6	1,000 (only opaque)	1	±0,100	1
NOTE Other dimensions of the optical mask may be used depending on the surface structure of the specimen if agreed upon between the interested parties.				

5.4   Geometry (for reflection measurement). The normal geometry is 45°:45°. The 60°:60° may be used if agreed upon between the interested parties.

NOTE   The 60°:60° geometry may be used depending on the surface structure of the specimen for conforming the visual assessments.

5.5   Black glass standard, giving a constant light intensity when any of the five line widths of optical mask 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 specifications such as given in ISO 2813.

5.6   Structure. A diagrammatic representation of the apparatus used for evaluation of image clarity in transmission is shown in Figure 2. Figure 3 shows a diagrammatic representation for reflection measurement of image clarity.

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Key

1   light source
2   source aperture-slit
3   collimating lens with a focal length 130 mm
4   specimen

5   de-collimating lens with a focal length 130 mm
6   optical mask
7   image of source aperture-slit on the optical mask
8   light receptor

Figure 2 — Typical diagrammatic representation for transmission measurement of image clarity
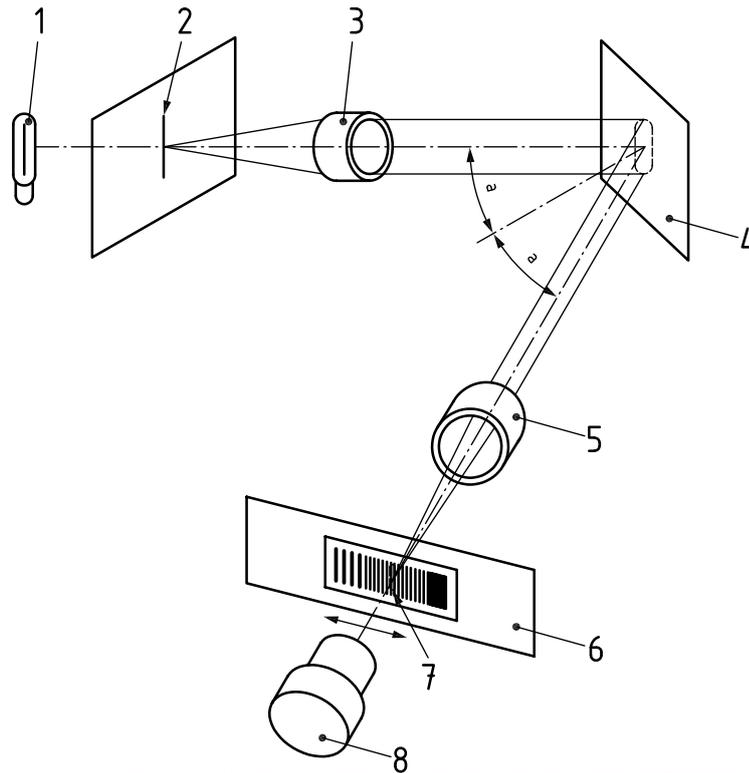
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Key

1   light source
2   source aperture-slit
3   collimating lens with a focal length 130 mm
4   specimen
a   45° or 60°

5   de-collimating lens with a focal length 130 mm
6   optical mask
7   image of source aperture-slit on the optical mask
8   light receptor

Figure 3 — Typical diagrammatic representation for reflection measurement of image clarity

6   Test specimen

For transmission and reflection, the size of the test specimen should be:

a)   not less than 30 mm × 30 mm,

b)   not larger than 150 mm × 150 mm, and

c)   less than 10 mm in thickness.

7   Procedure

7.1   Zero adjustment

Make a zero adjustment using the dark portion of the optical mask without specimen for transmission and with the black glass standard for reflection.

7.2 Sensitivity adjustment

Scan the optical mask over its full range and adjust the full scale standardization sensitivity so that the maximum signal is not saturating the electronics. That is increasing the sensitivity and causes a corresponding change in signal at maximum signal condition.

7.3 Measurement on the test specimen

Some specimens exhibit directionality. For those specimens, it is necessary to measure in one orientation, rotate 90° and measure again. If necessary, carry out measurements for other additional orientations. Record the image clarity values and the orientation of the specimen relative to the slit.

If specimens exhibit directionality and image clarity values do not conform to visual assessment, it is necessary to measure another direction.

8 Calculation

Calculate the image clarity value from the wave heights using Formula (1) (see Figure 4);

$$C(n) = \frac{M_n - m_n}{M_n + m_n} \times 100\,(\%) \tag{1}$$

where

$C(n)$ is the image clarity value, expressed as a percentage, at n (mm) of the optical mask line width;

M_n is the maximum relative light intensity at n (mm) of the optical mask line width;

m_n is the minimum relative light intensity at n (mm) of the optical mask line width.

NOTE 1   When the image clarity value is high, the image can be seen clearly. On the contrary, when the image clarity value is low, the image is distorted.

NOTE 2   Examples of determination of image clarity are shown in Annex A.

NOTE 3   Precision of the image clarity is shown in Annex B.