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**Fine ceramics (advanced ceramics,  
advanced technical ceramics) —  
Determination of light transmittance of  
ceramic films with transparent substrate**

*Céramiques techniques — Détermination de la transmission de la  
lumière des films céramiques avec substrats transparents*

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## Foreword

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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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20508 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

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# Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of light transmittance of ceramic films with transparent substrate

## 1 Scope

This International Standard specifies a test method for determining the visible light transmittance of a transparent coating material, e.g., the transparent electrode for display devices, in which a fine ceramic thin film is coated on to a substrate. This International Standard is not applicable to deliberately coloured, uneven or non-parallel faced test pieces. A translucent medium is not included in this International Standard.

## 2 Terms and definitions

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

### 2.1

#### **transmittance**

proportion of incident light which is transmitted through a transparent or semi-transparent body for a given luminous flux, expressed as a percentage

### 2.2

#### **spectral transmittance**

proportion of incident light which is transmitted through a transparent or semi-transparent body for a given monochromatic wavelength, expressed as a percentage

### 2.3

#### **reference**

means of providing 100 % transmittance that, for the purposes of this International Standard, is considered to be an air blank

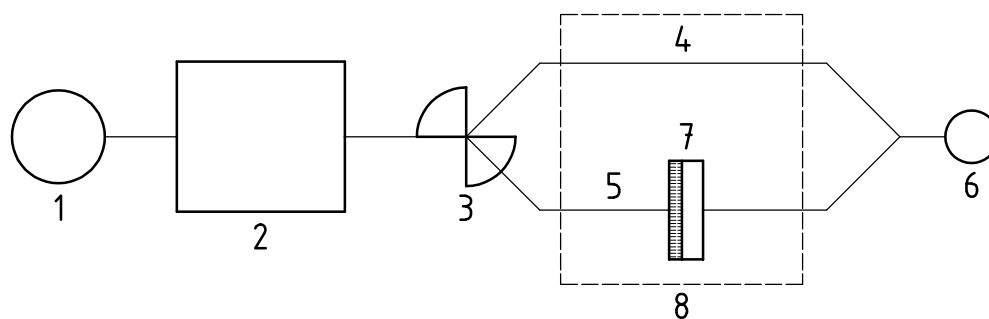
## 3 Principle of test and measurement

This International Standard concerns the measurement of spectral transmittance using a spectrophotometer, employing an air blank as a 100 % transmittance reference. The substrate alone shall not be used as the reference. The schematic diagram of the measurement equipment is shown in Figure 1. The transmittance is measured by placing the test piece perpendicular to the light beam as indicated in Figure 2 so that the beam is incident perpendicularly on the film side of the test piece and transmitted to the substrate side and thence to the detector.

## 4 Test environment and test conditions

### 4.1 Test environment

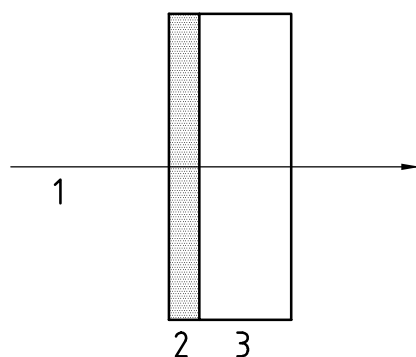
The test shall be carried out at a temperature between 15 °C and 27 °C and in an environment of between 35 % and 85 % humidity and which is free from mechanical vibrations that may affect the measurement. If there are specific conditions of use specified for the spectrophotometer, they shall be followed.



**Key**

- 1 light source
- 2 monochromator
- 3 sector or beam splitter
- 4 reference beam
- 5 sample beam
- 6 detector
- 7 sample
- 8 sample compartment

**Figure 1 — Schematic diagram of spectrophotometer**



**Key**

- 1 light beam
- 2 thin film
- 3 substrate

**Figure 2 — Cross section of installed specimen in light path**

**4.2 Test conditions**

The test conditions shall be as follows.

- a) The test-piece shall be placed with its coated face towards the light source and normal to it.

NOTE Although in principle the transmittance should not be dependent on the direction of light transmission, this International Standard unifies the procedure by specifying this condition. The angle tolerance on perpendicularity of the film/substrate to the light beam is  $1^\circ$ .

- b) The range of wavelength to be used for measurement shall be 380 nm to 780 nm.

- c) The spectral bandwidth of sample beam (in Figure 1) shall be smaller than 10 nm, and with advantage may be smaller than 2 nm.
- d) A wavelength scanning speed and spectrophotometer response time shall be selected for which, in accordance with the instruction manual for the instrument, no distortion is produced in the spectrum.

## 5 Apparatus

The measurement shall be based on the use of a spectrophotometer with the following minimum performance and functions.

**5.1 Spectrophotometer**, with the following performance specifications:

**5.1.1 Wavelength range**, capable of operating over at least the range given in 4.2 b).

**5.1.2 Wavelength accuracy**,  $\pm 0,5$  nm or less; the accuracy shall be calibrated by use of a wavelength standard before the test.

**5.1.3 Photometric accuracy**, (of the transmittance measurement)  $\pm 0,5$  % or less; the accuracy shall be checked by use of one or more certified transmittance standards (see Clause 6) before the test, or periodically.

**5.2 Test-piece holder**, capable of holding the test-piece with its surface perpendicular to the incident light beam.

## 6 Certified reference materials

### 6.1 General

The following reference materials shall be used for calibration and checking the performance of the spectrophotometer.

### 6.2 Wavelength standard

A certified optical filter calibrated for wavelength, or a well-established spectral line of the light source shall be used.

### 6.3 Transmittance standard

A certified optical filter with defined transmittance as a function of wavelength shall be used.

NOTE The transmittance standard is a specimen authorized by an official organization such as National Institute of Standards and Technology (NIST) or Japan Quality Assurance Organization (JQA).

## 7 Test-piece

The test-piece shall comprise a fine ceramic thin film coated on to the surface of a substrate such as glass, or a piece cut from such an item. The test-piece is wide enough for the luminous flux. The measurement is carried out on a test-piece to which no dust is adherent.

NOTE Dust and other dirt adhering to either face of the test-piece or reference standards can influence the transmittance spectrum by scattering light. Dust should be removed by a gentle clean-air jet. Adherent dirt should be removed only by methods agreed upon between relevant parties since damage to the film may result.

## 8 Method

Unless otherwise instructed in the recommended operational procedure for the spectrophotometer, determine the baseline of the spectrophotometer in the absence of a test-piece or reference to obtain the 100 % transmittance in accordance with the conditions given in 4.1 and over the wavelength range given in 4.2 b). Digitize the curve every 10 nm over the range 380 nm to 780 nm.

Unless recently calibrated, insert the cleaned certified wavelength standard into the test-piece holder and measure the transmittance spectrum. Check that the certified wavelength values are obtained to within  $\pm 0,5$  nm.

Insert the certified transmittance standard into the test-piece holder and measure its transmittance spectrum. Digitize the transmittance at the wavelength described in the data table of the transmittance standard over the range 380 nm to 780 nm. Check that the measured transmittance is in agreement with the certified values to within 1 %.

Insert the test piece into the test-piece holder and measure its transmittance spectrum. Digitize the transmittance every 10 nm over the range 380 nm to 780 nm. Normalize the digitized transmittance spectrum by the air blank to give the test-piece transmittance, and express as a percentage.

## 9 Test report

The test report shall contain at least the following information:

- a) reference to this International Standard, i.e., determined in accordance with ISO 20508;
- b) name and address of the testing establishment;
- c) date of the test, a unique identification of the report and of each page, the customer's name and address and a signatory to the report;
- d) description of the spectrophotometer used, and the certified materials used for wavelength and transmittance standards;
- e) description of the test-piece and its identity;
- f) test conditions used, including wavelength range, spectral bandwidth and wavelength scanning speed;
- g) original spectrum and the digitized transmittance spectrum, expressed as a percentage.



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