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Fine ceramics (advanced ceramics, advanced technical ceramics) — Light source for testing semiconducting photocatalytic materials used under indoor lighting environment

Céramiques techniques — Sources lumineuses destinées aux essais des matériaux photocatalytiques semi-conducteurs dans un environnement d'éclairage intérieur

Reference number
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Foreword

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The committee responsible for this document is ISO/TC 206, *Fine ceramics*.

Fine ceramics (advanced ceramics, advanced technical ceramics) — Light source for testing semiconducting photocatalytic materials used under indoor lighting environment

1 Scope

This International Standard specifies the light source and radiometer used in the performance evaluation of semiconducting photocatalytic materials used under an indoor lighting environment in a laboratory. A light source of an indoor lighting environment does not include the sunlight passing through the window glass.

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 10677, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Ultraviolet light source for testing semiconducting photocatalytic materials*

IEC 60081, *Double-capped fluorescent lamps — Performance specification*

CIE 13.3:1995, *Method of measuring and specifying colour rendering properties of light sources*

IEC 60050-845: 1987, *International electrotechnical vocabulary, Lighting*

3 Terms and definitions

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

3.1
photocatalyst
substance that carries out many functions based on oxidization and reduction reactions under optical irradiation, including decomposition and removal of air and water contaminants, deodorization, and antibacterial, antifungal, self-cleaning and antifogging actions

3.2
indoor light-active photocatalyst
substance that carries out many functions based on oxidization and reduction reactions produced by artificial light sources for general lighting service, including decomposition and removal of air and water contaminants, deodorization, and antibacterial, antifungal, self-cleaning and antifogging actions

3.3
indoor lighting environment
indoor lighting environment with artificial light sources for general lighting service that does not include sunlight

3.4
correlated colour temperature
the temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions

Note 1 to entry: The correlated colour temperature is expressed in kelvins (K).

Note 2 to entry: The recommended method of calculating the correlated colour temperature of a stimulus is to determine on a chromaticity diagram the temperature corresponding to the point on the Planckian locus that is intersected by the agreed isotemperature line containing the point representing the stimulus.

Note 3 to entry: Reciprocal correlated colour temperature is used rather than reciprocal colour temperature whenever correlated colour temperature is appropriate.

[SOURCE: IEC 60050-845: 1987, definition 845-03-50]

3.5
colour rendering index
measure of the degree to which the psychophysical colour of an object illuminated by the test illuminant conforms to that of the same object illuminated by the reference illuminant, suitable allowance having been made for the state of chromatic adaptation

[SOURCE: IEC 60050-845: 1987, definition 845-02-61]

3.6
CIE 1974 general colour rendering index
Ra
mean of the CIE 1974 special colour rendering indices for a specified set of eight test colour samples

[SOURCE: IEC 60050-845: 1987, definition 845-02-63]

3.7
high transmission region
HTR
wavelength region for which transmittance of a UV sharp cut-off filter is larger than 72 %; it is one of the performance descriptions for UV sharp cut-off filters

Note 1 to entry: See Key A in Figure 1.

3.8
threshold limit wavelength of high transmission
TLH
wavelength for which transmittance of a UV sharp cut-off filter is 72 %; it is one of the performance descriptions for UV sharp cut-off filters

Note 1 to entry: See Key B in Figure 1.

3.9
absorption region
AR
wavelength region for which transmittance of a UV sharp cut-off filter is less than 5 %; it is one of the performance descriptions for UV sharp cut-off filters

Note 1 to entry: See Key C in Figure 1.

3.10
threshold limit wavelength of absorption
TLA
wavelength for which transmittance of a UV sharp cut-off filter is 5 %; it is one of the performance descriptions for UV sharp cut-off filters

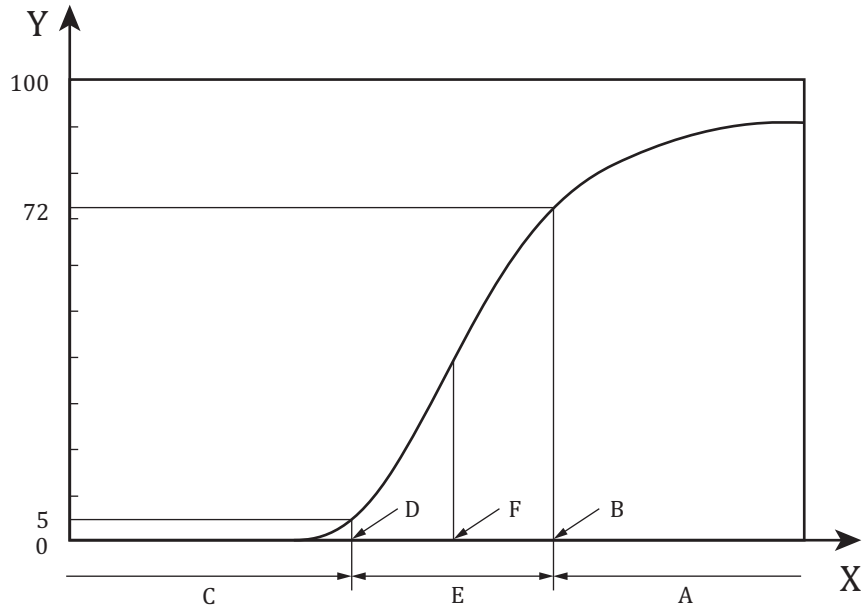
Note 1 to entry: See Key D in Figure 1.

3.11
range of slope
RoS
wavelength difference between the threshold limit wavelength of high transmission (TLH) and that of absorption (TLA); it is one of the performance descriptions for UV sharp cut-off filters

Note 1 to entry: See Key E in Figure 1.

3.12
threshold limit wavelength of transmission
TLT
middle wavelength of the threshold limit wavelength of high transmission (TLH) and threshold limit wavelength of absorption (TLA); it is one of the performance descriptions for UV sharp cut-off filters

Note 1 to entry: See Key F in Figure 1.



Key
X wavelength, nm
Y transmittance, %
A high transmission region (HTR)
B threshold limit wavelength of high transmission (TLH)
C absorption region (AR)
D threshold limit wavelength of absorption (TLA)
E range of slope (RoS)
F threshold limit wavelength of transmission (TLT)

Figure 1 — Definitions of UV sharp cut-off filters

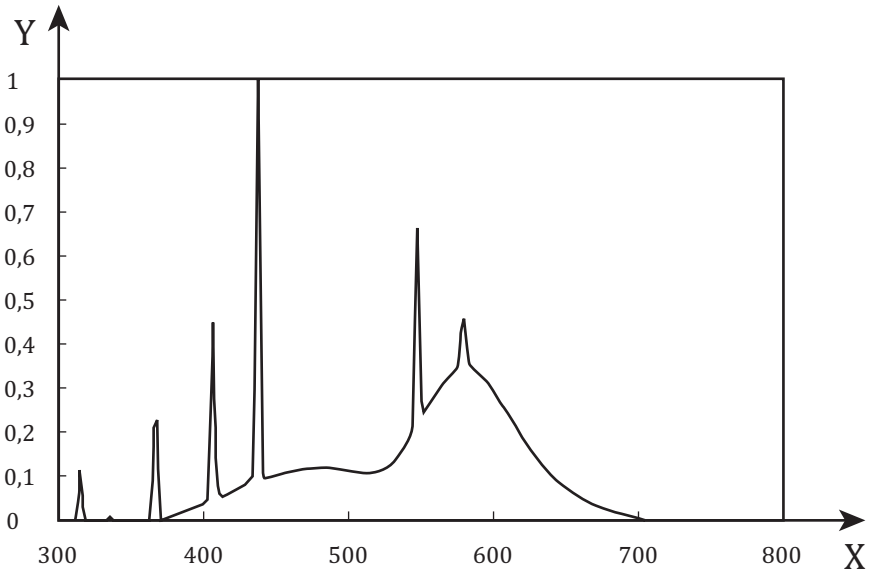
4 Light source

4.1 General

For evaluation of indoor light-active photocatalysts, the light source that is a combination of one of the lamps described below and an ultraviolet (UV) sharp cut-off filter shall be used.

4.2 Fluorescent lamps

A halophosphate or triphosphor fluorescent lamp that a correlated colour temperature is between 3800 K to 4500 K (F4000) shall be used for testing of indoor light-acitive photocatalytic materials used under an indoor lighting environment without sunlight. The CIE 1974 general colour rendering index (Ra) defined by CIE 13.3 of halophosphate fluorescent lamp is about 60. When a triphosphor fluorescent lamp is used for testing, the fluorescent lamp which Ra is higher than 80 shall be selected. Performance specifications of fluorescent lamps are specified in IEC 60081. A typical relative spectral power distribution of the halophosphate fluorescent lamp is shown in Figure 2, and triphosphor one is shown in Figure 3 respectively.

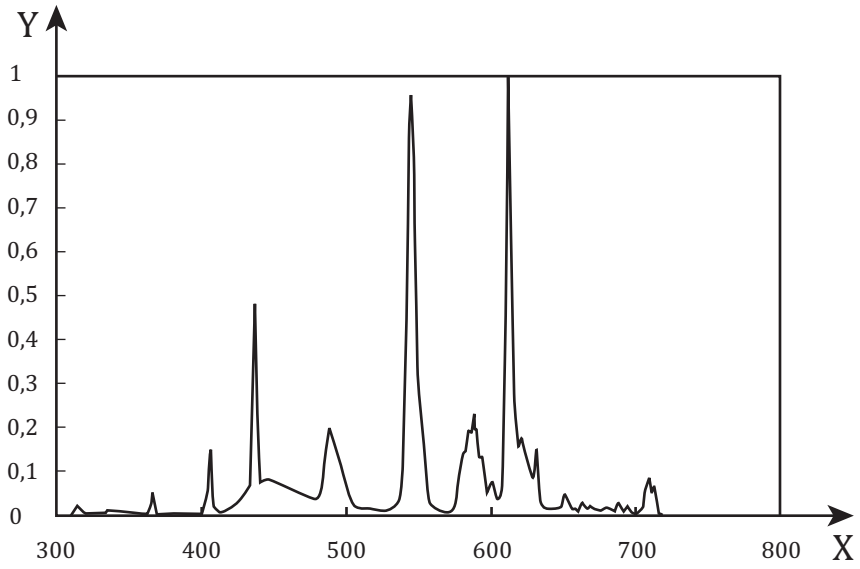


Key

X wavelength, nm

Y relative radiant power

Figure 2 — A typical spectral power distribution of a halophosphate fluorescent lamp in which a correlated colour temperature is 4100 K and CIE 1974 general colour rendering index is 60



Key

X wavelength, nm

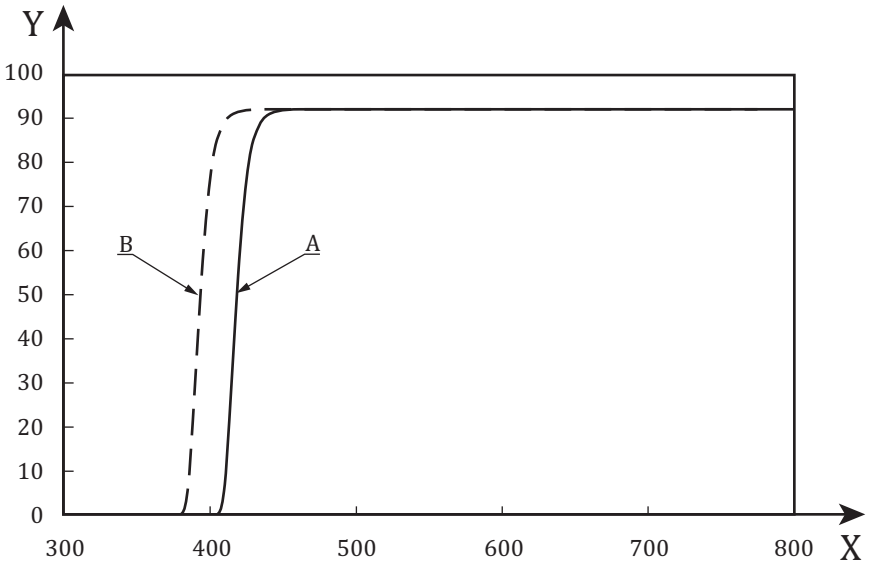
Y relative radiant power

Figure 3 — A typical spectral power distribution of a triphosphor fluorescent lamp in which a correlated colour temperature is 4288 K and CIE 1974 general colour rendering index is 80

5 UV sharp cut-off filters

Two types of UV sharp cut-off filters shall be used for testing.

A transmittance of first one is 0.1 % or less at 400 nm, threshold limit wavelength of transmission (TLT) is 416 nm ± 5 nm, range of slope (RoS) is 14 nm ± 5 nm and average transmittance between 450 nm to 780 nm is higher than 80 % (Type A). And a transmittance of the other one is 0.1 % or less at 380 nm, threshold limit wavelength of transmission (TLT) is 392 nm ± 5 nm, range of slope (RoS) is 14 nm ± 5 nm and average transmittance between 420 nm to 780 nm is higher than 80 % (Type B). Examples of spectral transmittance of UV sharp cut-off filters are shown in Figure 4. When using the filter of different transmittance from this standard for testing, spectral transmittance shall be reported with a product name, product number, manufacturer, and thickness.



Key

X wavelength, nm

Y transmittance, %

A Type A

B Type B

Figure 4 — Examples of spectral transmittance of UV sharp cut-off filters

6 Illuminance meters

The irradiance shall be measured in illuminance (lx) by using an illuminance meter that has been calibrated by a calibration laboratory and traceability with the national standard has been maintained.

7 UV radiometers

The UV irradiance shall be measured in irradiance (W/m^2 or mW/cm^2) by using a UV radiometer specified in ISO 10677.

8 Indoor lighting conditions and selection of UV sharp cut-off filters

To set three kinds of indoor lighting conditions (condition A, condition B, condition C), the method of selecting the UV sharp cut-off filter is defined.

Condition A

Condition A is an indoor lighting condition by luminaire with cover that transmits optical radiation longer wavelength than 400 nm. In this condition, the type A filter shall be used.

Condition B

Condition B is an indoor lighting condition by luminaire with cover that transimits optical radiation longer wavelength than 380 nm. In this condition, the type B filter shall be used.

Condition C

Condtion C is an indoor lighting condition by luminaire without cover. When evaluating this condition, the UV sharp cut-off filter is not needed in general. However, in general, a fluorescent lamp for general lighting service emits very small UV radiation and large amount of visible radiation, and photocatalytic responsivity in UV range is higher than that in visible range. It is necessary to separate UV effects and the visible one. Therefore, to evaluate true performance produced by only visible radiation, performance evaluation by combination of the UV sharp cut-off filter and the light source shall be done together. The type of filter is defined by each application.

9 Measurement and use conditions

a) The illuminance shall be measured with and without a UV sharp cut-off filter, along with the UV irradiance. The illuminance for testing shall be set as a standard value specified in each standard.

b) The illuminance and UV irradiance shall be measured at stabilized condition, which is a minimum of 15 min after the light is turned on.

c) The illuminance and UV irradiance shall be measured at start and end of the testing. The lamp shall be replaced when the illuminance has decreased to 70 % of the initial value.

d) If a luminaire with a reflection plate is used fot testing, the reflection plate shall be shown small absorption in ultraviolet and visible radiation.

e) The transmittance of the UV sharp cut-off filter might be changed by long time irradiation. Therefore, transmittance of the filter shall be measured periodically or the filter shall be replaced periodically.

f) If an acrylic sharp cut-off filter is used, the shape of the filter might be transformed by the long time irradiation. In this case, before switching the lighting on, the shape of the filter shall be checked.

10 Test report

The test report shall include at least the following information:

a) a reference to this International Standard: ISO 14605:2013;

b) kind of lamp used (catalogue number, manufacturer, emission data of the lamp);

c) kind of filter used (catalogue number, manufacturer, thickness, transmission data of the filter);

d) kind of illuminance meter and UV radiometer used in the measurement (catalogue number, manufacturer);

e) illuminance and UV irradiance with and without UV sharp cut-off filter at the samples surface.

ICS 81.060.30

Price based on 7 pages