ISO ~~TC 206/SC~~/FDIS 19810:2023(E)

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ISO 19810:2023(E)

ISO TC 206/SC /WG 9

Secretariat: JISC

Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for self-cleaning performance of semiconducting photocatalytic materials under indoor lighting environment — Measurement of water contact angle

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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~~document 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).~~www.iso.org/directives).

~~Attention is drawn~~ISO draws attention to the possibility that ~~some of~~ the ~~elements~~implementation of this document may ~~be~~involve the ~~subject~~use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights~~.~~ in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights. ~~Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).~~

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation ~~on~~of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT~~) see the following URL: www.iso.org/iso/foreword.html.~~), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 19810:2017), of which it constitutes a minor revision. The changes are as follows:

— definitions of 3.1, 3.2 and 3.4 corrected;

— minor editorial changes.

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.~~www.iso.org/members.html.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for self-cleaning performance of semiconducting photocatalytic materials under indoor lighting environment — Measurement of water contact angle

1 Scope

This document specifies a test method for the determination of the self-cleaning performance of sheet-form materials that contain an indoor-light-active photocatalyst or have indoor-light-active photocatalytic films on the surface, under indoor lighting environment.

This method is used to measure the change of water contact angle under indoor lighting environment, which is one of the indices reflecting the self-cleaning performance of semiconducting photocatalytic materials.

This document is not applicable to permeable materials on which water droplets cannot hold and rough materials which obscure water droplets. This document is not applicable to materials of which the changes in the water contact angle due to decomposition of adhered organic matter cannot be evaluated because even if the surface is clean, the water contact angle is remarkably large or the water contact angle cannot be sufficiently increased by attaching organic matter to the surface.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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*

ISO 14605, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Light source for testing semiconducting photocatalytic materials used under indoor lighting environment*

ISO 27448, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for self-cleaning performance of semiconducting photocatalytic materials — Measurement of water contact angle*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 27448 and the following apply.

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

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

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

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

3.1
photocatalyst
substance that performs one or more catalytic functions based on oxidation or reduction reactions under photoirradiation

Note 1 to entry: The functions include decomposition and removal of air and water contaminants, deodorization, antibacterial, self-cleaning and antifogging actions. A photocatalyst can also be used for light energy conversion.

[SOURCE: ISO 20507:2022, 3.1.62]

3.2
photocatalytic materials
material in which or on which the photocatalyst is added by coating, impregnation or mixing

Note 1 to entry: Materials include ceramic, metal, plastic, paper and cloth for general purposes.

3.3
semiconducting photocatalyst
substance that displays photocatalytic action based on its electronic band structure

Note 1 to entry: This applies to metal oxides like titanium dioxide, and sulphides. Photocatalysts which are not semiconducting includes metal complexes.

3.4
self-cleaning effect
maintenance of surface cleanliness of a material by employing a photocatalyst loaded onto the surface

Note 1 to entry: Self-cleaning using photocatalysis is achieved through decomposition of surface contaminants by oxidation and reduction reactions, and/or hydrophilicity that allows stains or dirt to be easily removed by the flow of (rain)water over the surface.

Note 2 entry: Examples include glass, tiling and other facings for buildings, and plastics and coatings for general purposes.

3.5
indoor lighting environment
indoor lighting environment with an artificial light source for general lighting service that does not include sunlight

Note 1 to entry: For the purposes of photocatalytic activity characterization, a clear definition of spectral range and intensity is normally required.

3.6
indoor-light-active photocatalyst
substance that carries out many functions based on oxidization and reduction reactions produced by an artificial light source for general lighting service, including decomposition and removal of air and water contaminants, deodorization, and antibacterial, antifungal, self-cleaning and antifogging actions

3.7
contact angle before pretreatment

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θ_1
water contact angle before pretreatment by UV irradiation and coating with organic matter

3.8
contact angle after UV irradiation and before coating
θ_2
water contact angle after pretreatment by UV irradiation and before coating with organic matter

3.9
initial contact angle
θ_3
water contact angle after pretreatment by UV irradiation and coating with organic matter and immediately before starting visible light irradiation (water contact angle after 0 h of visible light irradiation)

3.10
contact angle after *n* h of visible light irradiation
$\theta_4(n)$
water contact angle after applying visible light irradiation for *n* h

Note 1 to entry: The unit of time may also be in days, minutes, and seconds in addition to hours.

3.11
initial contact angle halving time
$n_{1/2}$
time required for water contact angle to reach half the value of the initial contact angle θ_3 due to visible light irradiation

3.12
contact angle reduction time (10°)
$n_{10°}$
time required for water contact angle to reach 10° due to visible light irradiation

3.13
test piece set
multiple test pieces of the same material, treated under the same conditions, to investigate time-series changes in a water contact angle by sequential measurement under identical visible light irradiation conditions

4 Principle

This test method measures the time until a water contact angle increased by attaching organic matter to a test piece is reduced due to decomposition of the organic matter by the photocatalytic effect of visible light irradiation, thus provides an index of the self-cleaning effect performance of an indoor-light-active photocatalytic material. First, the test piece is irradiated with UV light to remove any organic matter adsorbed to its surface, and organic matter for test purposes (stearic acid) is then applied to the test piece by a previously established method. Next, the initial contact angle is measured, and the test piece is then irradiated with a given amount of visible light. The time-series changes in the contact angle due to visible light irradiation are measured, and the elapsed time from the start of visible light irradiation until the contact angle reaches half of the initial value and until the contact angle reaches 10° or lower are determined.

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