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Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for antialgal activity of semiconducting photocatalytic materials

Titre manque

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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.

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 19635 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

Introduction

Under ultraviolet (UV) light illumination, photocatalysts have diverse functions, such as prevention of fouling, antifogging effects, antibacterial effects, deodorization, and decomposition of air and water contaminants, and their applications have grown in recent years. Since products utilizing these photocatalytic functions are commercialized in large quantities, a method to evaluate and determine photocatalytic effects is required. This standard is intended to provide a method for objective evaluation of activity in controlling algae, which are a primary producer of microbial contamination (in the form of environmental biofilms) of outdoor structures, under illumination with ultraviolet light to simulate the outdoor environment and to contribute, via control of algae, to conservation of urban landscapes, prevention of member corrosion, and prevention of fouling of water tank window materials.

Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for antialgal activity of semiconducting photocatalytic materials

1 Scope

This standard specifies a test method for evaluating anti-algal activities in outdoor structures, specifically flat photocatalytic materials (for example, window panes and water tank glasses, films, gurdrails, etc.) under irradiation of ultraviolet light. It does not include powder, granular or porous photocatalytic materials.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO31-0, *Quantities and units —Part 0: General principles*

ISO 27447, *Fine ceramics (advanced ceramics, advanced technical ceramics) -- Test method for antibacterial activity of semiconducting photocatalytic materials*

ISO 13125:2013 *Fine ceramics (advanced ceramics, advanced technical ceramics) -- Test method for antifungal activity of semiconducting photocatalytic materials*

3 Terms and definitions

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

3.1
photocatalyst
A substance with many functions based on oxidization and reduction reactions under photoirradiation, including decomposition and removal of contaminants, deodorization, antibacterial actions, and prevention of fouling.

3.2
photocatalytic materials
Materials in which or on which the photocatalyst is added by coating, impregnation, mixing, etc. Photocatalytic materials are to be used for building and road construction materials to obtain the above-mentioned functions.

3.3
photoirradiation
Irradiation of UV light at wavelength 300 - 380 nm.

3.4
antialgal activity
Activity in suppressing growth of algae over a material surface

3.5
photocatalytic antialgal treatment
Support of a photocatalyst by means of various methods, including coating, impregnation, blending, and others, for utilization of the antialgal activty of a photocatalyst

3.6
photocatalytic antialgal activity based on three-point absorbance spectrum method
Photocatalytic antialgal activity derived from the ratio of the absorbance of material treated with photocatalyst after photoirradiation of UV light to that of non-treated material after photoirradiation.

4 Algae used in the test

The type of algae to be used in the test with photocatalytic-treated antialgal materials shall be *Chlorella vulgaris* (NIES-227). The strain of algae to be used in the test shall be the same strain stored in agencies affiliated with the World Federation for Culture Collections or the Japan Society for Culture Collection.

5 Preparation for the test

5.1 Conditions for handling of algae

The test shall be performed in a laboratory with equipment needed to prevent mixing with other microorganisms.

5.2 Chemicals, materials, and apparatus

Unless otherwise specified, the chemicals, materials, and apparatus to be used in the test shall be as follows. Test tubes, flasks, pipettes, tweezers, etc. shall be carefully cleaned with alkaline or neutral detergent, rinsed thoroughly with water, dried, and sterilized by hot air or high-pressure steam before use.

5.2.1 Purified water: The water used for the preparation of all solutions and culture media and for all determinations shall be distilled or deionized and shall have a conductivity of < 1μS/cm.

5.2.2 Ethanol for disinfection: Solution whose ethanol concentration has been adjusted to 77 to 82% in volume fraction by means of purified water

5.2.3 Autoclave: Capable of maintaining the temperature at 121ºC ± 1ºC (equivalent to a pressure of 103 kPa)

5.2.4 Dry sterilizer: Capable of maintaining the temperature at 160 to 180ºC

5.2.5 Spectrophotometer: Capable of measurement within the wavelength range of 400 to 800 nm

5.2.6 Refrigerator: Capable of maintaining the temperature at 4ºC ± 1ºC**.**

5.2.7 Platinum loop: With an end loop of approximately 4 mm

5.2.8 Glass plate: Made from material not affecting the growth of microorganisms

5.2.9 Cotton plug: Plug of non-degreased cotton, or silicon plug, metal plug, or molten plug

5.2.10 Test tube mixer: For microorganism test

5.2.11 Contact film: Film of material not affecting the growth of microorganisms, which is free of water-absorbing properties and features satisfactory adherence, and in which transmittance in the range of 340 to 380 nm as measured according to the method specified in ISO 27447 accounts for 85% or more

5.2.12 Moisture retention glass: Glass with thickness of 1.1 mm or less, in which transmittance of 340 to 380 nm as measured according to the method specified in ISO 27447 accounts for 85% or more and which has been cut to a size capable of covering the entire surface of a Petri dish

5.2.13 Storage Petri dish: Dish with the inside diameter of about 90 mm

5.2.14 Moisture-conditioning filter paper: Filter paper not affecting the growth of microorganisms , which has been cut to a size appropriate for placement in the container in which the test piece is to be set

5.2.15 Disposable cuvette: Plastic cuvettes (about 12 × 12 × 45 mm) appropriate for placement in the storage container

5.2.16 Tooth brush: Soft type of brush made of polyamide

5.2.17 UV fluorescent lamp: 20-W black-light blue type UV fluorescent lamp (BLB lamp) that provides UV-A ranging from 300 nm to 400 nm with a peak emission at 351 nm.

5.2.18 Fluorescent lamp: 20-W starter and straight-type white (symbol: W) lamp

5.2.19 UV irradiator: System comprised of one UV fluorescent lamp, which can shield light from the surrounding region

5.2.20 UV light radiometer: A radiometer with a detector whose sensitivity peak is at 351 nm and provide limit, e.g. ±10 nm shall be used. The radiometer shall be calibrated for the light source to be used or corrected to ascertain sensitivity within the wavelength range to be absorbed by the photocatalytic test piece with suitable approach.

5.2.21 Illuminometer: General type AA-grade illuminometer

5.2.22 Filter unit: Filter unit, in which the membrane filter is made from a less-absorbent material, such as hydrophilic polyvinylidene-fluoride, hydrophilic polytetrafluoro-ethylene, etc., and the filter pore size is 0.22 or 0.45 µm

5.2.23 Centrifuge: Capable of the centrifugal force to 1500 × g for preparation of test solutions

5.3 Sterilization and filtration methods

5.3.1 Hot-air sterilization

The apparatus to be sterilized shall be placed in a hot-air sterilizer at 160 to 180ºC and held at this temperature for 30 to 60 minutes. If the sterilized sample exhibits any wet cotton plug or package water after completion of hot-air sterilization, the apparatus shall not be used.

5.3.2 Hot-steam sterilization

An autoclave shall be filled with water and the apparatus to be sterilized shall be placed in a wire cage and placed on the autoclave shelf. The autoclave shall be closed with the lid and heated and held at a temperature of 121ºC (equivalent to a pressure of 103 kPa) for 15 to 20 minutes. After discontinuing heating and allowing the temperature to cool to 100ºC or less, the exhaust valve shall be opened to bleed steam and the lid shall be opened. The apparatus sterilized in this fashion shall be taken out and, if necessary, allowed to cool in the safety cabinet.

In order to maintain cleanness to prevent contamination by culture media and processing chemicals, the autoclave shall be cleaned with neutral detergent as required and rinsed with water thoroughly.

5.3.3 Flaming