

Nederlandse norm

NEN-ISO 10678

(en)

Fine ceramics (advanced ceramics, advanced technical ceramics) - Determination of photocatalytic activity of surfaces in an aqueous medium by degradation of methylene blue (ISO 10678:2010, IDT)

ICS 81.060.30
september 2010

Als Nederlandse norm is aanvaard:

- ISO 10678:2010, IDT

OOORR
Preview

Normcommissie 342032 "Technische Keramiek"

Apart from exceptions provided by the law, nothing from this publication may be duplicated and/or published by means of photocopy, microfilm, storage in computer files or otherwise, which also applies to full or partial processing, without the written consent of the Netherlands Standardization Institute.

The Netherlands Standardization Institute shall, with the exclusion of any other beneficiary, collect payments owed by third parties for duplication and/or act in and out of law, where this authority is not transferred or falls by right to the Reproduction Rights Foundation.

Auteursrecht voorbehouden. Behoudens uitzondering door de wet gesteld mag zonder schriftelijke toestemming van het Nederlands Normalisatie-instituut niets uit deze uitgave worden verveelvoudigd en/of openbaar gemaakt door middel van fotokopie, microfilm, opslag in computerbestanden of anderszins, hetgeen ook van toepassing is op gehele of gedeeltelijke bewerking.

Het Nederlands Normalisatie-instituut is met uitsluiting van ieder ander gerechtigd de door derden verschuldigde vergoedingen voor verveelvoudiging te innen en/of daartoe in en buiten rechte op te treden, voor zover deze bevoegdheid niet is overgedragen c.q. rechtens toekomt aan de Stichting Reprorecht.

Although the utmost care has been taken with this publication, errors and omissions cannot be entirely excluded. The Netherlands Standardization Institute and/or the members of the committees therefore accept no liability, not even for direct or indirect damage, occurring due to or in relation with the application of publications issued by the Netherlands Standardization Institute.

Hoewel bij deze uitgave de uiterste zorg is nagestreefd, kunnen fouten en onvolledigheden niet geheel worden uitgesloten. Het Nederlands Normalisatie-instituut en/of de leden van de commissies aanvaardden derhalve geen enkele aansprakelijkheid, ook niet voor directe of indirecte schade, ontstaan door of verband houdend met toepassing van door het Nederlands Normalisatie-instituut gepubliceerde uitgaven.

Preview

ISO 10678

**Fine ceramics (advanced ceramics,
advanced technical ceramics) —
Determination of photocatalytic activity of
surfaces in an aqueous medium by
degradation of methylene blue**

*Céramiques techniques — Détermination de l'activité photocatalytique
des surfaces dans un milieu aqueux par dégradation du bleu de
méthylène*



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

Copyright
Preview

**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2010

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
1 Scope	1
2 Terms and definitions	1
3 Symbols and units	2
4 Principle	3
5 Apparatus	3
6 Calibration	3
7 Measuring and conditioning solution	3
8 Sample preparation	4
9 Preparation of the measurement	4
10 Procedure of the measurement	5
11 Evaluation of results	6
12 Precision	7
13 Test report	7
Annex A (informative) Example of a data evaluation	8
Annex B (informative) Examples of suitable measuring devices	9
Annex C (informative) Results of the inter-laboratory test	11
Bibliography	12

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 10678 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

Copyright
Preview

Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of photocatalytic activity of surfaces in an aqueous medium by degradation of methylene blue

1 Scope

This International Standard specifies a method for the determination of the photocatalytic activity of surfaces by degradation of the dye molecule methylene blue (MB) in aqueous solution using artificial ultraviolet (UV) radiation, and characterizes the ability of photoactive surfaces to degrade dissolved organic molecules on ultraviolet radiation.

The test method specified is also applicable to evaluation of the specific photocatalytic self-cleaning activity of surfaces covered with respective coatings.

This method is not applicable to characterizing the photoactivity of surfaces on visible illumination, regarding direct soiling, degradation of gaseous molecules and the determination of antimicrobial photoactivity of surfaces.

NOTE Correlations between these different kinds of photocatalytic activity can, however, exist, in particular at surfaces exhibiting low photonic efficiencies.

2 Terms and definitions

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

2.1

specific photocatalytic activity

P_{MB}
measure of the photochemical conversion

NOTE Specific photocatalytic activity is expressed in moles per square metre and hour [mol/(m²h)].

2.2

photonic efficiency

ζ_{MB}
measure of the selectivity of the incident photons to induce the decolourization of methylene blue

NOTE 1 Photonic efficiency is expressed as a percentage of the incident photon flux.

NOTE 2 It is assumed that one photon can induce the decolourization of one dye molecule.

2.3

test solution

aqueous methylene blue solution used to determine the photocatalytic activity of surfaces

ISO 10678:2010(E)

2.4 measuring solution
part of **test solution** (2.3) with a volume of $\leq 10\%$ of the volume of the test solution used for external determination of the optical absorbance employing a spectrophotometer

2.5 conditioning solution
aqueous methylene blue solution used for the pre-adsorption of methylene blue on the test surfaces prior to the determination of the photocatalytic activity of surfaces

3 Symbols and units

For the purposes of this document, the symbols and units in Table 1 apply.

Table 1 — Symbols and units

Designation	Symbol	Unit
Planck's constant ($h = 6,626 \times 10^{-34}$ Js)	h	Js
Avogadro number ($N_A = 6,022 \times 10^{23}$ 1/mol)	N_A	1/mol
Relative molar mass	M	g/mol
Molar extinction coefficient	ϵ	m^2/mol
Time	t	h
Time of measurement	t_m	h
Concentration	c	mol/l
Absorbance	A_λ	unitless
Length	d	cm
Volume of test solution	V	l
Irradiated area	A	m^2
Wavelength	λ	m
UV-radiation intensity	E	W/m^2
Average UV-radiation intensity	$E_{av} = \frac{\int E dt}{t_m}$	W/m^2
Specific degradation rate	$R = \frac{\Delta A_\lambda V}{\Delta t \epsilon d A}$	$\text{mol}/(\text{m}^2\text{h})$
Specific degradation rate with UV radiation	$R_{irr} = \frac{\Delta A_{\lambda, irr} V}{\Delta t \epsilon d A}$	$\text{mol}/(\text{m}^2\text{h})$
Specific degradation rate without UV radiation	$R_{dark} = \frac{\Delta A_{\lambda, dark} V}{\Delta t \epsilon d A}$	$\text{mol}/(\text{m}^2\text{h})$
Specific photoactivity	$P_{MB} = R_{dark} - R_{irr}$	$\text{mol}/(\text{m}^2\text{h})$
Photonic UV-radiation intensity	$E_P = \frac{\lambda_{max} E_{av}}{hc N_A} \times 3\,600$	$\text{mol}/(\text{m}^2\text{h})$
Average photonic UV-radiation intensity	$E_{P, av}$	$\text{mol}/(\text{m}^2\text{h})$
Photonic efficiency	$\zeta_{MB} = \frac{P_{MB}}{E_P} \times 100$	%

4 Principle

Methylene blue is degraded in an aqueous solution that is in contact with the potentially photocatalytically active surface by UV radiation of this surface through the solution, with light not capable of inducing the direct photolysis of the dye ($320 \text{ nm} \leq \lambda \leq 400 \text{ nm}$), with the overall result being the decolourization of the solution. The amount of dye remaining in the solution is determined at regular intervals during the UV-radiation period using UV/visible (vis)-spectroscopy. A reference measurement is either performed with the same sample without UV radiation or with an identical sample in a second container with the photoactive surface protected by a cover from the incident light beam. The results are used to calculate the specific degradation rates and the respective photonic efficiencies characteristic of the surface tested.

5 Apparatus

5.1 General

Apparatus that will be in contact with the methylene blue solution shall be made from materials exhibiting no or just a very small tendency to adsorb this dye on its surface, e.g. glass, stainless steel, polyethylene, polypropylene, polyacrylate, silicones with low organic emission. The test arrangement shall exhibit minimal stray light.

5.2 Measuring device, either two testing cylinders fixed on the sample surface by a suitable glue, or two testing cells, each consisting of a vessel with a sample holder (for a schematic diagram of a suitable measuring device, see Annex B).

5.3 Glass pane, to cover the measuring cell exhibiting minimal absorbance within the spectral emission region of the UV-radiation light source (5.4).

5.4 UV-radiation light source, i.e. a narrow-band emitter in the wavelength range between $\lambda = 320 \text{ nm}$ and $\lambda = 400 \text{ nm}$ (UV-A) with a UV-radiation intensity of $E = (10 \pm 0,5) \text{ W/m}^2$, measured at the height of the sample underneath the covering glass pane.

5.5 UV radiometer (sensor) to measure the UV-radiation intensity, calibrated to closely match the characteristic of the UV-radiation light source.

5.6 UV/vis-spectrophotometer, calibrated in the measuring range between $\lambda = 600 \text{ nm}$ and $\lambda = 700 \text{ nm}$, for the determination of methylene blue concentration.

5.7 Measurement cells, for the spectrophotometer made of glass or plastics, with an optical length of 10 mm and a transmittance $> 80 \%$ (600 nm to 700 nm).

6 Calibration

The apparatus according to 5.5 and 5.6, as well as the balances used, shall be calibrated following the instructions for equipment monitoring.

7 Measuring and conditioning solution

Aqueous methylene blue solutions shall be used for both the measurement and the conditioning. The methylene blue solutions shall be prepared freshly from stock solutions stored in the dark using distilled water in the absence of any other additives. The initial MB concentration c_0 for the test solution shall be $c_0 = (10 \pm 0,5) \mu\text{mol/L}$. The conditioning solution shall be prepared at a concentration of $c = (20 \pm 1) \mu\text{mol/L}$. The absorbance, A_λ , of the solutions shall be calculated using Equation (1):

$$A_\lambda = \varepsilon \times c \times d \quad (1)$$

Bestelformulier

NEN

Stuur naar:

NEN Standards Products & Services
t.a.v. afdeling Klantenservice
Antwoordnummer 10214
2600 WB Delft

NEN Standards Products & Services

Postbus 5059
2600 GB Delft

Vlinderweg 6
2623 AX Delft

T (015) 2 690 390
F (015) 2 690 271

www.nen.nl/normshop

Ja, ik bestel

__ ex. NEN-ISO 10678:2010 en Technische keramiek - Bepaling van de fotokatalytische activiteit van oppervlakken in een waterig medium door degradatie van methyleen blauw € 52.53

Wilt u deze norm in PDF-formaat? Deze bestelt u eenvoudig via www.nen.nl/normshop

Gratis e-mailnieuwsbrieven

Wilt u op de hoogte blijven van de laatste ontwikkelingen op het gebied van normen, normalisatie en regelgeving? Neem dan een gratis abonnement op een van onze e-mailnieuwsbrieven. www.nen.nl/nieuwsbrieven

Retourneren

Fax: (015) 2 690 271
E-mail: klantenservice@nen.nl
Post: NEN Standards Products & Services,
t.a.v. afdeling Klantenservice
Antwoordnummer 10214,
2600 WB Delft
(geen postzegel nodig).

Gegevens

Bedrijf / Instelling _____

T.a.v. _____ O M O V

E-mail _____

Klantnummer NEN _____

Uw ordernummer _____ BTW nummer _____

Postbus / Adres _____

Postcode _____ Plaats _____

Telefoon _____ Fax _____

Factuuradres (indien dit afwijkt van bovenstaand adres)

Postbus / Adres _____

Postcode _____ Plaats _____

Datum _____ Handtekening _____

Voorwaarden

- De prijzen zijn geldig tot 31 december 2016, tenzij anders aangegeven.
- Alle prijzen zijn excl. btw, verzend- en handelingskosten en onder voorbehoud bij o.m. ISO- en IEC-normen.
- Bestelt u via de normshop een pdf, dan betaalt u geen handeling en verzendkosten.
- Meer informatie: telefoon (015) 2 690 391, dagelijks van 8.30 tot 17.00 uur.
- Wijzigingen en typfouten in teksten en prijsinformatie voorbehouden.
- U kunt onze algemene voorwaarden terugvinden op: www.nen.nl/leveringsvoorwaarden.