



International
Standard

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*

**Second edition
2024-10**

Reference number
ISO 10678:2024(en)

Full document details: [ISO 10678-2024](#)

© ISO 2024  **Documents**
Document Sharing Hub



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviations	2
5 Principle	3
6 Apparatus	3
6.1 General	3
6.2 Measuring device	3
6.3 Glass pane	3
6.4 Light source	3
6.5 UV radiometer	3
6.6 Photometer or UV/visible spectrometer	4
6.7 Measuring cuvette	4
6.8 Magnetic stirrer	4
7 Calibration	4
8 Testing and conditioning solutions	4
9 Preparation of the test specimens	4
10 Preparation of the measurement	5
11 Measurement procedure	5
11.1 General	5
11.2 Testing with intermittently stirred test cylinders (method A)	6
11.3 Testing with continuously stirred test cells (method B)	6
12 Evaluation of results	6
12.1 General	6
12.2 Specific degradation rate R	6
12.3 Photon irradiance E_p	7
12.4 Average irradiance E_{av}	7
12.5 Average photon irradiance $E_{p,av}$	7
12.6 Specific photocatalytic activity P_{MB}	7
12.7 Photonic efficiency ζ_{MB}	7
13 Precision	7
13.1 Repeatability	7
13.2 Reproducibility	7
14 Test report	8
Annex A (informative) Example of an evaluation	9
Annex B (informative) Examples of measuring devices	11
Annex C (informative) Interlaboratory test results	13
Bibliography	14

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 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).

ISO draws attention to the possibility that the implementation of this document may involve the 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.

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

For an explanation 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 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 10678:2010), which has been technically revised.

The main changes are as follows:

- normative references have been updated;
- procedures for “Testing with intermittently stirred test cylinders” and “Testing with continuously stirred test cells” as “method A” and “method B” have been clarified and the whole document has been revised accordingly;
- precision data and interlaboratory test results for both methods have been updated and included in [Annex C](#);
- document has been editorially revised.

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.

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 document specifies a method for the determination of the photocatalytic activity of surfaces by means of degradation of methylene blue (MB) in an aqueous medium under artificial irradiation, and characterises photocatalytically active surfaces with respect to their activity for degradation of dissolved organic molecules under radiant exposure to ultraviolet light.

This document does not apply for the characterization of surfaces with respect to their photocatalytic activity under visible light. A correlation of photocatalytic activity with the removal of direct soiling, the degradation of gaseous molecules in the environmental air or the antimicrobial efficacy can exist, especially for surfaces with low photonic efficiency.

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*

3 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 specific photocatalytic activity

P_{MB}
measure for the photochemical conversion

Note 1 to entry: P_{MB} is expressed in moles per square metre and hour [mol/(m²·h)].

3.2 photonic efficiency

ζ_{MB}
measure for the selectivity of the incident photons for methylene blue decolouration

Note 1 to entry: It is assumed that one photon is sufficient for the decolouration of a molecule.

Note 2 to entry: ζ_{MB} is expressed as a percentage of the incident photons.

3.3**testing solution**

aqueous solution of methylene blue, which serves as the reactive solution for the determination of the photocatalytic activity of surfaces

3.4**measurement solution**

portion of the testing solution, the volume of which is < 10 % of the volume of the *testing solution* (3.3), used for the external determination of absorbance in a photometer

3.5**conditioning solution**

aqueous methylene blue solution used for the pre-adsorption of methylene blue on the test surface prior to the determination of the optical absorbance employing a spectrometer

4 Symbols and abbreviations

For the purposes of this document, the symbols and units given in [Table 1](#) apply.

Table 1 — Symbols and units

Designation	Symbol	Unit
Planck constant ($h = 6,626 \cdot 10^{-34}$ Js)	h	Js
Speed of light ($c = 3 \cdot 10^8$ m/s)	c	m/s
Avogadro constant ($N_A = 6,022 \cdot 10^{23}$ mol ⁻¹)	N_A	mol ⁻¹
Relative molecular mass	M	g/mol
Molar extinction coefficient	ε	m ² /mol
Time	t	h
Measuring time	t_m	h
Concentration of methylene blue	c_{MB}	mol/l
Initial concentration of methylene blue in the testing solution	c_{MB0}	mol/l
Absorbance	A_λ	1
Gauge length	d	mm
Volume	V	l
Internal diameter	d_i	mm
Irradiated surface	A	m ²
Wavelength	λ	m
Irradiance	E	W/m ²
Average irradiance	$E_{av} = \frac{\int E dt}{t_m}$	W/m ²
Specific degradation rate	$R = \frac{\Delta A_\lambda \cdot V}{\Delta t \cdot \varepsilon \cdot d \cdot A}$	mol/(m ² ·h)
Specific degradation rate under radiant exposure	$R_{irr} = \frac{\Delta A_{\lambda, irr} \cdot V}{\Delta t \cdot \varepsilon \cdot d \cdot A}$	mol/(m ² ·h)
Specific degradation rate without radiant exposure	$R_{dark} = \frac{\Delta A_{\lambda, dark} \cdot V}{\Delta t \cdot \varepsilon \cdot d \cdot A}$	mol/(m ² ·h)
Specific photocatalytic activity	$P_{MB} = R_{irr} - R_{dark}$	mol/(m ² ·h)