INTERNATIONAL STANDARD

ISO 11507

Second edition
2007-02-01

Paints and varnishes — Exposure of coatings to artificial weathering — Exposure to fluorescent UV lamps and water

Peintures et vernis — Exposition des revêtements au vieillissement artificiel — Exposition au rayonnement de lampes à fluorescence UV et à l'eau

Reference number
ISO 11507:2007(E)

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

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 11507 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 11507:1997), which has been technically revised. The main changes are:

— the data on the lamps (tables in 5.1.2) have been harmonized with the data given in ISO 4892-3;

— the purity of the water for wetting the test panels has been changed from grade 2 to grade 3;

— conditioning of the coated test panels prior to testing has been deleted.

Introduction

Coatings from paints, varnishes and similar materials are weathered in the laboratory, in order to simulate ageing processes occurring during natural weathering. Generally, valid correlations between ageing during artificial and natural weathering cannot be expected because of the large number of influencing factors. Certain relationships can only be expected if the effect of the important parameters (spectral distribution of the irradiance in their photochemically relevant range, temperature of the specimen, type of wetting, wetting cycle relative humidity) on the coating is known. However, unlike natural weathering, testing in the laboratory is carried out taking into consideration a limited number of variables which can be controlled and therefore the results are more reproducible.

Paints and varnishes — Exposure of coatings to artificial weathering — Exposure to fluorescent UV lamps and water

1 Scope

This International Standard specifies exposure conditions for paint coatings exposed to artificial weathering in apparatus including fluorescent UV lamps and condensation or water spray. The effects of weathering are evaluated separately by comparative testing of chosen parameters.

NOTE The ultraviolet light produced by fluorescent lamps simulates only part of the UV region of natural sunlight and, consequently, the test pieces are subjected to a small but destructive portion of the spectrum.

Due to the lack of visible and infra-red energy in the light from such UV lamps compared to sunlight, the test pieces are not heated above the temperature of the surrounding air in the way in which they would be in practical use.

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.

ISO 1513, *Paints and varnishes — Examination and preparation of samples for testing*

ISO 1514, *Paints and varnishes — Standard panels for testing*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 4892-1:1999, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Terms and definitions

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

3.1
ageing criterion
given degree of change in a selected property of the coating under test

NOTE The ageing criterion is specified or agreed upon.

[ISO 11341:2004]

3.2
ageing behaviour
change in the properties of a coating during weathering or exposure to radiation

[ISO 11341:2004]

NOTE One measure of ageing is the radiant exposure below 400 nm or the radiant exposure at a specific wavelength that is necessary to cause a specific property change.

3.3
irradiance
E
radiant flux/area for a specified wavelength range, expressed in watts per square metre

3.4
radiant exposure
H
amount of radiant energy to which a test panel has been exposed, given by the equation

$$H = \int E \mathrm{d}t$$

where

E is the irradiance, in watts per square metre;

t is the exposure time, in seconds.

NOTE 1 H is therefore expressed in joules per square metre.

NOTE 2 If the irradiance E is constant throughout the whole exposure time, the radiant exposure H is given simply by the product of E and t.

[ISO 11341:2004]

4 Principle

Artificial weathering of coatings using fluorescent UV lamps and condensation or water spray is carried out in order to produce a certain radiant exposure or mutually agreed total number of operation hours and a given degree of a change in a property or properties.

The properties of the exposed coatings are compared with those of unexposed coatings, prepared from the same coating materials under identical conditions, or with coatings whose degradation properties are known. These properties are evaluated in accordance with criteria agreed in advance between the interested parties.

Radiation, temperature and humidity all contribute to the ageing process. Therefore, apparatus specified in this International Standard simulates all three factors.

The results obtained by the use of this method do not necessarily relate directly to the results obtained under natural exposure conditions. The relationship between these results needs to be established before the method can be used to predict performance. Different chemical behaviour can result in a different correlation between accelerated weathering and natural weathering.

5 Apparatus

5.1 Test chamber

5.1.1 General

The test chamber consists essentially of a conditioned enclosure, made from corrosion-resistant material, in which are housed the lamps, a heated water-tray or spray nozzles and test panel racks.

5.1.2 Lamps

UV lamps emit UV light from a low-pressure mercury arc. The required spectral distribution is achieved by a careful selection of the type of phosphor coating on the inner surface of the lamp and the nature of the glass used in the construction of the tubes.

Unless otherwise specified, the lamp shall be one of the three types listed below:

Type I: This lamp emits a significant amount of radiation at wavelengths below 300 nm which is not present in the sun's radiation. Some lamps of this type have a measurable emittance at the 254 nm mercury line. Due to the higher quantum energy of this radiation, photochemical ageing processes can be initiated which do not take place in natural weathering. Therefore, this type of fluorescent lamp should be used only when specially agreed between the parties concerned.

This lamp, commonly called UVB-313, has a peak emission at 313 nm and the relative spectral irradiance given in Table 1.

Table 1 — Relative ultraviolet spectral irradiance for UVB-313 lamps [a,b]

Spectral passband (λ = wavelength in nm)	Minimum [c] %	CIE No. 85:1989, Table 4 [d,e] %	Maximum [c] %
$\lambda < 290$	1,3	0	5,4
$290 \leqslant \lambda \leqslant 320$	47,8	5,4	65,9
$320 < \lambda \leqslant 360$	26,9	38,2	43,9
$360 < \lambda \leqslant 400$	1,7	56,4	7,2

[a] This table gives the irradiance in the given passband, expressed as a percentage of the total irradiance between 250 nm and 400 nm. To determine whether a specific type I (UVB-313) lamp meets the requirements of this table, the spectral irradiance from 250 nm to 400 nm shall be measured. The total irradiance in each passband is then summed and divided by the total irradiance between 250 nm and 400 nm.

[b] The minimum and maximum limits given in this table are based on 44 spectral irradiance measurements with type I (UVB-313) lamps from different production lots and of various ages [18]. The spectral irradiance data are for lamps within the ageing recommendations of the apparatus manufacturer. As more spectral irradiance data become available, minor changes in the limits are possible. The minimum and maximum limits are at least three sigma from the mean for all the measurements.

[c] The minimum and maximum columns will not necessarily sum to 100 % because they represent the minima and maxima for the measurement data used. For any individual spectral irradiance distribution, the percentages calculated for the passbands in this table will sum to 100 %. For any individual type I (UVB-313) fluorescent lamp, the calculated percentage in each passband shall fall within the minimum and maximum limits given. Test results can be expected to differ between exposures using type I (UVB-313) lamps in which the spectral irradiance differs by as much as that allowed by the tolerances. Contact the manufacturer of the fluorescent UV apparatus for specific spectral irradiance data for the type I (UVB-313) lamp used.

[d] The data from Table 4 in CIE Publication No. 85:1989 is the global solar irradiance on a horizontal surface for an air mass of 1,0, an ozone column of 0,34 cm at STP, 1,42 cm of precipitable water vapour and a spectral optical depth of aerosol extinction of 0,1 at 500 nm. These data are provided for reference purposes only.

[e] For the solar spectrum represented by Table 4 in CIE No. 85:1989, the UV irradiance (290 nm to 400 nm) is 11 % and the visible irradiance (400 nm to 800 nm) is 89 %, expressed as a percentage of the total irradiance from 290 nm to 800 nm. Because the primary emission of fluorescent UV lamps is concentrated in the 300 nm to 400 nm passband, there are limited data available for the visible light emission of fluorescent UV lamps. The percentages of UV irradiance and visible irradiance on specimens exposed in fluorescent UV apparatus can vary due to the number of specimens being exposed and their reflectance properties.