

Geosynthetic barriers — Screening test method for determining the resistance to oxidation

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British Standard

ICS 59.080.70; 91.100.50

National foreword

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English version

Geosynthetic barriers - Screening test method for determining the resistance to oxidation

Barrières géosynthétiques - Méthode d'essai sélective pour la détermination de la résistance à l'oxydation

Geosynthetische Dichtungsbahnen - Orientierungsprüfung zur Bestimmung der Oxidationsbeständigkeit

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Foreword

This document (EN 14575:2005) has been prepared by Technical Committee CEN/TC 189 “Geosynthetics”, the secretariat of which is held by IBN/BIN.

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Introduction

In many civil engineering applications geosynthetic barriers may be in contact with water or aqueous solutions in the present soil environment. At the same time, in specific parts of the construction the geosynthetic barriers may be exposed to slowly diffusing oxygen in the soil.

The presence of oxygen gives rise to a very slow oxidative degradation process. Polyolefin materials such as polypropylene and polyethylene may be relatively more sensitive to oxidative degradation than polyesters, depending on the formulation of the material and the circumstances in use.

It is the purpose of this document to provide a method for screening the resistance of geosynthetic barriers to oxidation in service for at least 25 years.

1 Scope

This document specifies a test method for screening the resistance of polyethylene and polypropylene polymeric and bituminous geosynthetic barriers to oxidation.

The data are suitable for screening but not for deriving performance data such as lifetimes greater than 25 years, unless supported by further evidence.

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.

EN ISO 9862, *Geosynthetics - Sampling and preparation of test specimens (ISO 9862:2005)*

ISO 188:1998, *Rubber, vulcanised or thermoplastic - Accelerated ageing and heat-resistance tests*

3 Principle

Test specimens are exposed to an elevated temperature in air during a fixed time period, using a regulated laboratory oven with forced air circulation.

The test specimens shall hang freely in the oven space.

After the fixed time period of oven ageing the exposed test specimens are submitted to a tensile test. The tensile strength and the elongation at break are measured for both the control specimens and the exposed specimens.

NOTE The oxidative degradation of the exposed specimen may also be evaluated by comparing the oxidative induction time of the specimen measured according to ASTM D 3895-03 with the oxidative induction time of the control sample.

4 Specimens

The sample shall be taken in accordance with EN ISO 9862. Products shall have been manufactured at least 24 h prior to testing. The number of specimens shall be five test specimens and five control specimens, unless further specimens are required to assure statistical significance.

Test and control specimens shall conform to the requirements of the relevant test method as specified in the standard pertaining to the type of application where the geosynthetic barrier will be used (see Bibliography).

NOTE It is recommended to expose additional specimens in case an extra mechanical test is required (see 7.4).

5 Apparatus

- A thermostatically regulated oven with forced air circulation, according to ISO 188:1998 (4.1.3), with an internal volume capable of exposing test specimens to a temperature of $(85 \pm 1) ^\circ\text{C}$.
- Glass or other chemically inert fixtures for suspending the specimens in the center of the oven, such that the specimens are spaced by a distance of not less than 10 mm, and that the distance from each wall is at least 100 mm.

- A means of monitoring the temperature around the specimens at least every 15 min, e.g. calibrated thermocouples and a data logger.

6 Conditioning

Conditioning of the specimens before exposure in the laboratory oven is not required.

7 Test procedure

7.1 Oven temperature

Set the oven temperature at (85 ± 1) °C. Monitor the temperature at least every 15 min.

NOTE For purposes other than conformity assessment alternative oven temperatures may be agreed between the interested parties.

7.2 Specimens

Suspend the specimens from the fixtures. Place the specimens in the oven once the temperature has reached a steady value. Place the specimens in the centre of the oven, spaced, not touching each other, and so that the distance from each wall shall be at least 100 mm.

7.3 Duration of the oven test

The duration of exposure shall be 90 d.

Expose the control specimens to the same oven temperature for 16 h to 24 h, remove and store them at (23 ± 2) °C. Observe and record the effect of temperature on the control specimen.

NOTE For purposes other than conformity assessment an alternative test duration may be agreed between the interested parties.

7.4 Determination of mechanical properties

When the fixed time period of oven ageing has elapsed, remove the specimens. Determine - for both the control specimens and the exposed specimens - the tensile strength and elongation at break according to the relevant test method, as specified in the standard pertaining to the type of application where the geosynthetic barrier will be used. If the test on one of the specimens is invalid, a further specimen shall be tested in its place.

Derive the percentage retained strength, which equals the mean tensile strength of the exposed specimens divided by that of the control specimens and expressed as a percentage. Derive the percentage retained elongation at break, which equals the mean elongation at break of the exposed specimens divided by that of the control specimens and expressed as a percentage.

NOTE Practical experience has shown that, to achieve good reproducibility, the following should be taken into account::

- the specimens should be placed in the middle of the oven;
- before each new test, the oven, the grille and the fixtures should be cleaned of any remaining residues;
- thermo-oxidative degradation of polymer material (e.g. polypropylene) may release substances which have a catalytic effect; therefore, polymers containing different stabilisers should not be tested at the same time in the same oven.

8 Test report

The test report shall include the following information:

- a) reference to this document;
- b) test laboratory;
- c) full identification of the geosynthetic barrier;
- d) tensile strength of exposed and control specimens, and percentage retained strength;
- e) elongation at break of exposed and control specimens, and percentage retained elongation at break;
- f) visual observation of the effect of temperature on the control specimen;
- g) any deviation from this document or any factor likely to have influenced the results.

Bibliography

- [1] ASTM D 3895-03, Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
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- [3] EN 13362:2005, *Geosynthetic barriers – Characteristics required for use in the construction of canals*
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