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BSI Standards Publication

Determination of long-term radiation ageing in polymers

Part 2: Procedures for predicting ageing at low dose rates

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National foreword

This Published Document is the UK implementation of IEC/TS 61244-2:2014. It supersedes BS 7816-2:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/112, Evaluation and qualification of electrical insulating materials and systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Determination of long-term radiation ageing in polymers – Part 2: Procedures for predicting ageing at low dose rates

Détermination du vieillissement à long terme sous rayonnement dans les polymères – Partie 2: Méthodes pour prédire le vieillissement à faible débit de dose

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CONTENTS

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DETERMINATION OF LONG-TERM RADIATION AGEING IN POLYMERS –

Part 2: Procedures for predicting ageing at low dose rates

FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 61244-2, which is a technical specification, has been prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems.

This second edition cancels and replaces the first edition published in 1996 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) examples and background information moved to annexes;

b) examples updated with more recent references.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
112/288/DTS	112/305/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61244 series, published under the general title *Determination of long-term ageing in polymers*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

DETERMINATION OF LONG-TERM RADIATION AGEING IN POLYMERS –

Part 2: Procedures for predicting ageing at low dose rates

1 Scope

This part of IEC TS 61244, which is a technical specification, applies to procedures for predicting ageing of polymeric materials at low dose rates.

The object is to present three methods which can be used to extrapolate data obtained from high dose rate experiments to the low dose rates typical of service conditions. These methods assume that homogeneous oxidation has been achieved under the test conditions. The techniques described in the following clauses are methods which have been found to be useful for a range of elastomeric, thermoplastic and thermoset materials. The procedures require a considerable number of test data to enable predictions to be made under low dose rate conditions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60544-2, *Guide for determining the effects of ionizing radiation on insulating materials – Part 2: Procedures for irradiation and test*

IEC 61244-1, *Determination of long-term radiation ageing in polymers – Part 1: Techniques for monitoring diffusion-limited oxidation*

3 General

The general guidelines of IEC 60544-2 shall be used in the selection of specimen types, radiation source, dosimetry and temperature control. All irradiations shall be carried out in air or at constant oxygen overpressure, although as noted in IEC 61244-1, oxygen overpressure techniques entail some risk of over-ageing the samples. The homogeneity of oxidation through the specimen thickness can be checked using profiling techniques such as those described in IEC 61244-1. The test report shall include details of the irradiation source, dose rate, atmosphere, temperature, sample type and thickness.

All of the procedures described require extensive data obtained over considerable periods of time. Each method has been found to be of practical use within its limitations, but none of the methods can be used where there is more than one mechanism operating with different apparent activation energies.

The power-law extrapolation method (Clause 4) is the simplest of the predictive techniques and requires the least amount of experimental data. This procedure cannot be used at dose rates low enough for thermal ageing to dominate, but appears to be valid for extrapolation of data obtained at near ambient temperatures (20 °C to 30 °C) for polymers such as polyolefins.

Because of the limited data involved, caution should be used in extrapolating by more than a factor of 10 in dose rate.