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Rubber, vulcanized or thermoplastic — Estimation of life-time and maximum temperature of use

Caoutchouc vulcanisé ou thermoplastique — Estimation de la durée de vie et de la température maximale d'utilisation

Reference number
ISO 11346:2004(E)

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Foreword

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ISO 11346 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This second edition cancels and replaces the first edition (ISO 11346:1997), which has been technically revised.

This corrected version of ISO 11346:2004 incorporates the following corrections:

— the text of Clause 9, which was incorrect, has been replaced by a new text;

— ISO 471, which was withdrawn in 2004, has been replaced by ISO 23529 (see Clauses 2 and 8);

— in Subclause 11.1, line 16, the sentence: “An example is given in Figure 1.” has been deleted;

— in the key to Figure 3, the words “as a fraction of initial value” have been deleted;

— in Subclause 11.2, last-but-one paragraph, the word “equation” has been inserted after WLF.

Introduction

The rate of a chemical reaction normally increases with increase in temperature. By exposing test pieces to a series of elevated temperatures, the relation between the reaction rate of degradative mechanisms and temperature can be deduced. Estimates can then be made by extrapolation of the degree of degradation after a given time at a given temperature or the time at a given temperature to reach a given degree of degradation.

The reaction rate/temperature relationship can often be represented by the Arrhenius equation. The reaction rate at any given temperature is obtained from the change in the value of a selected property with exposure time at that temperature. The reaction rate can be represented by the time to a particular degree of degradation (threshold value) and this may be the only measure to use if the property/temperature relation is complex.

The Arrhenius approach is only suitable for chemical degradation reactions and may give wrong results for tests where physical (viscoelastic) changes cannot easily be separated from chemical changes.

An alternative approach for rubbers is to use the Williams Landel Ferry (WLF) equation. This equation performs a time/temperature transformation and no assumptions are made as to the form of the property/time relation at any temperature. Hence, in principle, it can be applied to any physical property, including set and relaxation, or where the property/time relation is complex. Further explanation of the use of the WLF equation can be found in the literature [1].

During the preparation of this International Standard, account was taken of the contents of ISO 2578 [2] and IEC 60216 [3].