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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Plastics - Determination of apparent activation energies of
property changes in standard weathering test methods**

塑料 标准气候老化试验方法中性能变化的表观活化能测定

(English Translation)

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Reference

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document modifies and adopts ISO 23706:2020 "Plastics - Standard weathering test method - Apparent activation energy of performance changes".

Measurement.

The technical differences between this document and ISO 23706:2020, and the reasons therefor, are as follows.

---The scope of this document has been expanded (see Chapter 1) to improve its standardization;

---ISO 4892-2 (see Chapters 4, 5.1, 7, and 8) has been replaced with the normatively referenced GB/T 16422.2 to suit my needs.

Improve the country's technical conditions and enhance operability;

---ISO 4892-3 (see Chapters 4, 5.1, and 8) has been replaced with the normatively referenced GB/T 16422.3 to accommodate my country's national standards.

Technical conditions and improved operability;

---ISO 4892-1 (see 5.1, Chapters 6, 8, and 10) has been replaced with the normatively referenced GB/T 16422.1 to accommodate [the new standard].

Improve my country's technological capabilities and operational feasibility;

---The description regarding the number of samples has been changed from a recommended clause to a required clause (see 9.1) to improve its regulatory nature;

---ISO 4582 (see 9.5) has been replaced with the normatively referenced GB/T 15596 to adapt to my country's technical conditions and improve operability.

Actual nature;

---ISO 10640 (see 9.5) has been replaced with the normatively referenced GB/T 43297 to adapt to my country's technical conditions and improve operability.

Actual nature;

--- An additional variable, "Irradiance," has been added for plotting curves (see Chapter 10) to meet the needs of different experimental analyses.

The following editorial changes have been made to this document.

---Added notes for abbreviations (see note 3.2);

---ISO 2578 has been replaced by GB/T 7142 (see note 2, A.4 of Chapter 4, 7.4.2);

---ISO 11358-2 has been replaced by GB/T 33047.2 (see Chapter 4) for informational purposes;

---Added an option to characterize sample temperature [see 7.1d];

---The section on "surface temperature" has been removed (see section 7.2 of ISO 23706:2020);

---Added notes (see notes in Chapter 10);

---Added curve descriptions to the graph (see Figure B.2);

---The method for determining chemical properties has been changed, and ISO 16472 has been replaced with GB/T 43297 [see Appendix D c).

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the China Petroleum and Chemical Industry Federation.

This document is under the jurisdiction of the National Technical Committee on Plastics Standardization (SAC/TC15).

Introduction

Standards such as GB/T 16422.1 and ISO 16474-1 regarding climate aging have clearly defined the effects of temperature on accelerated climate aging tests using laboratory light sources.

It has a significant impact on the correlation and acceleration.

The Arrhenius equation reflects the effect of temperature on the rate of chemical reactions and is also used to describe the reaction rate of photochemical/climate aging reactions.

The Arrhenius equation has certain assumptions and limitations, and therefore is insufficient to describe complex degradation behavior, but it serves as a basic...

This fundamental approach helps to better understand the impact of temperature on the climate aging of polymer materials.

Activation energy E_a is an important material property that characterizes the effect of temperature on degradation reactions; it is the energy barrier required for a material to undergo a chemical reaction.

E_a is only effective for specific materials and specific degradation processes. During climate aging, degradation processes are typically based on specific performance changes.

The Arrhenius equation is used to determine the temperature dependence of polymer thermal degradation. The polymer can be calculated according to GB/T 33047.2.

Thermal decomposition activation energy. Currently, there are no standards for measuring the activation energy of polymer natural aging or photochemical degradation. Regarding photochemical degradation or climate...

Information on the activation energy of aging reactions is extremely limited; even in extensive studies, the available activation energies are often based on unsuitable climatic aging (e.g., outdoor aging).

Calculated by climate aging and accelerated climate aging experiments.

To determine the activation energy of the photochemical degradation reaction, climate tests must be conducted at at least two different temperatures. This document specifies some basic...

The experimental requirements help improve the reliability and effectiveness of activation energy determination using the Arrhenius equation in accelerated climate aging.

Note 1: Different properties may have different activation energies, such as yellowing and surface cracking of materials.

Note 2: The activation energy in this method is independent of the temperature within the selectable temperature range.

The determination of the activation energy of photochemical degradation reactions allows temperature to be incorporated as a quantitative factor into different climate aging tests for correlation assessment.

Understanding activation energy can help improve the reliability and predictive value of artificial climate aging tests.

Note 3: The Arrhenius equation is used in artificial climate aging to simplify the complex chemical degradation process. The activation energy is derived from a temperature-dependent constrained model.

It can be calculated. However, by following some basic preconditions, the correlation between the calculated value and the true value can be enhanced.

In the standard climate aging test method for plastics Apparent activation energy determination of performance changes