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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 1685-2008

Replacing GB/T 13643-1992, GB/T 1685-1982

Rubber, vulcanized or thermoplastic -- Determination of stress relaxation in compression at ambient and at elevated temperatures

硫化橡胶或热塑性橡胶 在常温和高温下压缩应力松弛的测定

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Standardization Administration of the People's Republic of China..

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Foreword

The modification of this Standard uses the International standard ISO 3384:2005 "Rubber, vulcanized or thermoplastic -- Determination of stress relaxation in compression at ambient and at elevated temperatures" (English version).

This Standard replaces GB/T 13643-1992 "Rubber, vulcanized or thermoplastic -- Determination of compressions tress relaxation (rings)" and GB/T 1685-1982 "Rubber, vulcanized -- Determination of stress relaxation in compression at normal and at elevated temperature".

This Standard has been redrafted based on ISO 3384:2005.

The main differences between this Standard and the international standard ISO 3384:2005, the reasons for these differences, and the changes in clause and sub-clause structure are as follows:

1993 "Rubber and rubber products -- Determination of precision for test method standards". The correspondence between the two is non-equivalent.

- A cylindrical Type I specimen has been added. This provision was primarily established in light of China's specific conditions.

For ease of use, the following editorial changes have been made to this Standard:

Compared with GB/T 13643-1992 and GB/T 1685-1982, the main changes in this Standard are as follows:

- Added an introduction (the introduction to this Edition);

- Added requirements for the thermal and mechanical conditioning of test specimens (6.5 of this Edition);

- Added content regarding precision and test reports (Chapters 10 and 11 of this edition).

Annex A of this Standard is an informative annex.

This Standard was proposed by China Petroleum and Chemical Industry Association.

This Standard shall be under the jurisdiction of Subcommittee on Physical and Chemical Test Methods for Rubbers of National Technical Committee on Rubbers of Standardization Administration of China (SAC/TC 35/SC 2).

This Standard is interpreted by Subcommittee on Physical and Chemical Test Methods for Rubbers of National Technical Committee on Rubbers of Standardization Administration of China (SAC/TC 35/SC 2).

Main drafting organizations of this Standard: China National Tire & Rubber Corporation Shenyang Rubber Research & Design Institute; Northwest Rubber & Plastics Industry Research & Design Institute.

Main drafters of this Standard: Yu Kaijiang, Zhu Wei, Zhao Bodan.

Versions of standard substituted by this Standard are:

Introduction

When a constant strain is applied to rubber, the force required to maintain that strain is not constant but decreases over time; this phenomenon is known as stress relaxation. Conversely, when rubber is subjected to a constant stress, the strain increases over time; this phenomenon is known as creep.

In essence, stress relaxation is primarily driven by physical and chemical processes. While these two processes generally coexist, stress relaxation is predominantly caused by physical processes at ambient or low temperatures and/or over short durations, whereas chemical processes dominate under conditions of high temperature and/or long duration.

To investigate the service life of the material, aging tests may be conducted in an aircirculating oven in accordance with GB/T 20028 "Rubber, vulcanized or thermoplastic -- Estimation of life-time and maximum temperature of use from an Arrhenius plot".

In addition to specifying temperature and time intervals, stress relaxation tests require the specification of the initial stress and the loading conditions of the specimen, as these factors influence the test results particularly for rubber containing fillers.

When conducting stress relaxation tests, maintaining constant temperature and compression is the most important factor for achieving good test repeatability and reproducibility.

1 Scope

This Standard specifies two methods for determining the decrease in force of vulcanized or thermoplastic rubber when compressed to and maintained at a constant strain at a specified test temperature.

The test specimens come in two types: cylindrical and ring-shaped. Different specimen sizes and shapes yield different test results. Results can only be compared when the specimens share the same shape and dimensions.

Ring-shaped specimens are particularly suitable for determining stress relaxation in a liquid environment.

This Standard does not specify tests at temperatures below standard laboratory temperature. This method may be used for low-temperature testing, but the reliability of the results has not been verified.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

3 Terms and definitions

3.1 compression stress relaxation

It refers to the phenomenon where the compressive force decreases over time following the application of a constant compressive deformation, expressed as a percentage of the initial force.

4 Principle

At a specified test temperature, a vulcanized or thermoplastic rubber test specimen is compressed to and maintained at a constant strain, and the reduction in compressive force is measured.

Method A: Compress the test specimen at the test temperature and measure all compressive forces at the test temperature.

Method B: Compress the test specimen at standard laboratory temperature and measure all compressive forces. The specimen is stored at the test temperature.

of method depends on the purpose of the test. Therefore, Method A is preferred for basic research and applications involving high-temperature sealing. Method B is recommended for applications involving temperature cycling from ambient to high temperatures.

standard laboratory temperature and measuring the compressive force at different temperatures.

5 Instruments

5.1 Compression device

5.2 Force-measuring device

The force-measuring device shall be capable of measuring the applied force within the required range with an accuracy of 1%. Preference shall be given to a device capable of monitoring the compressive force throughout the entire test. Such a device allows for the continuous measurement of compressive stress variations over time. Throughout the test, the deformation of the specimen shall be maintained within ±0.01 mm. Another method