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**Solution-polymerized SBR - Evaluation methods of viscoelastic
properties
(English Translation)**

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References

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 is modified to adopt ISO 23508:2021 "Method for evaluating the viscoelastic properties of solution-polymerized styrene-butadiene rubber".

The technical differences between this document and ISO 23508:2021, and the reasons therefor, are as follows.

---The regulations for precipitated silica, zinc oxide, stearic acid, and sulfur have been revised (see Table 1) to accommodate the use of materials in my country;

---ISO 2393:1994 (see 5.1) has been replaced with the normatively referenced GB/T 6038 to accommodate my country's sample preparation procedures;

---ISO 23529 (see 5.2, 5.3 and 5.4) has been replaced with the normatively referenced GB/T 2941 to accommodate my country's sample conditioning standards.

Regulation;

---Adjustable parameters have been added to meet the requirements of unloading conditions (see 5.3), making operation easier;

---ISO 289-1 (see Chapter 6) has been replaced with the normatively referenced GB/T 1232.1 to adapt to the determination of viscosity of uncured rubber in my country.

Regulations;

---ISO 6502-2 (see 7.2) has been replaced with the normatively referenced GB/T 9869.2 to accommodate the determination of [specific standards] using a disc oscillating vulcanizer in my country.

Specifications for vulcanization characteristics;

---ISO 6502-3 (see 7.3) has been replaced with the normatively referenced GB/T 9869.3 to accommodate the determination of sulfur using rotorless sulfurizers in my country.

Specifications of chemical properties;

---ISO 4664-1 (see 8.3) has been replaced with the normatively referenced GB/T 9870.1 to adapt to the dynamic viscoelasticity evaluation in my country.

Regulation.

The following editorial changes have been made to this document.

---Increased domestic precision (see E.3 in Appendix E);

---Added references (see References).

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 Standardization of Rubber and Rubber Products (SAC/TC35).

Introduction

Solution-polymerized styrene-butadiene rubber (S-SBR) has been developed into various types due to its excellent balance between rolling resistance and wet skid resistance.

S-SBR is used in tire manufacturing.

Functionalized S-SBR interacts strongly with fillers, resulting in better dispersibility and helping to reduce tire rolling resistance.

Force. These phenomena can be explained by the viscoelastic properties of rubber.

To describe the characteristics of S-SBR, it is essential to evaluate its viscoelastic properties. Therefore, standard test formulations and mixtures for evaluating the viscoelastic properties of S-SBR are necessary.

The refining process, sample preparation, and test conditions are very useful for the rubber industry.

Evaluation method of viscoelastic properties of solution-polymerized styrene-butadiene rubber Warning---Personnel using this document should have practical experience working in a formal laboratory. This document does not address all possible safety issues.

Users are responsible for taking appropriate safety and health measures and ensuring compliance with relevant national regulations.

1 Scope

This document specifies the standard test formulation and mixing method for evaluating the viscoelastic properties of solution-polymerized styrene-butadiene rubber (S-SBR) (including functionalized S-SBR).

The refining procedure describes the corresponding experimental methods.

This document applies to the evaluation of the viscoelastic properties of S-SBR.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to this document, only the version corresponding to that date applies. For undated references, the latest version (including all amendments) applies.

This document.

GB/T 1232.1 Determination of Mooney viscosity in uncured rubber using a disc shear viscometer - Part 1: Determination of Mooney viscosity (GB/T 1232.1) 1232.1-2016, ISO 289-1:2014, IDT) GB/T 2449.1-2021 Industrial Sulfur Part 1: Solid Products GB/T 2941 General procedures for specimen preparation and conditioning in physical testing of rubber (GB/T 2941-2006, ISO 23529.

2016, IDT)

GB/T 3185-2016 Zinc Oxide (Indirect Method) GB/T 6038 Rubber testing compound batching, mixing and vulcanizing equipment and operating procedures (GB/T 6038-2006, ISO 2393.

1994, MOD)

GB/T 9103-2013 Industrial Stearic Acid GB/T 9870.1 Determination of dynamic properties of vulcanized rubber or thermoplastic rubber - Part 1: General rules (GB/T 9870.1-2006) ISO 4664-1:2005, IDT GB/T 9869.2 Determination of vulcanization properties of rubber using a vulcanizing apparatus - Part 2: Circular oscillating vulcanizing apparatus (GB/T 9869.2-2025, ISO 6502-2:2018, IDT) GB/T 9869.3 Determination of vulcanization properties of rubber using a vulcanizing apparatus - Part 3: Rotorless vulcanizing apparatus (GB/T 9869.3-2025) ISO 6502-3:2023 (IDT) Terms and Definitions

3 Terms and Definitions

The terms and definitions defined in GB/T 9870.1 apply to this document.