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

GB/T 1682-2014

Replacing GB/T 1682-1994

**Vulcanized rubber - Determination of low-temperature
brittleness - Single test piece method**

硫化橡胶 低温脆性的测定 单试样法

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Foreword

This Standard was drafted in accordance with the rules in GB/T 1.1-2009. This Standard serves as a replacement of GB/T 1682-1994 Rubber, Vulcanized - Determination of Low-temperature Brittleness (single test piece method). In comparison with GB/T 1682-1994, there are several main technical changes as follows:

---In order to satisfy the requirements of material testing and simplify test procedure, test procedure B is added, namely, the method of impacting test sample at a stipulated temperature and judging whether any fail is caused (please refer to Chapter 1; 7.2; 8.2; Chapter 9);

---"fail" is used to replace "embrittlement" (please refer to 3.2;

3.2 in Version 1994);

---"lifting device" is used to replace "lifting poker and lifting spring" (please refer to 4.1;

4.1 in Version 1994);

---Figure 1 is re-drawn; the title and keys of the figure are added (please refer to 4.1;

4.1 in Version 1994);

---The selection of cooling mode is added, namely, in the selection of refrigerant, except from dry ice and liquid nitrogen, other cooling modes may also be adopted (please refer to

4.4.2;

4.4.2 in Version 1994);

---Sample thickness is modified from (2.0 ± 0.3) mm into (2.0 ± 0.2) mm (please refer to 5.1;

5.1 in Version 1994);

---The requirement of sample temperature regulation and surface inspection before test is added (please refer to 5.2;

5.2 in Version 1994);

1 Scope

China's national method for finding the temperature at which a vulcanized rubber stops behaving like rubber and starts behaving like glass, tested one specimen at a time. It specifies the test equipment, the specimens, the laboratory temperature, the test procedure, the treatment of results and the test report for the determination of low-temperature brittleness by the single test piece method. Every rubber has a glass transition. Above it the polymer chains move and the material stretches and recovers; below it they do not, and the same material shatters under an impact it would have absorbed a few degrees warmer. For a seal, a hose, a boot, a bushing or a tyre that has to work through a northern winter, the brittleness temperature is the property that decides whether the part survives at all - and it is not predictable from the compound on paper, because plasticisers, fillers and the cure state all move it. The test is a direct one: a strip specimen is clamped at one end, conditioned in a cooled bath at a chosen temperature for a specified time, and struck by a moving striker at a fixed speed. The specimen either cracks or it does not. By repeating at different temperatures the brittleness temperature is found - the temperature at which failure occurs under those exact conditions. The single test piece method tests one specimen per impact rather than a set, which makes it the practical choice when material is scarce or when a single value is being checked against a specification rather than determined from scratch. What the standard fixes is everything that changes the answer: the striker speed and geometry, the clamping and the free length, the bath medium and the conditioning time, the specimen dimensions and their preparation, and the laboratory conditions. Issued on 31 December 2014 and in force since 1 July 2015, it replaces GB/T 1682-1994.

This Standard stipulates the method of adopting single test piece brittleness temperature testing machine to test vulcanized rubber's brittleness temperature and judging whether vulcanized rubber is failed after being impacted at a stipulated temperature. The method includes two procedures. Procedure A is applicable to the test of brittleness temperature; Procedure B is applicable to the judgment of whether fail is caused after the impact at a stipulated temperature. NOTE. the brittleness temperature tested in this Standard is

characteristic temperature of vulcanized rubber. It does not represent the lower limit of operating temperature of vulcanized rubber and its products. Through brittleness temperature, the strengths and weaknesses of low-temperature performance of different rubber materials or different formulas of vulcanized rubber may be compared. Therefore, in the quality inspection and production process control of rubber materials and their products, it is of certain practical value.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specific date, only versions with the specific date are applicable to this document. In terms of references without a specific date, the latest versions (including all the modification orders) are applicable to this document.

GB/T 2941-2006 Rubber - General Procedures for Preparing and Conditioning Test Pieces for Physical Test Methods (ISO 23529.2004, IDT)

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Brittleness Point (single test piece method) Brittleness point refers to the highest temperature when sample is failed after being impacted under certain conditions.

4 Test Equipment

4.1 Composition Equipment is constituted of workbench, lifting clamp holder, impact device, low- temperature thermometer, cryogenic container which holds freezing medium, and blender, etc.

4.2 Lifting Clamp Holder Lifting clamp holder is constituted of clamp and lifting device. The distance from the impacted part of sample, to the lower end of the clamp is (11.0 ± 0.5) mm, as it is shown in Figure 1.

4.3 Impact Device Impact device is constituted of impactor and impact spring, etc.

4.4 Low-temperature Thermometer Adopt low-temperature thermometer, whose minimum division value is not more than 1 °C, to test the temperature of freezing medium.

Low-temperature thermometer, thermocouple and resistance thermometer may be used. Low-temperature thermometer shall be internal standard type of semi-dipping.

4.5 Freezing Medium Freezing medium is prepared by appropriate heat-transfer medium and refrigerant.

4.5.1 Heat-transfer medium At test temperature, liquid that can maintain its flowability and exert no additional influence on sample may be considered as heat-transfer medium.

Generally speaking, this type of heat-transfer medium uses ethanol, and also, acetone and siloxane, etc.

5 Sample

5.1 Specification Sample length. (25.0 ± 0.5) mm; width. (6.0 ± 0.5) mm; thickness.

5.2 Requirements Before test, sample shall be placed and adjusted at standard laboratory temperature for at least 3 h.

6 Laboratory Temperature

Laboratory temperature shall comply with relevant stipulations in GB/T 2941-2006.

7.1 Procedure A

7.1.1 Test preparation. lower the lifting clamp holder; place the low-temperature thermometer; place the thermometer's temperature measurement point in the same horizontal position as the lower end of the clamp. Inject heat-transfer medium into the cryogenic container; the injection volume shall guarantee that the distance from the lower end of the clamp to the liquid level is (75 ± 10) mm.

7.1.4 Lower the lifting clamp holder. Start to freeze the sample, meanwhile, start the timing. The stipulated freezing time is. During sample freezing time, temperature fluctuation of the freezing medium shall not exceed ± 1 °C.

7.1.5 Raise the lifting clamp holder; make the impactor impact the sample within

0.5 s.

7.1.6 Take down the sample; place it still for at least 30 s. Then, wipe off residual liquid on the sample surface. In accordance with the impact direction, bend the sample into 180°. Under bright light, meticulously observe whether there is any fail; record it. When the sample is failed, record the specific phenomena of the fail.

7.2 Procedure B Conduct the test in accordance with the steps in 7.1.1 ~ 7.1.6. A group of test needs at least 3 samples.

8.1 Procedure A

8.2 Procedure B If no sample manifests fail in a group of samples, then, the test result is non-fail. If 2 or more than 2 samples manifest fail in a group of samples, then, the test result fails.