GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 83.140.01

G 40

GB/T 10707-2008

Replacing GB/T 10707-1989, GB/T 13488-1992

Rubber - Determination of the burning

橡胶燃烧性能的测定

Issued on: June 04, 2008 **Implemented on: December 01, 2008**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine;

Standardization Administration of PRC.

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Rubber - Determination of the burning

1 Scope

This standard specifies two methods for determining the burning properties of rubber in a laboratory environment: the oxygen index method (method A) and the vertical burning method (method B).

This standard is applicable to evaluate the burning properties and flame-retardant properties of rubber materials in a laboratory environment. It is not suitable to evaluate the fire hazard of rubber materials under actual use conditions.

2 Normative references

The provisions in following documents become the provisions of this standard through reference in this standard. For the dated references, the subsequent amendments (excluding corrections) 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.

GB/T 2941-2006 Rubber - General procedures for preparing and conditioning test pieces for physical test methods (ISO 23529:2004, IDT)

GB/T 3863 Industrial oxygen

GB/T 3864 Industrial nitrogen

HG/T 3095 Fire tests terms for rubber

3 Terms and definitions

The terms and definitions as established by HG/T 3095 as well as the following terms and definitions apply to this standard.

3.1

Oxygen index

Under the specified test conditions, in a mixed-gas of oxygen and nitrogen at 23 °C ± 2 °C, the minimum oxygen concentration (expressed as a volume

4.3 Specimen

4.3.1 The specimen size is length 80 mm ~ 150 mm, width 6.5 mm ± 0.5 mm, thickness 3 mm ± 0.25 mm.

4.3.2 The preparation and conditioning of the specimen shall be carried out in accordance with the requirements of GB/T 2941-2006.

4.3.3 In order to facilitate the measurement of the burning length of the specimen, mark it at a distance 50 mm from the ignition end of the specimen.

4.3.4 For the rubber materials with a known oxygen index value range within ± 2, it shall prepare 15 specimens; for the rubber materials with unknown oxygen index or unstable burning features, prepare 15 ~ 30 specimens.

4.4 Test procedure

4.4.1 Check the test device to ensure it is in good condition. The burning cylinder should be placed vertically. The specimen is clamped vertically on the specimen holder at the center of the cylinder. The top of the specimen is at least 100 mm from the cylinder mouth.

4.4.2 Based on experience or the burning of the specimen in air, estimate the oxygen concentration at the start of the test. If the specimen is burned rapidly in air, the oxygen concentration (volume fraction) is estimated at 18%; if the specimen is burned slowly or unstably, it is estimated at 21%; if the specimen does not catch fire in the air, it is estimated at least 25%. The calculation formula for the oxygen concentration is as shown in Appendix A.

4.4.3 After determining the oxygen concentration according to 4.4.2, adjust the flow rate of the mixed-gas of oxygen-nitrogen (see Appendix B for the flow rate of oxygen and nitrogen) and let it flow for at least 30 s in the burning cylinder, to remove the air from the burning cylinder. Before test, each specimen shall be subjected to this procedure, to ensure that the gas flow in the burning cylinder does not change during the ignition and burning of the test. In the ignition and burning process, it shall not change the gas flow rate and gas concentration of oxygen-nitrogen.

4.4.4 Ignite the ignitor, adjust the flame to the specified length, extend the ignitor's nozzle into the burning cylinder. Allow the flame to fully contact the top surface of the specimen, but not the side surface. The flame application time is not more than 30 s, move away the ignitor every 5 s to observe whether the specimen is ignited. If the entire top surface of the specimen is burned, the specimen is considered to have been ignited, then start timekeeping immediately or otherwise measure the burning length.

The oxygen index which is calculated according to 4.5.1 is credible, otherwise:

If d < 2σ/3, increase the d value, repeat the operations of 4.4.9 ~ 4.4.11, until the condition is satisfied;

If d > 3σ/2, when d = 0.2%, the oxygen index is considered to be credible. However, when d > 0.2%, decrease the d value, repeat the operations of 4.4.9 ~ 4.4.11, until the condition is satisfied.

4.5 Calculation of results

4.5.1 Oxygen Index (OI)

The formula for calculation of the oxygen index (OI) is as shown in formula (1):

$$OI = c_f + kd \qquad \cdots\cdots(1)$$

Where:

OI - The oxygen index expressed by the volume fraction, which retains two decimal places in the calculation, and only one decimal place in the report;

c_f - The final oxygen concentration expressed by the volume fraction, which retains one decimal place;

k- Coefficient, the determination method of which is as shown in 4.5.2;

d - The oxygen concentration level difference expressed by the volume fraction, which retains one decimal place.

4.5.2 Determination of k value

The k value and its positive-negative sign are dependent on the features of the specimen, which can be determined from Table 1 as follows.

4.5.2.1 If the feature “0” is obtained by the test in 4.4.8, then the first opposite feature (see 4.4.9) shall be “X”. From the last four feature arrangements per row in the first column of Table 1, find the row that is exactly the same as the feature arrangement as obtained in 4.4.10. Then, based on the number of features “0” as obtained in 4.4.8 and 4.4.9, find the column with the same number from the row (a). The intersection of rows and columns is the calculated k value.

4.5.2.2 If the feature “X” is obtained by the test in 4.4.8, the first opposite feature shall be “0”. From the arrangement of the last 4 features per row in column 6 of Table 1, find the row that is exactly the same as the feature arrangement as obtained in 4.4.10. Then, based on the number of features “0” as obtained in

Note: The thickness of the specimen can be other sizes, but the test results cannot be compared with the test results of the standard specimen, they shall be indicated in the test report.

5.3.2 Five specimens form a group.

5.3.3 The preparation and conditioning of specimen shall comply with the provisions of GB/T 2941-2006.

5.4 Test procedure

5.4.1 Use the holder to hold the upper end of the specimen at about 6 mm, keep vertical. The distance from the lower end of the specimen to the absorbent cotton is 300 mm ± 10 mm.

5.4.2 Tighten the lamp tube, open the gas valve, ignite the Bunsen burner away from the specimen. Adjust the gas valve to produce a yellow flame with a height of approximately 20 mm, then adjust the air flow to produce a blue flame with a height of 20 mm ± 1 mm.

5.4.3 Align the flame to the center of the lower end of the specimen, keep the spacing between the lamp and the lower end of the specimen at 10 mm ± 1 mm. Apply flame for 10 s ± 0.5 s, move the Bunsen burner to beyond 150 mm, meanwhile start the stopwatch, record the flame burning time $t_{1,i}$. If there is melts or burning droplets, it shall tilt the Bunsen lamp for 45°, but the distance between the lower end of the specimen and the inclined Bunsen burner is still 10 mm ± 1 mm. The tilting form is as shown in Figure 3.

Note: In order to keep the distance between the lamp holder and the lower end of the specimen at 10 mm ± 1 mm, it may select the Bunsen burner with a scaled pole, as shown in Appendix D.

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