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Rubber, Vulcanized - Determination of Compression Set at Constant Strain

硫化橡胶 恒定形变压缩

永久变形的测定方法

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Rubber, Vulcanized - Determination of Compression Set at Constant Strain

1 Scope

This Standard specifies the methods of determining the characteristics of compression set of vulcanized rubber at constant strain.

This Standard is applicable to the evaluation of vulcanized rubber's capability of maintaining its elasticity after continuous compression under the condition of stipulated temperature and compression ratio.

2 Normative References

The following documents are indispensable to the application of this Standard. In terms of references with a specified date, only versions with a specified date are applicable to this Standard. The latest version (including all the modifications) of references without a specified date is also applicable to this Standard.

GB/T 2941-2006 Rubber - General Procedures for Preparing and Conditioning Test Pieces for Physical Test Methods

GB/T 3512-2014 Rubber, Vulcanized or Thermoplastic - Accelerated Ageing and Heat Resistance Tests - Air-oven Method

GB/T 7759.1-2015 Rubber, Vulcanized or Thermoplastic - Determination of Compression Set - Part 1: At Ambient or Elevated Temperatures

3 Principle

In this test, vulcanized rubber test piece is compressed to a stipulated height. After a certain temperature and a certain period of time, or after infiltration with medium, determine the compression set of the test piece at constant strain.

4 Test Devices

4.1 Test Fixture

4.1.1 Test fixture shall include compression plate, limiter and fastener. Please refer to Figure 1 for a typical test fixture.

Test pieces can also be trimmed with a round cutter from a vulcanized rubber sheet, whose thickness complies with the stipulation in 5.1; the inner diameter of the cutter shall be (10.2 ± 0.02) mm. During the process of trimming, the cutting edge of the cutter can be lubricated with neutral soap. Slowly enter the cutter, which can reduce the taper of the diameter.

Test pieces that are prepared under different methods mentioned above might lead to different test results. The test results are incomparable.

5.3 Quantity of Test Piece

In each group, there shall be not less than 3 test pieces.

5.4 Time Interval from Vulcanization to Test

In all the tests, the shortest interval from vulcanization to test is 16 h.

In terms of the tests of non-finished products, the longest interval from vulcanization to test shall be 4 weeks. In terms of comparative test, the time interval shall be as similar as possible.

In terms of the tests of finished products, if it is possible, the interval from vulcanization to test shall not exceed 3 months. Under other circumstances, the tests shall be conducted within 2 months since the day that the demand side accepts the products (please refer to GB/T 2941-2006).

5.5 Adjustment

Within the time interval from vulcanization to test, samples and test pieces shall be kept away from light and heat.

Before test, the prepared test pieces shall be adjusted for at least 3 h at a standard laboratory temperature that is stipulated in GB/T 2941-2006. In order to compare the results, the same temperature shall be maintained during the whole test.

6 Test Conditions

6.1 Selection of Constant Compression Ratio

In accordance with the hardness (Shore A) of the test pieces, there are the following options:

- When the hardness is below 50, 40 % compression ratio can be selected;
- When the hardness is between 50 ~ 75, 30% compression ratio can be selected;
- When the hardness is above 75, 20% compression ratio can be selected.

on the compression surface of the fixture.

7.2 Adjust the thickness gauge to point at zero, then, measure the initial height (h_0) of the test piece before compression.

7.3 Select a suitable limiter; place the test piece and the limiter in an appropriate position in the fixture, then, evenly compress it to a stipulated height (h_1). During the compression, the test piece and the limiter shall not contact each other.

7.4 During the liquid medium-resistant test, the fixture shall be placed in a sealed container. The test piece shall be completely soaked in the liquid medium. Liquid medium for tests cannot be used repeatedly.

7.5 In terms of tests at a stipulated temperature, the time of test shall be calculated since the fixture or the container is placed into the test chamber.

7.6 After the stipulated time, take out the fixture or the container from the test chamber. Select one of the standard laboratory temperatures that are stipulated in GB/T 2941-2006; cool down for 2 h. Then, open the container and the fixture; take out the test piece. At the same standard laboratory temperature, place the test piece in a free state for 1 h, then, measure the recovered height (h_2) after compression.

7.7 After the test with less volatile liquid medium, before opening the fixture, certain solvents, for example, gasoline, can be used to rinse it. The duration of rinsing shall not exceed 30 s.

8 Test Result

8.1 Compression set value K (%) shall be calculated in accordance with Formula (1):

$$K = \frac{h_0 - h_2}{h_0 - h_1} \times 100 \quad \text{.....(1)}$$

Where:

h_0 ---height of test piece before compression, expressed in (mm);

h_2 ---recovered height of test piece after compression, expressed in (mm);

h_1 ---height of limiter, expressed in (mm).

8.2 When test piece is ruptured after the test, the test data shall be abolished.

8.3 The arithmetic mean value of 3 test results shall be deemed as the test result.

8.4 Allowable deviation: when compression set value is less than 10%, the allowable relative deviation is $\pm 1\%$; when compression set value is more than 10%, the

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