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Textiles – Test Method of the Tensile Elasticity for Woven Fabrics

纺织品 机织物拉伸弹性试验方法

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Textiles – Test Method of the Tensile Elasticity for Woven Fabrics

1 Scope

This Standard specifies the method for measuring the tensile elasticity of woven fabrics.

This Standard applies to woven fabrics.

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.

GB/T 3291.3 Textiles - Terms of textile material properties and test - Part 3: General

GB/T 3923.1 Textiles - Tensile properties of fabrics - Part 1: Determination of maximum force and elongation at maximum force using the strip method

GB 6529 Textiles - Standard atmospheres for conditioning and testing

3 Terms and Definitions

For the purposes of this Standard, the terms and definitions given in GB/T 3291.3 apply.

4 Principles

The fabric is stretched with a constant elongation or a constant force to produce deformation. After a specified time, the tensile force is released, and its residual elongation is measured after it recovers for a specified time. Based on this, the elastic recovery rate and plastic deformation rate are calculated. And characterizes fabric tensile elasticity.

5 Apparatus

5.1 Constant velocity elongation (CRE) tester: It shall comply with the requirements of GB/T 3923.1, meeting 1% of the force indication; and be able to perform constant elongation and constant force stretching; and have a recording device.

5.2 Apparatus for cutting specimens.

6 Sampling

6.1 The sampling shall be representative to ensure that obvious wrinkles and defects that affect the test results are avoided.

6.2 The cutting of specimens shall be in accordance with the provisions of GB/T 3923.1. Cut 10cm away from the edge of the sample. Each sample shall not contain the same yarn.

6.3 Size and quantity of specimens: At least three specimens in the warp and weft directions shall be cut from each specimen. The length of the specimens shall meet the gauge length of 200mm, and the width shall meet the effective width of 50mm.

7 Humidifying and Testing Environment

7.1 The pre-humidifying and humidifying of the specimen shall be carried out in accordance with the provisions of GB 6529.

7.2 The test is conducted in the secondary temperate standard atmosphere specified in GB 6529.

8 Procedures

8.1 Instrument settings

8.1.1 The zero position and full force of the instrument and recording device shall be calibrated before the test.

8.1.2 Correct the gap length to 200mm, and make the clamps aligned and parallel to each other.

8.1.3 Setting the stretching speed

--- Constant elongation: When the elongation is ≤8%, the stretching speed is 20mm/min; when the elongation is >8%, the stretching speed is 100mm/min.

--- Constant force: According to the pre-test, when the elongation reaching the specified

L_1 – length of specimen when it is stretched to constant force, in mm;

ΔL - elongation at pretension when specimen is clamped loosely, in mm. ΔL is 0 when performing pretension clamping.

8.3.2 Determination of constant elongation force

8.3.2.1 The constant elongation shall be determined according to product requirements or mutual agreement. If there is no agreement, it is recommended to use 3%, 5% or 10%.

8.3.2.2 Start the instrument (when the sample is loosely clamped, the elongation shall be measured from the time when the pretension is reached), stretch the specimen to a constant elongation value; and read the corresponding stress, in Newton (N).

8.3.2.3 The measurement results are expressed by the average of three specimens, rounded off to 0.1N.

8.3.3 Determination of elastic recovery rate and plastic deformation rate at constant force

8.3.3.1 Select the constant force value according to product requirements or mutual agreement. If there is no agreement, it is recommended to use 20N, 25N or 30N.

8.3.3.2 The stretching holding time and recovery time shall be determined according to the agreement between the two parties. If there is no agreement, it is recommended to use a stretching holding time of 1 min and a recovery time of 3 min.

8.3.3.3 Start the instrument, stretch the specimen to a constant force; and read the specimen length L_1 after maintaining the constant force for 1 min. Then return the clamp to the zero position at the same speed and stop for 3 min.

8.3.3.4 Then stretch the specimen at the same speed to the pretension specified in 8.2.1; and read the specimen length L_2.

8.3.3.5 Calculate the elastic recovery rate and plastic deformation rate (%) of each specimen according to formulas (2) and (3). The measurement results are expressed by the average of the three specimens, rounded off to 0.1%.

$$\text{Recovery rate of elasticity at constant force} = \frac{L_1 - L_2}{L_1 - (L_0 + \Delta L)} \times 100 \quad \cdots\cdots (2)$$

$$\text{Deformation rate of plastics at constant force} = \frac{L_2 - (L_0 + \Delta L)}{(L_0 + \Delta L)} \times 100 \quad \cdots\cdots (3)$$

Where:

L_0 – gauge length, in mm.

L_1 - the length of the specimen after being stretched to a constant force for 1 min; in mm;

L_2 - the length of the specimen when it returns to the zero position and rests for 3 min before applying pretension, in mm;

ΔL - Elongation at pretension when specimen is clamped loosely, in mm. ΔL is 0 when clamping at pretension.

8.3.4 Determination of elastic recovery rate and plastic deformation rate under repeated stretching at constant force

8.3.4.1 Select the number of cycles based on product requirements or mutual agreement. If there is no agreement, it is recommended to use 3 times, 5 times or 10 times.

8.3.4.2 Stretch repeatedly according to 8.3.3.1~8.3.3.3. After reaching the predetermined number of cycles, measure the length L_1.

8.3.4.3 Then measure the length L_2 according to the method in 8.3.3.4.

8.3.4.4 Calculate the elastic recovery rate and plastic deformation rate of each specimen under repeated stretching at constant force according to Formulas (2) and (3). The measurement results are expressed by the average of the three specimens, rounded off to 0.1%.

8.3.5 Determination of elastic recovery rate and plastic deformation rate at constant elongation

8.3.5.1 Select a constant elongation according to product requirements or mutual agreement. If there is no agreement, it is recommended to use 3%, 5% or 10%.

8.3.5.2 The stretching dwell time and recovery time are determined according to product requirements or mutual agreement. If there is no agreement, it is recommended to use a stretching dwell time of 1 min and a recovery time of 3 min.

8.3.5.3 Start the instrument (when the specimen is loosely clamped, the elongation shall be measured from the time when the pretension is reached), stretch the specimen to a certain elongation L_3, and stop for 1 min. Then return the clamp to the zero position at the same speed and stop for 3 min.

8.3.5.4 Then stretch the specimen at the same speed to the constant elongation L_3.

8.3.5.5 Read the specimen length L_2 corresponding to the pretension in 8.2.1.

8.3.5.6 Calculate the elastic recovery rate at constant elongation and plastic deformation rate (%) of each specimen according to Formulas (4) and (5). The measurement results are expressed by the average of the three specimens, rounded off to 0.1%.

$$\text{Recovery rate of elasticity at constant elongation} = \frac{L_3 - L_2}{L_3 - (L_0 + \Delta L)} \times 100 \quad \cdots\cdots (4)$$

$$\text{Deformation rate of plastics at constant elongation} = \frac{L_2 - (L_0 + \Delta L)}{L_0 + \Delta L} \times 100 \quad \cdots\cdots (5)$$

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