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Tensile testing method for fine wire of nonferrous metals

有色金属细丝拉伸试验方法

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Tensile testing method for fine wire of nonferrous metals

1 Scope

This Standard specifies method summary, instruments and equipment, specimen, test requirements, test steps, test data processing and test report of tensile testing method for fine wire of nonferrous metals.

This Standard is applicable to determination of tensile mechanical properties at room temperature of fine wire of nonferrous metals of which the nominal diameter is not more than 0.25mm or cross-sectional area is not more than 0.0491mm².

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 8170, *Rules of rounding off for numerical values & expression and judgement of limiting values*

GB/T 10623, *Metallic material - Mechanical testing - Vocabulary*

GB/T 15077, *Geometric size measuring methods of precious metals and their alloy materials*

JJG 139, *Verification Regulation of Universal Tension and Compression Testing Machine*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 10623 as well as the followings apply.

3.1 proof force of total elongation; F_t

the force used to make the total extension (including elastic extension and

6 Instruments and equipment

6.1 The measurement error of the testing machine complies with the relevant regulations in JJG 139. The accuracy of the force value shall be level 1 or better.

6.2 The testing machine shall be calibrated or verified regularly. The force value range used in the test shall be within the tested range.

7 Specimen

7.1 Specimens shall be taken at least 300mm from the end of the wire. The spacing between each specimen shall not be less than 300mm.

7.2 The original gauge length of the specimen, L_0 , shall be 100mm. When there are other requirements, it can be 200mm or 50mm. When it is not necessary to determine the percentage extension, the original gauge length L_0 of the specimen shall be 50mm.

7.3 The total length of the specimen shall be determined according to the original gauge length of the specimen and the length of the clamping end.

7.4 The specimen shall not have mechanical damage and bending that affect the test result.

8 Test requirements

8.1 Test temperature

The test is generally carried out in the room temperature range of 10°C~35°C. For tests with strict temperature requirements, the test temperature shall be $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

8.2 Chuck spacing

The spacing between the two chucks of the testing machine is $L_0 \pm 0.5\text{mm}$.

8.3 Specimen processing

When clamping the specimen, keep the specimen free droop and straight. Apply pre-tension to the specimen if necessary. Its size generally does not exceed 5% of the maximum force of the wire. It may also stick the tested specimen on the straight line at both ends of the paper frame. The bonding length h and paper frame width b are determined by the size of the chuck, as shown in Figure 1. Cut the paper frame after the specimen is installed.

Where,

S_0 - Original cross-sectional area of the specimen, in square millimeters (mm²);

d_0 - Original diameter of the specimen, in millimeters (mm).

9.1.2 For wires with a nominal diameter of not more than 0.1mm, measure the cross-sectional area of specimen S_0 according to the weighing method specified in GB/T 15077.

9.1.3 If allowed by relevant standards or agreements, the nominal size can also be used to calculate the original cross-sectional area of the wire specimen.

9.1.4 The calculation of the original cross-sectional area of the specimen is rounded to three significant figures. The rounding method is carried out according to GB/T 8170.

9.1.5 Without the need to determine the strength index, the cross-sectional area of the specimen may not be measured.

9.2 Performance determination

9.2.1 Determination of proof force of total elongation F_t and proof strength of total elongation R_t

On the force-extension (displacement) curve, make a straight line parallel to the force axis and the distance from the force axis equal to the proof force of total elongation. The straight line intersects the curve. The force corresponding to the intersection point is the proof force of total elongation F_t , see Figure 2. According to formula (2), the proof strength of total elongation R_t is calculated:

$$R_t = \frac{F_t}{S_0} \dots\dots\dots (2)$$

Where,

R_t - Proof strength of total elongation, in megapascals (MPa);

F_t - Proof force of total elongation, in newtons (N);

S_0 - Original cross-sectional area of specimen, in square millimeters (mm²).

Table 3 -- Rounding off of value

10.2 The test result shall be invalid if one of the following situations occurs. It shall retest.

- a) The specimen breaks within 5% L_0 from the chuck, resulting in nonconforming performance. If the measured performance meets the minimum requirements specified, the test may not be retested. But the location of the fracture shall be indicated;
- b) Testing machine or recorder has malfunction;
- c) Due to improper operation, the specimen slips or there is mechanical damage that affect the accuracy of the test result.

10.3 When the original gauge length and cross-sectional area of the specimen are the same, the elongation can be compared.

10.4 When determining elongation, if there is no specific reference to determination of elongation after fracture in the product standard, it is regarded as determining the percentage total extension at fracture.

10.5 The test result is the arithmetic mean of the measured values of at least three specimens.

11 Test report

The test report shall contain the following information:

- a) Reference to this Standard;
- b) Requester;
- c) Material designation, state, specification and batch number;
- d) Specimen identifier;
- e) Test rate, original gauge length of specimen;

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