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Thermostat metal strip

热双金属带材

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Thermostat metal strip

1 Scope

This Standard specifies the designation expression method, order content, size, shape, marks, technical requirements, test methods, inspection rules, packaging, signs and quality certificate for thermostat metal strip.

This Standard is applicable to the production of thermostat metal strip (hereinafter referred to as the strip) for thermal sensitive components in temperature control, temperature compensation and temperature indicating devices.

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 5986, *Test method for modulus of elasticity of thermostat metals*

GB/T 6146, *Test method for resistivity of precision resistance alloys*

GB/T 8364, *Test methods of thermal flexure of thermostat metals*

YB/T 5242, *General Rules of Packaging, Marking and Quality Certification for Precision Alloys*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 thermostat metal

A composite material for heat-sensitive elements that is composed of two or more layers of metals or alloys with different average linear thermal expansion coefficients that are firmly bonded along the entire contact surface.

NOTE: Rewrite definition 3.3.1 of GB/T 15014-2008.

3.2 component alloy

The collective name of the material layers that make up the thermostat metal. According to the characteristics and functions of the material layer, it is divided into active component of thermostat metal, passive component of thermostat metal, intermediate passive component of thermostat metal.

[GB/T 15014-2008, definition 3.3.2]

3.2.1 active component of thermostat metal

A component layer with a larger average linear thermal expansion coefficient in a thermostat metal.

NOTE 1: The active component of thermostat metal is also called the high expansion layer. When the thermostat metal is heated and deformed, the active component of thermostat metal is always on the convex side. The basic requirements for the materials of active component of thermostat metal are: the average linear thermal expansion coefficient is large; the structure is stable; the weldability is good when combined with other component layer materials; the modulus of elasticity is close to that of the passive layer.

NOTE 2: Rewrite definition 3.3.5 of GB/T 15014-2008.

3.2.2 passive component of thermostat metal

The component layer with a relatively small average linear thermal expansion coefficient in the thermostat metal.

NOTE 1: The passive component of thermostat metal is also called the low expansion layer. When the thermostat metal is heated and deformed, the passive component of thermostat metal is always on the concave side. The basic requirements for the materials of passive component of thermostat metal are: in a certain temperature range, the average linear thermal expansion coefficient value shall be small and the material structure shall be stable.

NOTE 2: Rewrite definition 3.3.4 of GB/T 15014-2008.

3.3 specific thermal deflection

K

For flat thermostat metal with unit thickness, when the temperature changes by 1°C, half of the curvature change along the longitudinal centerline.

The expression for specific thermal deflection K is:

$$K = 1/2 \cdot \delta / (t_2 - t_1) \cdot 1/R$$

Where,

K - specific thermal deflection, in per degree Celsius ($^{\circ}\text{C}^{-1}$);

δ - thickness of thermostat metal sheet, in millimeters (mm);

t_1 - temperature when the thermostat metal sheet is flat, in Celsius ($^{\circ}\text{C}$);

t_2 - temperature when the thermostat metal sheet is bent, in Celsius ($^{\circ}\text{C}$);

R - curvature radius of the thermostat metal sheet when bending, in millimeters (mm).

NOTE: Rewrite definition 3.3.7 of GB/T 15014-2008.

3.4 flexivity

F

For a unit thickness of a thermostat metal sheet, the curvature of the longitudinal centerline changes per unit temperature change.

The expression of flexivity F is:

$$F = \delta \cdot (1/R_2 - 1/R_1) / (t_2 - t_1)$$

Where,

F - flexivity, in per degree Celsius ($^{\circ}\text{C}^{-1}$);

δ - thickness of thermostat metal sheet, in millimeters (mm);

t_1 - initial measured temperature of the thermostat metal sheet, in Celsius ($^{\circ}\text{C}$);

t_2 - end measured temperature of the thermostat metal sheet, in Celsius ($^{\circ}\text{C}$);

R_1 - radius of curvature of the longitudinal centerline of the specimen at the initial measurement temperature of the thermostat metal sheet, in millimeters (mm);

R_2 - radius of curvature of the longitudinal centerline of the specimen at the end measurement temperature of the thermostat metal sheet, in millimeters (mm).

NOTE: Rewrite definition 3.3.9 of GB/T 15014-2008.

3.5 elastic modulus of thermostat metal

E

Within the elastic limit of thermal bimetal, the ratio of stress to corresponding

8 Surface quality

The strip surface shall be smooth. Cracks, bubbles, flaking, rust spots, severe scratches and harmful spots are not allowed. Burrs shall not exceed half of the allowable thickness deviation.

9 Test methods

9.1 Size, shape

The size and shape of the strip are checked with measuring tools that can meet the accuracy requirements.

9.2 Flexivity

The flexivity test and specimen preparation are carried out in accordance with the provisions of GB/T 8364. Refer to Annex C for the heat treatment system of the specimen.

9.3 Resistivity

The resistivity test is carried out according to the provisions of GB/T 6146. The specimen size is shown in Table 6. It can also be measured with a bridge with an accuracy of not less than level 0.05 or a potentiometer with an accuracy of not less than level 0.03.

9.4 Elastic modulus

The elastic modulus test and specimen preparation are carried out in accordance with the provisions of GB/T 5986. The specimen size is shown in Table 6. Refer to Annex C for the heat treatment system of the specimen.

9.5 Bonding strength

9.5.1 Test method I

Test method I is repeated bending test (see Figure 1). The specimen size is shown in Table 6. Repeatedly bend to break. Visually observe the state of the bonding site.

9.5.2 Test method II

9.5.2.1 Twist

The specimen size is shown in Table 6. During the twist test, use a clamp to

clamp the specimen at a distance of about 5mm from both ends. It is advisable that the specimen is not loose. For the specimen with nominal thickness less than 1mm, the number of twists is: integer value obtained by dividing the distance between the two fixtures (i.e., torsion distance) by 15mm. For the specimen with nominal thickness not less than 1mm, the number of twists is: the distance between the two clamps (i.e., the twist pitch) is an integer value obtained by dividing by 30mm. Twist as many times as it is calculated. Then reverse the twist (twist by 360°) the same number of times, and it shall be once. Visually observe the state of the bonding site.

9.5.2.2 Repeated bending

The specimen size is shown in Table 6. The schematic diagram of repeated bending test is shown in Figure 1. Use an arc-shaped metal fixture of which the radius is equal to r_1 corresponding to the thickness of the specimen specified in Table 5 to clamp the specimen. Bend the specimen 90° to one side (called it the first bending). Then restore the specimen (called it the second bending). In the same way, bend the specimen 90° in the opposite direction (called it the third bending). Then restore the specimen (called it the fourth bending). Visually observe the state of the bonding site.

9.5.2.3 Bending

The specimen size is shown in Table 6. In the bending test, use an arc-shaped metal fixture of which the radius is equal to r_2 corresponding to the thickness of the specimen specified in Table 5 to clamp the specimen. Bend the specimen to one side by 90° . Then move the specimen outward about 10mm. Bend the specimen in the opposite direction by 90° . Visually observe the state of the bending part of the specimen at this time.

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