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Test methods of colourless optical glass - Part 7: Extent of striae

无色光学玻璃测试方法 第7部分：条纹度

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1 Scope

This document describes the test principle, instruments, sample, test conditions, test procedures, result expression, and test report for the extent of striae of colorless optical glass.

This document applies to the testing of the extent of striae of colorless optical glass. It can be used as a reference for testing the extent of striae of other materials that transmit light in the test wave band.

2 Normative References

GB/T 903-2019

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Striae

The non-uniformity of a material caused by the difference in refractive index between localized areas and surrounding areas within the glass.

3.2 Extent of striae

The degree, to which striae are present within the glass under test.

NOTE. it includes the thickness, length and density of the striae.

4 Test Principle

When striae are present in glass, there is a difference in refractive index between the striae and the glass matrix. When a beam of light passes through a striae-containing glass sample, the presence of the striae causes the light to be deflected, resulting in a striae image on the beam cross-section. This method uses a parallel beam of light passing through the glass under test.

Via optical imaging, the striae image is projected onto a projection screen for observation by the human eye or received by an image sensor. Against a dark background, the shape, size and distribution of the striae are tested to determine the extent of striae.

When the light-transmitting surface of the glass sample under test is a polished parallel plane, conventional testing is used; when the light-transmitting surface of the glass sample under test is a finely ground parallel plane, the light-transmitting surface is fitted with a refractive liquid using a mounting plate, and testing is performed using the mounting plate method; when the light-transmitting surface of the glass sample under test is a spherical, aspherical, or other non- parallel planes, for example, a molded pre-form, the sample is immersed in a refractive liquid using a sample cell, and testing is performed using the immersion method.

5 Instruments

The basic composition of a striae meter using the projection method is shown in Figure 1.

Depending on the mode of acquiring the striae image by the image receiving system, it is divided into two modes. human eye observation via projection screen reception and direct image acquisition via image sensor. The instrument mainly includes a light source system (light source, filter, aperture slot), a beam expansion and collimation system, an image receiving system, and a sample stage. For the mounting plate method and the immersion method, accessories such as mounting plates and sample cells are also included. Specific requirements are as follows.

a) Light source system. primarily composed of light source, filter and aperture slot,

providing an illumination of ? 50 lx and a matched test wavelength for striae testing.

- Light source. adjustable intensity. When using a projection screen to receive striae images, the illuminance projected onto the projection screen shall be ? 50 lx. When using an image sensor to receive striae images, the intensity of illumination on the image sensor shall meet its operational requirements, forming a clear electronic image without overexposure or underexposure.

- Filters. when using a projection screen to receive striae images, a visible light filter suitable for human eye observation is used. When using an image sensor to receive striae images, a matching filter suitable for the image sensor is used to protect the sensor.

- Aperture slot. adjustable aperture, with an aperture of 0.5 mm to 4 mm, matched with a beam expansion and collimation system to adjust beam quality, ensuring a uniform and spotless beam illuminating the sample.

b) Beam expansion and collimation system. F-number (i.e., the reciprocal of the relative aperture) ? 10.

c) Image receiving system. depending on the mode of acquiring the striae image, either a projection screen or an image sensor can be used.

- The illuminated surface of the projection screen shall be a uniform clean white board coated with 250-mesh fine white gypsum powder, or an equivalent white board. The screen size shall not be smaller than the projection spot size.

- -The operating wavelength of the image sensor shall match the light source system, with a pixel count of not less than 1 K ?1 K and a spatial resolution ? 0.05 mm.

d) Sample stage. the sample height and state can be adjusted in accordance with the sample specifications, and the angle can be adjusted left and right.

e) Mounting plate. made of materials, for example, glass with high transmittance, good chemical stability, and extent of striae meeting Grade A as specified in GB/T 903- 2019, with a thickness ? 2 mm, a polished working surface, a roughness Ra ? 0.05 ?m, and a parallelism ? 1?.

f) Sample cell. made of materials, for example, glass with high transmittance, good chemical stability, and extent of striae meeting Grade A as specified in GB/T 903- 2019 The light-transmitting surface is polished, with a roughness Ra ? 0.05 ?m and a parallelism ? 1?.

b) Direct image acquisition mode via image sensor Description of indexes. 1---light source; 2---filter; 3---aperture slot;

4---beam expansion and collimation system; 5---sample testing station; 6---sample stage;

7---sample testing using the immersion method (including sample cell and refractive liquid);

8---sample testing using conventional methods;

9---sample testing using the mounting plate method (including mounting plate and refractive liquid); 10---projection screen; 11---human eye observation; 12---image sensor and lens; 13---computer.

Figure 1 -- Schematic Diagram of Striae Meter Using Projection Method (continued)

6 Sample

The striae samples used for testing are divided into three categories, with the following requirements for each category.

a) Routine test samples. sample specifications are based on natural dimensions, with polished light-transmitting surfaces, roughness Ra ? 0.05 ?m, and parallelism ? 2?.

For sampled striae glass, the sample length is 50 mm ? 0.5 mm.

b) Test samples for the mounting plate method. sample specifications are based on natural dimensions, with finely ground light-transmitting surfaces, roughness Ra ? 1 ?m, and thickness difference ? 0.02 mm.

c) Test samples for the immersion method. all surfaces of the samples must be clean.

7 Test Conditions

Testing shall be conducted in a well-ventilated dark room, but local illumination that does not affect human eye observation, projection screen brightness, and image sensor is permissible. .....