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Colorless optical glass

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Table of Contents

Foreword.....	3
1 Scope	5
2 Normative references.....	5
3 Terms and definitions.....	6
4 Series, types, naming, marking	7
5 Requirements.....	8
6 Test methods.....	14
7 Inspection rules	16
8 Signs and labels	17
9 Packaging, transportation, storage.....	18
Appendix A (Informative) Colorless optical glass's n_d-v_d field diagram	19
Appendix B (Informative) Some physical-chemical performance parameters of colorless optical glass.....	20

Colorless optical glass

1 Scope

This standard specifies the terms and definitions, series, types, naming and marking, requirements, test methods, inspection rules, signs and labels, packaging, transportation, storage of colorless optical glass (hereinafter referred to as optical glass).

This standard is applicable to the colorless optical glass blanks, which have $8\text{ mm} \leq$ minimum side length $\leq 150\text{ mm}$ AND in the form of strips (bars) and blocks

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 191 Packaging - Pictorial marking for handling of goods

GB/T 2829 Sampling procedures and tables for periodic inspection by attributes (Apply to inspection of process stability)

GB/T 7962.1-2010 Test methods of colorless optical glass - Part 1: Refractive index and coefficient of dispersion

GB/T 7962.2-2010 Test methods of colorless optical glass - Part 2: Optical homogeneity - Fizeau plano-interferometry

GB/T 7962.5-2010 Test methods of colorless optical glass - Part 5: Stress birefringence

GB/T 7962.8-2010 Test methods of colorless optical glass - Part 8: Bubble

GB/T 7962.9-2010 Test methods of colorless optical glass - Part 9: Coefficient of optical absorption

GB/T 7962.10-2010 Test methods of colorless optical glass - Part 10: X-rays stability

GB/T 7962.12-2010 Test methods of colorless optical glass - Part 12: Spectral internal transmittance

GB/T 7962.14-2010 Test methods of colorless optical glass - Part 14: Resistance to

acid

GB/T 7962.15-2010 Test methods of colorless optical glass - Part 15: Resistance to humidity

GB/T 7962.16-2010 Test methods of colorless optical glass - Part 16: Linear thermal expansion coefficient transformation temperature and yield point temperature

GB/T 7962.18-2010 Test methods of colorless optical glass - Part 18: Knoop hardness

GB/T 7962.20-2010 Test methods of colorless optical glass - Part 20: Density

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

Environment friendly colorless optical glass

The optical glass, which has a total amount of environmentally hazardous impurities caused by impurities in chemical raw materials or furnace materials and processes as follows: lead (Pb) ≤ 100 mg/kg, arsenic (As) ≤ 100 mg/kg, cadmium (Cd) ≤ 5 mg/kg, mercury (Hg) ≤ 100 mg/kg, hexavalent chromium (Cr⁶⁺) ≤ 100 mg/kg.

3.2

Color cord

λ_{80}/λ_5

The ratio -- of the wavelength λ_{80} corresponding to the spectral transmittance of 80% of optical glass (thickness of $10\text{ mm} \pm 0.1\text{ mm}$) TO the wavelength λ_5 corresponding to the spectral transmittance of 5%. When $n_e \geq 1.85$, the wavelength λ_{70} corresponding to the spectral transmittance of 70% is used, instead of λ_{80} .

Example: When the spectral transmittance is 80%, the corresponding wavelength is 367 nm; when the spectral transmittance is 5%, the corresponding wavelength is 323 nm; THEN, λ_{80}/λ_5 is 37/32.

3.3

Inclusions

Foreign impurities or foreign matter, which is present in optical glass.

Note: For example, bubbles, grains, nodules, stones, platinum particles.

Chinese Pinyin alphabet of the word "Huan" plus "-" as a prefix. Environmentally friendly optical glass, which has low softening point properties is represented by the initial "D" of the Chinese Pinyin alphabet of the word "Di" plus "-" as a prefix. Each optical glass designation is represented by its type code plus serial number.

4.4 Marking

4.4.1 Marking method

It consists of three parts: Optical glass grade, smelting batch number, standard number.

4.4.2 Marking example

The optical glass, which is designated H-K9 AND has the melting batch number G0220091105, is marked as follows:

Colorless optical glass GB/T 903-2019-G0220091105 H-K9

5 Requirements

5.1 Specifications, dimensions, surface quality

5.1.1 Strip (bar) material's specification tolerance

Length tolerance: It shall be less than or equal to 20 mm.

Width tolerance: It shall be less than or equal to 2 mm.

Center thickness tolerance: It shall be less than or equal to 3 mm.

5.1.2 Tolerance of round (bar) material

Round bar length tolerance: It shall be less than or equal to 20 mm.

5.1.3 Surface quality of strip (bar) material

The surface of the strip (bar) material is naturally smooth; OR after grinding, the depth of surface defects (including bumps, burst points, ripples, cracks, inclusions, etc.) shall be less than or equal to 0.5 mm.

5.1.4 Blocks

5.1.4.1 Single block supply: If the side length is less than 100 mm, the tolerance range of each side shall be not more than 3 mm; if the side length is not less than 100 mm, the tolerance range of each side shall be not more than 5 mm.

5.1.4.2 Multiple block supply: According to the multiple side length, the tolerance provisions of 5.1.4.1 shall be implemented. Reserve the kerf, which needs to be cut,

resistance to moisture RC, transition temperature T_g , relaxation temperature T_s , linear expansion coefficient α , Knoop hardness HK, density ρ , etc., as shown in Appendix B.

6 Test methods

6.1 Specifications, dimensions, surface quality

The specification tolerance of optical glass is measured with a steel ruler, which has a division value of 1 mm. Visually check the surface defects.

6.2 Environmentally hazardous substances

For the indicators of environmentally hazardous substances in environmentally friendly colorless optical glass, the acid dissolution method can be used to treat the sample; use the inductively coupled plasma emission spectroscopy (ICP-AES) or atomic absorption spectroscopy (AAS) or atomic fluorescence spectroscopy (AFS), to carry out analysis. It may also directly grind the environmentally friendly glass into a flat plate; use X-ray fluorescence spectroscopy for analysis.

6.3 Refractive index, dispersion coefficient, batch deviation

The refractive index, dispersion coefficient, batch deviation of optical glass are tested according to the method of GB/T 7962.1-2010. The measurement uncertainty of refractive index is $\pm 5 \times 10^{-5}$.

6.4 Optical uniformity

The optical uniformity of optical glass is tested, according to the method of GB/T 7962.2-2010.

6.5 Stress birefringence

The stress birefringence of optical glass is tested, according to the method of GB/T 7962.5-2010.

6.6 Streak degree (projection method)

There are two types of streak detection methods:

- a) Streak degree detection method 1: The principle is as shown in Figure 1. S is the monochromatic light source; D is the fine frosted glass immersion screen; A is the pinhole aperture, which is located at the back focal point of the collimating achromatic lens L1; B is the movable cross slit, which is located on the back focal plane of the objective lens L2. The sample to be tested is placed at point P, so that its polished surface is perpendicular to the line of sight. The light deflection and drift, which is caused by the slight non-parallelism of the polished surface, are compensated by a movable cross slit. The cross slit shall be adjusted, so that the

6.7 Inclusions

The inclusions of optical glass are tested, according to the method of GB/T 7962.8-2010.

6.8 Color cord, light absorption coefficient

The optical absorption coefficient of optical glass is tested, according to the method specified in GB/T 7962.9-2010. Color cord test of optical glass: use the samples which have a thickness of $10\text{ mm} \pm 0.1\text{ mm}$; grind the two opposite surfaces to be parallel; use a spectrophotometer to test the transmittance (including surface reflection loss), according to the method of GB/T 7962.12-2010. Respectively use $\lambda_{80(70)}$ and λ_5 , to represent wavelengths at a transmittance of 80% (70%) and 5%.

6.9 X-ray resistance

The X-ray resistance of X-ray-resistant optical glass is tested, according to the method of GB/T 7962.10-2010.

6.10 Physical-chemical properties

The acid resistance of optical glass is tested, according to the method of GB/T 7962.14-2010; the moisture resistance is tested, according to the method of GB/T 7962.15-2010; the linear expansion coefficient, transition temperature, relaxation temperature are tested, according to the method of GB/T 7962.16-2010; Knoop hardness is tested, according to the method of GB/T 7962.18-2010; density is tested, according to the method of GB/T 7962.20-2010.

7 Inspection rules

7.1 General

Inspection is divided into exit-factory inspection and type inspection.

7.2 Exit-factory inspection

Optical glass is supplied in batches. A batch of optical glass blanks shall consist of the same designation, smelting batch number, annealing number.

7.3 Type inspection

Type inspection shall be carried out, in one of the following situations:

- a) When the product is subject to type finalization OR trans-plant production;
- b) After formal production, where there are major changes in raw materials, formulas and processes, which may affect product performance;

8.2.1 Labels for packing box

The labels for packing box shall have the following markings:

- a) Optical glass's designation, melting number;
- b) Specification and mass (kg).

8.2.2 Product certificate

The product certificate shall have the following marks:

- a) Qualification seal;
- b) Optical glass's designation, melting number;
- c) Contract number;
- d) Some properties and some technical indicators, such as: refractive index n_d , dispersion coefficient v_d , density ρ , bubble degree, streak degree, stress birefringence, color cord, etc.;
- e) Optical density increment of X-ray resistant glass.

9 Packaging, transportation, storage

9.1 Packaging

It is packed in qualified carton or wooden box; each piece of glass shall be separated by cardboard to avoid collision; there shall be no looseness in the box. The packaging shall be intact, the box surface is clean, the handwriting is clear, the text is consistent with the content. Each batch of glass shall be accompanied by a product certificate.

9.2 Transportation and storage

9.2.1 When the glass is stacked, the upper and lower glasses shall be separated by a cardboard.

9.2.2 When transporting or storing, it shall be rain-proof and moisture-proof; handle with care; do not collide.

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