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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 42800-2023

High purity opaque quartz glass

高纯不透明石英玻璃

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Foreword

This document was issued on 23 May 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 December 2023.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 42800-2023 specifies high purity opaque quartz glass. Opaque quartz is deliberately filled with fine bubbles so that it scatters infrared instead of transmitting it, which makes it a thermal insulator that keeps the chemical purity and thermal shock resistance of fused silica - the reason it lines the hot zones of semiconductor diffusion furnaces and photovoltaic crystal pullers, where any metallic contamination would reach the wafer. Purity is therefore specified more tightly than for any other glass. The standard sets the grades, the requirements, the test methods, the inspection rules and the marking, packaging, transport and storage provisions. It took effect on 1 December 2023.

This document specifies the classification, requirements, test methods, inspection rules, marking, packaging, transportation, and storage of high-purity opaque quartz glass.

This document is applicable to high-purity opaque quartz glass materials with thermal insulation in semiconductor, photovoltaic, and other fields.

2 Normative references

The following documents contain the provisions which, through normative reference in this document, constitute the essential provisions of this document. For the dated referenced documents, only the versions with the indicated dates are applicable to this document; for the undated referenced documents, only the latest version (including all the amendments) is applicable to this document.

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

GB/T 3284 Analytical method of the chemical composition in the quartz glass

GB/T 5432 Test method for density of glass by buoyancy

GB/T 10701-2008 Test methods for thermal stability of silica glass

GB/T 22588 Determination of thermal diffusivity or thermal conductivity by the flash method

JC/T 2205 Terminology of quartz glass

3 Terms and definitions

The terms and definitions defined in JC/T 2205 apply to this document.

4 Grades

According to product appearance quality and impurity element content, it is divided into semiconductor grade and photovoltaic grade.

5 Requirements

5.1 Specifications, dimensions, and dimensional deviations

They are negotiated by the supply and demand sides.

5.2 Appearance quality

5.2.1 The surface shall be smooth, uniform in color, and free from cracks, regular microcracks, and scratches with a length greater than 10 mm or a width greater than 0.5 mm.

5.2.2 Visually it is milky white, and there shall be no transparent areas.

5.2.3 Semiconductor-grade high-purity opaque quartz glass shall not have speck spots,

coloured spots, and raw material particles; photovoltaic-grade high-purity opaque quartz glass shall not have speck spots, coloured spots, and raw material particles with a diameter greater than 1 mm, and the total number of speck spots, coloured spots, and raw meal particles, whose diameters are not greater than 1 mm, in any area of 100 cm² shall not exceed 4.

5.3 Density

The density shall not be greater than 2.15 g/cm³ and not less than 1.90 g/cm³.

5.4 Spectra transmittance

The spectra transmittance in the wavelength range of 380 nm~3000 nm shall be less than 1.0%.

5.5 Thermal stability

After the test, there shall be no cracks, breaches, or skin flake-off.

5.6 Heat resistance

The deformation rate after the test shall not exceed 2.0%.

5.7 Thermal conductivity

At 20 degrees C, the thermal conductivity shall not be greater than 1.25 W/(m · K) and not less than 1.00 W/(m · K).

5.8 Content of impurity elements

The impurity elements include aluminum (Al), iron (Fe), calcium (Ca), magnesium (Mg), titanium (Ti), copper (Cu), cobalt (Co), nickel (Ni), manganese (Mn), lithium

Clean the sample in an ultrasonic bath, then wipe it clean with alcohol, rinse it with deionized water, and dry it naturally; then, carry out the test according to the method specified in GB/T 5432, and round the results to two decimal places.

6.5 Spectra transmittance

6.5.1 Sample

Take one piece of sample; the length and width are about 50 mm, the thickness after grinding is 5 mm±0.5 mm, and there are no obvious speck spots, coloured spots, raw material particles, or other defects that affect the test.

6.5.2 Test equipment

The requirements for the spectrophotometer:

- a) It is able to measure the spectra transmittance of regular light;
- b) The wavelength includes the range of 380 nm~3000 nm;
- c) The transmittance measurement accuracy is not less than $\pm 1\%$.

6.5.3 Test procedure

The test is carried out as follows:

- a) Wipe the surface of the sample with alcohol until it is clean, rinse it with deionized water, and dry it at $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$;
- b) Use a spectrophotometer to measure the spectra transmittance of the sample in the range of 380 nm~3000 nm for regular light.

6.5.4 Data processing

Read the maximum transmittance value and round the result to one decimal place.

6.6 Thermal stability

Carry out the test according to the air cooling method specified in GB/T 10701-2008.

Take three samples with a length of $50\text{ mm} \pm 1\text{ mm}$, a width of $50\text{ mm} \pm 1\text{ mm}$, and a thickness of $5\text{ mm} \pm 1\text{ mm}$, keep them at the temperature of $1200\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ for 30 min,

take them out and cool them in the air to room temperature.

6.7 Heat resistance

6.7.1 Samples

Take 3 samples; the length is $180\text{ mm} \pm 2\text{ mm}$, the width is $20\text{ mm} \pm 1\text{ mm}$, and the

H1 -- the arch height of the sample before the test, in millimeters (mm);

H2 -- the arch height of the sample after the test, in millimeters (mm).

The result is rounded to one decimal place, and the maximum deformation rate among the three samples is taken as the measurement result.

6.8 Thermal conductivity

Clean the sample in an ultrasonic bath, then wipe it with alcohol, rinse it with deionized water, and dry it at $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ or dry it naturally; carry out the test