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

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**Test methods for density and apparent porosity of fine
ceramics**

(English Translation)

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1 Scope

This Standard specifies the instruments and equipment, test pieces, test procedure, result calculation, and test report for the test methods for apparent solid density, bulk density, and apparent porosity of fine ceramics.

This Standard applies to bulk fine ceramics; other inorganic non-metallic materials may also refer to this Standard.

NOTE: This method is not applicable to materials with an apparent porosity greater than 10 %.

Furthermore, the measurement of apparent porosity when the apparent porosity is less than 0.5 % may be inaccurate.

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 8747 Meteorological liquid-in-glass thermometer (GB/T 8747-1988, neq ISO 386.1977)

GB/T 22230 Liquid chemical products for industrial use - Determination of density at 20 °C (GB/T 22230-2008, ISO 758.1976, IDT)

3 Terms and definitions

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

3.1

open pores

Pores that can be connected to air or penetrated by the immersion liquid.

3.2

closed pores

Pores that cannot be connected to air or penetrated by the immersion liquid.

3.3

bulk volume

Sum of the volumes of the solid material, the open pores, and the closed pores.

3.4

apparent solid volume

Sum of the volumes of the solid material and the closed pores.

3.5

apparent solid density

Ratio of the mass of the dried material to the apparent solid volume.

3.6

bulk density

Ratio of the mass of the dried material to the bulk volume.

3.7

apparent porosity

Ratio of the volume of the open pores to the bulk volume.

4.1 Oven

An oven with a temperature control range of $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

4.2 Balance

When the mass of the test piece is not greater than 10 g, the accuracy is 0.1 mg; when the mass of the test piece is greater than 10 g, the accuracy is 0.001 % of the mass of the test piece.

4.3 Heating apparatus

An apparatus capable of boiling the sample.

4.4 Thermometer

Accurate to ± 1 °C as specified in GB/T 8747.

4.5 Immersion liquid

For test pieces that do not react with water, use distilled water or ion-exchanged water.

For test pieces that react with water, use a suitable organic liquid.

4.6 Basket

A basket for placing the test piece in the immersion liquid to determine the suspended mass.

4.7 Suspending wire

Diameter not greater than 0.25 mm, and the wire shall be clean.

4.8 Evaporating apparatus

Pressure not greater than 2.5 kPa when using the vacuum method.

5.1 Volume

The volume of the test piece for each test shall not be less than 0.4 cm³.

When the volume of a single sample is less than 0.4 cm³, multiple samples shall be combined to form a test piece with a total volume greater than 0.4 cm³ for testing, but the volume of each sample shall not be less than 0.04 cm³.

NOTE: If the volume of the test piece is less than 0.04 cm³, the bulk density can only be obtained by performing geometric measurements on processed test pieces. The apparent porosity of this kind of test pieces can be measured using the mercury porosimetry.

5.2 Surface

The surface of test pieces shall be free of contamination and shall not crumble during the test.

6.1 Measuring the mass of the dry test piece

Dry the test piece in the oven at $100\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, cool it to room temperature in a desiccator and weigh it again; repeat this step until a constant weight is obtained, which gives the mass of the dry test piece, m_1 . If the test piece cracks during boiling, the mass of the dry test piece, m_1 , shall be weighed after weighing the suspended mass, m_2 , and the mass of the wet test piece, m_3 .

6.2.1 Boiling method

The boiling method is suitable for materials that do not react with water.

Immerse the test piece in water, ensuring it remains submerged, and boil for at least 3 h. Cool to room temperature. Water at room temperature can also be used to cool the test piece.

6.4 Measuring the mass of the wet test piece

Remove the test piece from the liquid, wipe the liquid off the outer surface of the wet test piece with an absorbent cloth, such as gauze or soft leather, then quickly weigh the test piece to obtain the mass of the wet test piece, m_3 .

The absorbent cloth shall be completely soaked in the immersion liquid and gently wrung out to avoid drawing water from the pores of the test piece.

6.5 Measuring the density of the immersion liquid

6.5.1

For water, determine the density using Table 1.

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