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**Chemical Analysis Methods and Determination of Physical
Performance of Alumina – Part 27: Particle Size Analysis –
Sieves Method**

氧化铝化学分析方法和物理性能测定方法 第 27 部分：粒度分析 筛
分法

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Chemical Analysis Methods and Determination of Physical Performance of Alumina – Part 27: Particle Size Analysis – Sieves Method

1 Scope

This Document describes a method for determining the particle size distribution of alumina by sieving.

This Document applies to the determination of the particle size distribution of alumina. The dry sieving method is applicable to particle size distributions where less than 50% of the particles are smaller than 45 μm ; the wet sieving method is applicable to particle size distributions in the range of 16 μm to 63 μm ; and the solvent rinse method is applicable to particle size distributions where less than or equal to 4% of the particles are smaller than 20 μm .

2 Normative References

The provisions in following documents become the essential provisions of this Document through reference in 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 Document.

GB/T 6003.1 Test sieves - Technical requirements and testing - Part 1: Test sieves of metal wire cloth

GB/T 6003.3 Test sieves of electroformed sheets

GB/T 6609.22 Chemical analysis methods and determination of physical performance of alumina - Sampling

GB/T 6609.23 Chemical analysis methods and determination of physical performance of alumina - Preparation and storage of test samples

GB/T 8170 Rules of rounding off for numerical values & expression and judgement of limiting values

3 Terms and Definitions

No terms and definitions are listed in this Document.

4 Sample

Sampling shall be carried out in accordance with the provisions of GB/T 6609.22; and the preparation and storage of specimen shall be carried out in accordance with the original sample specified in GB/T 6609.23.

5 Dry Sieving Method

5.1 Principle of method

The test materials are forced through each level of the sieve by mechanically vibrating the test sieve. The mass of the test materials on each test sieve and on the sieve bottom is weighed, and the ratio of the mass to the total mass is the particle size distribution of the sample.

5.2 Apparatus

5.2.1 Test Sieve: The test sieve is circular, 200 mm in diameter, 50 mm or 75 mm in height, and includes a lid and sieve bottom. The lid, test sieve, and sieve bottom constitute a screening test system. The sieve is constructed of smooth metal wire or square-hole sheet, with mesh deviations conforming to the provisions of GB/T 6003.1 or GB/T 6003.3, respectively. The mesh sizes are 150 μm , 106 μm , 75 μm , 53 μm , and 45 μm .

5.2.2 Sieve vibrator: Provides horizontal rotation and vertical vibration.

5.2.3 Electronic balance: Accuracy 0.01 g.

5.2.4 Oven: Controllable temperature $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

5.2.5 Ultrasonic cleaner: Sufficient volume to completely submerge the test sieve vertically.

5.2.6 Optical microscope: Desktop or portable, capable of magnification of 100 $\times$ or more.

5.3 Test procedure

5.3.1 Preparation of test sieve

Before the measurement, calibrate the test sieve using an optical microscope (5.2.6). If the pore blockage rate is no greater than 10%, it shall be used for the measurement. Otherwise, clean the test sieve in an ultrasonic cleaner (5.2.5) for 3 to 5 min to remove any surface debris. Place the test sieve in an oven (5.2.4) and dry at $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$ drying for 2 h. Remove and cool to room temperature. Weigh the mass (m_1) of each test sieve (or sieve bottom) on an electronic balance (5.2.3), accurate to 0.01 g.

5.3.2 Test material

$$w'_i = \left(1 - \frac{m_4 - m_3}{m_0} \right) \times 100\% \quad \dots\dots\dots (3)$$

Where:

m_4 - Mass of the test sieve and remaining test material, in g;

m_3 - Mass of the test sieve, in g;

m_0 - Mass of the test material, in g.

Numerical rounding shall be performed in accordance with the provisions of GB/T 8170. Calculated results shall be expressed to two digits after the decimal point.

7 Solvent Rinse Method

7.1 Principle

Wash the alumina sample with acetone and pass it through a 20 µm electroformed sieve. After drying at 300°C, calculate the content of the material on the sieve.

7.2 Reagents

7.2.1 Acetone: Analytically pure. Acetone is flammable and shall be used in a fume hood.

7.2.2 Desiccant: Activated alumina or molecular sieves are suitable; silica gel is not suitable.

7.2.3 Ethanol: Industrial pure.

7.3 Apparatus

7.3.1 Test Sieve: Meet the requirements of GB/T 6003.3, with a diameter of 75 mm to 150 mm, an electroformed sieve with a sieve aperture of 20 µm and circular mesh.

7.3.2 Brush: The material shall be resistant to acetone corrosion.

7.3.3 Oven: Oven with air circulation, capable of controlling to 300°C ± 10°C.

7.3.4 Vacuum dryer.

7.3.5 Platinum Crucible: Two crucibles, approximately 35 mm in diameter and 40 mm in height, with a capacity of 25 mL and lids. These are designated Platinum Crucible A and Platinum Crucible B.

7.3.6 Wash Bottle: A polyethylene bottle suitable for containing acetone.

7.3.7 Sampling spoon: A stainless steel or brass handle capable of weighing 0.5 g of alumina at

a time.

7.3.8 Electronic balance: with accuracy of 0.000 1 g.

7.4 Test procedure

7.4.1 Inspect the test sieve

First, inspect the sieve meshes to ensure they are not broken. If the pore blockage rate is greater than 30%, clean the sieve according to the requirements of 5.3.1.

7.4.2 Operation procedure

7.4.2.1 Use the sampling spoon (7.3.7) to take a sample. Using an electronic balance (7.3.8), weigh $2.0\text{ g} \pm 0.1\text{ g}$ of the sample (see Clause 4) and record it as m_5 , accurate to 0.000 1 g. Transfer the weighed test material to the test sieve (7.3.1).

7.4.2.2 Weigh the masses of the dried platinum crucibles with lids (Platinum Crucible A and Platinum Crucible B in 7.3.5) and record them as m_6 and m_7 , respectively. Weigh $2\text{ g} \pm 0.1\text{ g}$ of test material into platinum crucible A. Weigh the mass of the test material and platinum crucible A (m_8), accurate to 0.0001 g. Platinum crucible A is used for moisture correction of the test material. Prior to step 7.4.2.6, store the weighed crucible containing the test material in a dryer. Platinum crucible B is used to dry the sieved test material. Both test materials shall be weighed simultaneously.

7.4.2.3 In a fume hood, wet the test material on the sieve with acetone. Then, use a wash bottle (7.3.6) to spray acetone to rinse the test material on the test sieve, while scrubbing with the brush (7.3.2).

7.4.2.4 Scrub for 10 min, ensuring that all test material on the meshes are scrubbed. Use the brush to remove any test material from the inner wall of the test sieve and remove any test material adhering to the brush.

7.4.2.5 Wash the test material on the mesh with acetone and transfer it to platinum crucible B. Evaporate the sample in a fume hood to dry it to prevent spillage.

Warning: Do not place the crucible in an oven until the acetone has completely evaporated.

7.4.2.6 Dry platinum crucibles A and B in an oven (7.3.3) at $300^\circ\text{C} \pm 10^\circ\text{C}$ for 2 h.

7.4.2.7 Remove the crucible from the oven; cover it; and place it in the vacuum dryer (7.3.4). Evacuate the chamber and cool it to room temperature. Weigh the mass of platinum crucible A and the test material (m_9), and the mass of platinum crucible B and the test material (m_{10}), and accurate to 0.0001 g.

7.5 Test data processing

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