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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 6609.5-2026

Replacing GB/T 6609.5-2004

Chemical analysis and physical property determination methods for alumina - Part 5: Determination of sodium oxide and potassium oxide contents

氧化铝化学分析方法和物理性能测定方法 第5部分：氧化钠、氧化钾含量的测定

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Table of Contents

Foreword

GB/T 6609.5-2026 | Chemical analysis methods and determination of physical performance of alumina - Part 5: Determination of sodium oxide and potassium oxide contents

GB/T 6609.5-2026 English version. Chemical analysis methods and determination of physical performance of alumina - Part

1 Scope

GB/T 6609.5-2026 is the Chinese national standard covering soda and potash in alumina - the soda content is the single most watched impurity in smelter grade alumina, because it goes straight into the electrolyte balance of the reduction cell. It fixes the reagents, the sample preparation, the procedure and the precision. It replaces GB/T 6609.5-2004 and takes effect on 1 December 2026, one of the parts of the GB/T 6609 series revised together

in this batch. It was issued on 25 May 2026 and takes effect on 1 December 2026, replacing GB/T 6609.5-2004. The document is under the responsibility of the China Nonferrous Metals Industry Association. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

4.1 Method Overview The sample was dissolved in boric acid and starch at high temperature to convert sodium and potassium into borates. After leaching with water, the insoluble matter was separated, and n-butanol was added as a sensitizer. The emission intensity of sodium oxide was measured at wavelengths of 589 nm to 590 nm using a flame photometer, and at wavelengths of 766 nm to 770 nm. The emission intensity of potassium oxide was calculated based on the working curves to obtain the contents of sodium oxide and potassium oxide.

4.2 Reagents Unless otherwise specified, only reagents confirmed to be of superior purity and water conforming to GB/T 6682 shall be used in the analysis.

4.2.1 Boric acid.

4.2.2 Starch. If the blank value is high, purify by repeatedly washing with water using the decantation method, then wash twice with anhydrous ethanol, air dry, and grind into a fine powder. spare.

4.2.3 Hydrochloric acid (1 19).

4.2.4 Boric acid solution (29 g/L).

4.2.5 n-Butanol. Place 500 mL of n-butanol in a 1000 mL separatory funnel, add 150 mL of water, shake for 3 min, and discard after separation of layers. Remove the aqueous phase. Extract twice more with water (approximately 75 mL each time).

4.2.6 Standard stock solutions of sodium oxide and potassium oxide. Weigh 1.8859 g of sodium chloride (place it in a platinum crucible (4.3.1) and ignite at 500 °C). [After 2 hours, place in a desiccator (4.3.4) and allow to cool naturally to room temperature] and 0.1583 g of standard potassium chloride [placed in a platinum crucible (4.3.1) and heated at 500°C]. Ignite for 2 hours, place in a desiccator (4.3.4), and allow to cool naturally to room temperature. Place in a 500mL beaker, add.200mL of water, and dissolve completely. Transfer to a 1000 mL volumetric flask, dilute to the mark with water, mix well, and store in a polyethylene bottle. 1 mL of this solution contains 1 mg of sodium oxide and...

0.1 mg potassium oxide. Or use a commercially available certified solution.

2 Flame Atomic Absorption Spectrometry

5.1 Method Overview Dissolve the sample in phosphoric acid-sulfuric acid (method I) or

place the sample in a microwave digestion system and digest it with sulfuric acid at high temperature and pressure (method I). Method II) uses an air-acetylene flame to determine the absorbance and wavelength of sodium oxide at a wavelength of 589.0 nm using a flame atomic absorption spectrometer. The absorbance of potassium oxide was measured at 766.5 nm, and the contents of sodium oxide and potassium oxide were calculated based on the working curve.

5.2 Reagents Unless otherwise specified, only reagents confirmed to be of superior purity and Grade I water conforming to GB/T 6682 shall be used in the analysis.

5.2.1 Phosphoric acid (rho=1.69g/mL).

5.2.2 Sulfuric acid (rho=1.84g/mL).

5.2.3 Sulfuric acid (1 2).

4.2.7 Sodium oxide and potassium oxide standard solutions. Transfer

50.00 mL of sodium oxide and potassium oxide standard stock solutions (4.2.6) into a 500 mL volumetric flask. Dilute with water to the mark, mix well, and store in a polyethylene bottle. 1 mL of this solution contains

0.1 mg sodium oxide and

0.01 mg potassium oxide.

4.3 Instruments and Equipment

4.3.1 Platinum crucible. 30 mL, with lid.

4.3.2 Muffle furnace. 1100°C±20°C.

4.3.3 Flame photometer. air-acetylene flame.

4.3.4 Dryer. Use activated alumina as a desiccant, and activate it at 300°C before each use.

4.4 Sample Sampling shall be carried out in accordance with the provisions of Chapter 6 of GB/T 6609.22-2026, and sample preparation shall be carried out in accordance with Section

7.4 of GB/T 6609.22-2026. The regulations shall be followed.

4.5 Test Procedure

4.5.1 Sample According to the different elements and contents (mass fractions) to be determined, weigh the sample (4.4) amount and melting amount according to Table 2, accurate to 0.0001g.

4.5.2 Parallel Tests Perform two parallel experiments and take the average value.

4.5.3 Blank Test A blank test was performed along with the sample.

4.5.4 Preparation of analytical solutions

4.5.4.1 Place the sample (4.5.1) in a platinum crucible (4.3.1), add the flux according to Table 2, stir well, cover with the platinum crucible lid, and place in a muffle furnace. (4.3.2) Heat from room temperature to 1100°C±20°C, hold for 10 minutes, and then remove.

4.5.4.2 Place the platinum crucible on a hot plate at a low temperature, add boiling water, and heat to near boiling to loosen the molten metal. Transfer the molten metal and solution to 150 mL. In a beaker, use a wiping rod to remove the precipitate from the platinum crucible wall, and wash with hot water. Add the washing solution to the beaker, ensuring the solution volume does not exceed [a certain value]. 70mL.

4.5.4.3 Place the beaker on a hot plate and heat until it just begins to boil. Use a flat-headed glass rod to crush the molten material, maintain the simmering state for 10 minutes, then remove and place in a cool environment. Cool to room temperature in a water bath.

4.5.4.4 Transfer the mixture of solution and precipitate (4.5.4.3) to a 100 mL volumetric flask, wash the beaker with water, and add the washings to the volumetric flask. Dilute with water to the mark and mix well. Filter using medium-speed quantitative filter paper [the filter paper and funnel should be washed four times with hydrochloric acid (4.2.3) and hot water]. Wash 5 times, then wash 2 to 3 times with the initial filtrate.

4.5.4.5 Transfer

40.00 mL of the filtrate (4.5.4.4) to a 50 mL volumetric flask, add

3.50 mL of n-butanol (4.2.5), shake, and allow the n-butanol to settle. Mix the alcohol (4.2.5) thoroughly, dilute with water to the mark, and mix well.

4.5.5 Measurement According to the instrument's operating conditions, use an air-acetylene flame on a flame photometer (4.3.3) at wavelengths of 589nm~590nm or 766nm~ At 770 nm, with water used for zeroing, the emission intensity of the analytical solution (4.5.4.5) and the blank test solution (4.5.3) prepared along with the sample were measured. The corresponding sodium oxide or potassium oxide content can be found on the working curve.

4.5.6 Plotting the Working Curve

4.5.6.1 In a set of 1000mL volumetric flasks, add sodium oxide and potassium oxide standard stock solutions (4.2.6) or sodium oxide and potassium oxide according to Table 3. Add 300 mL of boric acid solution (4.2.4) and 70 mL of n-butanol (4.2.5) sequentially to the standard solution (4.2.7), then add water to approximately 950 mL and shake. After dissolving n-butanol (4.2.5) by stirring, dilute with water to the mark, mix well, and store in a