

ICS 91.100.10

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

GB/T 176-2017

**Methods for chemical analysis of cement
(English Translation)**

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1 Scope

This standard specifies methods for chemical analysis of cement, X-ray fluorescence analysis methods, inductively coupled plasma emission spectrometry for the determination of loss on ignition (LOI), SO₃, insoluble (IR),

SiO₂, Fe₂O₃, Al₂O₃, CaO, MgO, TiO₂, Cl⁻, K₂O, Na₂O, S²⁻, MnO, P₂O₅, CO₂, ZnO,

F⁻, free calcium oxide (fCaO), SrO. Chemical analysis methods of cement are further divided into reference methods and alternative methods. If multiple determination methods are listed for the same component, the reference method shall prevail in case of dispute.

This standard applies to general Portland cement, clinker, raw material for the preparation of the above cement, other cements and materials designated to use this standard.

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) are applicable to this standard.

GB/T 5762 Methods for chemical analysis of limestone, quicklime and hydrated lime for building materials industry

GB/T 6682 Water for analytical laboratory use - Specifications and test methods

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

GB/T 12573 Sampling method for cement

GB/T 15000 (all parts) Directives for the work of reference materials

GSB 08-1110 Standard sample of cement raw materials for X-ray fluorescence analysis

GSB 08-1355 Standard sample for analysis of cement clinker composition

GSB 08-1356 Standard sample for composition analysis of ordinary Portland cement

3 Terms and definitions

The terms and definitions as defined in GB/T 15000 (all parts) and the following terms and definitions apply to this document.

3.1

Repeatability conditions

The conditions under which the same operator uses the same equipment in the same laboratory according to the same determination method to obtain independent test results from the same test subject in a short time.

3.2

Reproducibility conditions

Conditions under which different operators in different laboratories use different equipment but same determination method to obtain the test results from the same determination object.

3.3

Repeatability limit

A value, under the repeatability condition (3.1), the probability that the absolute difference between the two test results does not exceed this number is 95%.

4.1 Number of tests and requirements

The number of tests for each determination is specified as two; the absolute difference between the two results is within the repeatability limit (Table 3, Table

4, Table 5). The average value of the two test results is used to indicate the determination result.

4.2 Representation of mass, volume, titer and results

Mass is expressed in "grams (g)" and is accurate to 0.0001 g. The volume of the burette is expressed in "milliliter (mL)"; the reading is accurate to 0.01 mL.

The titer is expressed in "milligrams per milliliter (mg/mL)".

4.3 Repeatability limit and reproducibility limit

The repeatability limits and reproducibility limits listed in this standard are absolute deviations, expressed in terms of mass fraction (%).

4.7 Checking chloride (silver nitrate inspection)

After washing the precipitate several times as required, use water to rinse the lower end of the funnel; continue using water to wash the filter paper and the precipitate; collect the filtrate in a test tube; add a few drops of silver nitrate solution (6.1.31); observe whether the solution in the test tube is turbid. If it is turbid, continue washing and testing until it is no longer turbid when checking by the use of silver nitrate.

4.8 General requirements for reagents

Unless otherwise specified, the reagents used shall not be lower than analytical grade; the reagents used for calibration shall be reference reagents. The water used shall not be lower than the requirements of the third-grade water as specified in GB/T 6682.

5 Preparation of specimens

Take sample according to the method of GB/T 12573. The sample sent to the laboratory shall be a representative uniform sample. The sample is divided to about 100 g by a quartering method or a divider. After sieving through a 150 μm square hole sieve, the debris is removed. After the sieve residue is ground, it is passed through a 150 μm square hole sieve.

6.1.1 Hydrochloric acid (HCl)

1.18 g/cm³ ~ 1.19 g/cm³, mass fraction is 36% ~ 38%.

6.1.2 Hydrofluoric acid (HF)

1.15 g/cm³ ~ 1.18 g/cm³, mass fraction is 40%.

1.12 g/cm³, mass fraction is 99%.

6.1.12 Ethanol

The volume fraction of ethanol is 95%.

6.1.13 Absolute ethanol (C₂H₅OH)

The volume fraction of absolute ethanol is not less than 99.5%.

6.1.14 Glycerol [C₃H₅ (OH) 3]

The volume fraction is not less than 99%.

6.1.18 Nitric acid (1 + 1); (1 + 2); (1 + 9); (1 + 100)

6.1.19 Sulfuric acid (1 + 1); (1 + 4); (1 + 9); (5 + 95)

6.1.34 Ammonium molybdate solution (50 g/L)

Dissolve 5 g of ammonium molybdate [(NH₄)₆Mo₇O₂₄ · 4H₂O] in hot water; after cooling, add water to dilute it to 100 mL; store it in a plastic bottle; if necessary, filter it before use. This solution is used within one week.

6.1.35 Ascorbic acid solution (5 g/L)

Dissolve 0.5 g of ascorbic acid (V.C) in 100 mL of water; if necessary, filter it before use. Prepare it before use.

6.1.48 Sodium hydroxide solution (200 g/L)

Dissolve 20 g of sodium hydroxide (NaOH) in water. Add water to dilute it to 100 mL. Store it in a plastic bottle.

6.1.55 pH 4.3 buffer solution

Dissolve 42.3 g of anhydrous sodium acetate (CH₃COONa) in water; add 80 mL of glacial acetic acid; add water to dilute it to 1 L. After preparation, use a precision pH test paper to check.

6.1.56 Potassium fluoride solution (20 g/L)

Place 20 g of potassium fluoride (KF · 2H₂O) in a plastic cup; add water to dissolve it; add water to dilute it to 1 L; store it in a plastic bottle.

6.1.57 Ammonium oxalate solution (50 g/L)

Dissolve 50 g of ammonium oxalate [(NH₄)₂C₂O₄ · H₂O] in water; add water to dilute it to 1 L; if necessary, filter it before use.