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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

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Replacing GB/T 176-2017

Methods for chemical analysis of cement

水泥化学分析方法

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References

Foreword

This document was issued on 31 October 2025 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 May 2026.

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

It is classified under ICS 91.100.10 and Chinese classification Q 11.

The document runs to 98 pages. The identification, the dates, the classification and the table of contents on this page are taken from the cover and the printed contents of the standard itself.

This document was drafted in accordance with GB/T 1.1-2020 "Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents".

This document replaces GB/T 176-2017 "Methods for chemical analysis of cement". Compared with the 2017 edition, apart from structural adjustments and editorial changes, the main technical changes are as follows:

a) "repeatability limit" has been changed to "permissible difference within the same laboratory" and "reproducibility limit" to "permissible difference between laboratories" (see 4.3, 6.48, 7.8 and 8.7; 4.3, 6.41, 7.7 and 8.6 of the 2017 edition);

b) requirements have been added for the preparation of cement and clinker samples and for the drying of cement raw meal samples (see Clause 5);

c) "ammonium nitrate solution" has been changed to "nitric acid-ammonia mixed solution" (see 6.1.33, 6.6.2 and 6.29.2; 6.1.33, 6.6.2 and 6.26.2 of the 2017 edition);

d) the ignition temperature for ferric oxide has been changed (see 6.1.78 and 7.2.1; 6.1.73 and 7.2.1 of the 2017 edition);

e) in the determination of loss on ignition by the ignition difference method, "porcelain crucible" has been changed to "platinum crucible or porcelain crucible, the result obtained

with the platinum crucible prevailing in case of dispute" (see 6.3.2; 6.3.2 of the 2017 edition);

f) to i) the wording of the gravimetric methods has been aligned throughout (see 6.5, 6.7 and 6.18); a rapid ageing option has been added to the determination of sulfate as sulfur trioxide by the barium sulfate gravimetric method, the beaker being placed in an ultrasonic water bath at 80 degrees Celsius, precipitated for 10 min and cooled to room temperature (see 6.5); "determination of sulfide" has become "determination of sulfide sulfur" (see 6.15); and the determination of chloride ion by potentiometric titration has been made the reference method, the ammonium thiocyanate volumetric method becoming the alternative (see 6.13 and 6.34).

j) to l) acid decomposition of the sample has been added to the determination of manganese monoxide by potassium periodate oxidation spectrophotometry (see 6.16.2.2); the sample decomposition for the determination of phosphorus pentoxide by molybdenum blue spectrophotometry has been changed to decomposition with hydrochloric acid at a controlled acidity of 1.18 plus or minus 0.10 mol/L (see 6.17); and fusion with sodium hydroxide has been added to the determination of fluoride ion by ion selective electrode, the fused sample prevailing in case of dispute (see 6.20.2.1).

m) to r) the following determinations have been added: water-soluble alkali content by flame photometry (see 6.21); the alkalinity (pH value) of cement by ion selective electrode (see 6.22); manganese monoxide by potassium permanganate titration, as an alternative method (see 6.38); phosphorus pentoxide by the vanadomolybdophosphoric yellow spectrophotometric method, as an alternative method (see 6.39); and carbon dioxide by infrared analysis, as an alternative method. The sample decomposition in the determination of chloride ion by ion chromatography has also been changed (see 6.35.2).

u) the method summary, the reagents and the calibration and confirmation of the X-ray fluorescence method have been revised, and the conversion of results and the correction of the total analysis in the presence of sulfides and halides have been added (see Clause 7; Clause 7 of the 2017 edition);

v) determination of silica by inductively coupled plasma optical emission spectrometry (ICP-OES) has been added (see 8.6).

Attention is drawn to the possibility that some elements of this document may be the subject of patent rights. The issuing body assumes no responsibility for identifying them.

This document was proposed by the China Building Materials Federation.

It is under the jurisdiction of the National Technical Committee on Cement of Standardization Administration of China (SAC/TC 184).

The drafting organisations include China Testing & Certification International Group, Anhui Conch Cement, Yitaike (Zhuji) Intelligent Equipment, CTC Jiangsu, Beijing Jianyetong

Engineering Testing Technology, Guangdong Jiaoke Testing, PowerChina Roadbridge Group, Tianshan Material, Guizhou Shunkang Testing and the Yunnan Institute for Quality Inspection of Building Materials, together with some sixty further testing institutes, cement producers and instrument makers.

1 Scope

GB/T 176 is the Chinese standard for the chemical analysis of cement, and at 98 pages it is one of the largest analytical standards in the building materials field. Clause 6 alone carries forty-eight determinations: loss on ignition, sulfate as sulfur trioxide, insoluble residue, silica, ferric oxide, alumina, calcium oxide, magnesium oxide, titanium dioxide, chloride, potassium and sodium oxide, sulfide sulfur, manganese, phosphorus pentoxide, carbon dioxide, zinc oxide, fluoride, water-soluble alkali and the pH of cement, each with a designated reference method and, in most cases, one or more alternative methods. Clause 7 covers X-ray fluorescence analysis and Clause 8 inductively coupled plasma optical emission spectrometry. Throughout, the document fixes the permissible difference within one laboratory and between laboratories, which is what decides whether two results agree. Cement is sold on its chemical composition, so this text sits behind every delivery note, every acceptance test and every dispute between supplier and buyer in the Chinese market. The 2025 edition replaces GB/T 176-2017.

3 Terms and definitions

The terms and definitions given in GB/T 15000 (all parts), together with the following, apply to this document.

3.1 fused bead: a disc obtained by fusing the sample with a flux, for analysis by X-ray spectrometer.

3.2 pellet: a compressed disc of finely ground sample, for analysis by X-ray spectrometer.

3.3 certified reference material (CRM): a reference material characterised by a metrologically valid procedure for one or more specified properties, accompanied by a certificate that provides the value of the specified property, its associated uncertainty and a statement of metrological traceability. [SOURCE: GB/T 15000.3-2023, 3.2]

3.4 calibration sample: a reference material used for the calibration of equipment or of a measurement procedure. [SOURCE: GB/T 15000.3-2023, 3.7]

4 Basic requirements for the tests

4.1 Number of determinations and requirements. The number of determinations for each constituent is fixed at two. Where the absolute difference between the two results falls within the permissible difference within the same laboratory (see Tables 4, 5 and 6), the result is