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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 12960-2019

Replacing GB/T 12960-2007

Quantitative determination of constituents of cement

水泥组分的定量测定

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Table of Contents

1 Scope

GB/T 12960-2019 is the Chinese national standard on quantitative determination of constituents of cement, in the field of construction materials and building. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 18 October 2019 by the State Administration for Market Regulation; Standardization Administration of China, and has been in force since 1 September 2020. Classification: ICS 91.100.10, CCS Q11. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This Standard specifies the methods of quantitative determination of constituents of Portland cement, ordinary Portland cement, slag Portland cement, pozzolanic Portland cement, fly-ash Portland cement and composite Portland cement. This Standard is

applicable to cement containing one or more materials among granulated blast-furnace slag, pozzolanic mixed material, fly ash, limestone, sandstone, kiln dust, gypsum and Portland cement clinker.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 176 Method for Chemical Analysis of Cement

GB/T 5484 Methods for Chemical Analysis of Gypsum

GB/T 6682 Water for Analytical Laboratory Use - Specification and Test Methods

GB/T 8170 Rules of Rounding off for Numerical Values & Expression and Judgement of Limiting Values

3 Basic Requirements for Test

3.1 Test Number and Requirements The number of tests for each determination is specified as two. Use the average value of two test results to represent the determination result.

3.2 Laboratory Temperature It is required that laboratory temperature shall be between 16 °C ~ 30 °C.

3.3 Constant Mass After the first drying or burning, cooling and weighing, through the method of continuously drying or burning the vessel or specimen for 15 min each time, and then, cooling and weighing it, determine the constant mass. When the difference of two consecutive weighings is less than 0.0005 g, it reaches a constant mass.

4 Reagents and Materials

Unless it is otherwise specified, all reagents shall be not lower than analytically pure. The used water shall be not lower than the requirements for Grade-3 water specified in GB/T 6682.Carbon dioxide-free water refers to water that is freshly boiled and cooled to room temperature.

4.1 Nitric acid (HNO3). density.

1.41 g/cm3; mass fraction. 65% ~ 68%.

4.2 Sulfuric acid (H2SO4). density.

1.84 g/cm3; mass fraction. 95% ~ 98%.

4.3 Phosphoric acid (H3PO4). density.

1.68 g/cm3; mass fraction >= 85%.

4.4 Triethanolamine [N(CH2CH2OH)3]. density.

1.12 g/cm3; mass fraction. 99%.

4.5 Ethanol (C2H5OH). mass fraction. 95%.

4.6 Nitric acid (1 + 5). NOTE 1.use volume ratio to indicate the degree of reagent dilution, the same below. Nitric acid (1 + 5) means that 1 volume of concentrated nitric acid is mixed with 5 volumes of water.

4.10 Phosphate pH standard buffer solution. weigh-take

2.238 g of disodium hydrogen phosphate (Na2HPO4 12H2O) and

0.851 g of potassium dihydrogen phosphate (KH2PO4), accurate to 0.0001 g. Place it in a 200 mL beaker; add about 100 mL of carbon dioxide-free water. Warm and stir it, so as to dissolve it. Then, cool it to room temperature; transfer it to a 250 mL volumetric flask. Use carbon dioxide-free water to wash the beaker and dilute to the scale, then, shake it well. The pH values of phosphate pH standard buffer solution at different temperatures are shown in Table 1. Table 1 -- pH Values of Standard Buffer Solution

4.16 Anhydrous magnesium perchlorate [Mg (ClO4)2]. made into a particle size of

0.6 mm ~ 2 mm; stored in a sealed bottle.

5 Instruments and Equipment

5.1 Balance. division value is not less than 0.0001 g.

5.2 Drying oven. controlled temperature 105 °C ± 5 °C, 150 °C ± 5 °C.

5.3 Acidity meter. pH value measurement value 0 ~ 14, accurate to 0.02.

5.4 Glass sand core funnel. with a diameter of 35 mm ~ 60 mm; model G4 (average pore size. 3 μm ~ 4 μm).

5.5 Suction filter flask. 1,000 mL.

5.6 Air pump. pumping speed

0.25 L/s.

5.10 High-temperature furnace, controlled temperature 580 °C ± 20 °C, 950 °C ± 25 °C.

5.11 Desiccator. internally hold color-changing silica gel.

5.12 Porcelain crucible, with a lid, capacity. 20 mL ~ 30 mL.

6 Preparation of Specimens

Cement specimens shall be sampled in accordance with the method of GB/T 12573.

7 Determination of Cement Constituents - Method 1

7.1 Principle In terms of pozzolanic mixed material or fly-ash constituent, adopt the selective dissolution method. Use nitric acid solution for the selective dissolution of cement specimen. The pozzolanic mixed material or fly-ash constituent is basically insoluble, while the other constituents are basically dissolved.

7.2 Test Procedures

7.2.1 Determination of insoluble slag content after selective dissolution with nitric acid solution

7.3 Processing of Test Result

7.3.1 Calculation of insoluble slag content after selective dissolution with nitric acid solution The insoluble slag content (a) in cement after selective dissolution with nitric acid solution shall be calculated in accordance with Formula (1).

8 Determination of Cement Constituents - Method 2

8.1 Principle In terms of granulated blast-furnace slag constituent, adopt the sulfide determination method. The determination of sulfide adopts the iodometric method. If granulated blast- furnace slag with a relatively low sulfide content is used, or, other mixed materials in cement have a relatively high sulfide content, the error of the determination of granulated blast-furnace slag constituent through the sulfide determination method might be relatively large.

8.2 Test Procedures

8.2.1 Determination of sulfide in cement and sulfide content in EDTA insoluble slag The determination of sulfide content (S1) in cement shall be conducted in accordance with GB/T 176.

8.2.3 Determination of carbon dioxide - infrared analysis method In terms of the determination of carbon dioxide (D2) through the infrared analysis method, weigh-take about

0.05 g of specimen, accurate to 0.0001 g; directly place it on a platinum dish and conduct the determination in accordance with GB/T 35151.