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Replacing JC/T 740-1988 (1996)

Portland Phosphorous Slag Cement

磷渣硅酸盐水泥

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Foreword

This Standard is a revised edition of JC/T 740-1988 (1996) Portland Phosphorous Slag Cement.

Since the date of implementation, this Standard shall serve as a replacement of JC/T 740-1988 (1996) Portland Phosphorous Slag Cement.

In comparison with JC/T 740-1988 (1996), there are several main changes as follows:

---The mixing amount of granulated electric furnace phosphorous slag in cement is modified from “20% ~ 40%” to “20% ~ 50%” (Chapter 3 in Version 1988; 4.1 in this Version);

---Chapter “Composition and Materials” is added (Chapter 4 in this Version);

---In strength grade, early-strength Portland phosphorous slag cement is added (Chapter 4 in Version 1988; Chapter 5 in this Version);

---The requirement of cement fineness is modified from 0.080 mm square-hole sieve residue “not more than 12%” to “not more than 6.0%” (5.4 in Version 1988; 6.2.1 in this Version);

---The time requirement for the final condensation of Portland phosphorous slag cement is shortened, namely, time requirement is modified from “shall not exceed 12 h” to “shall not exceed 10 h” (5.5 in Version 1988; 6.2.2 in this Version);

---The limitation of ignition loss of Portland phosphorous slag cement is deleted (5.2 in Version 1988; Chapter 6 in this Version);

---Cement strength index is consistent with GB 1344-1999 Portland Blast Furnace - Slag Cement, Portland Pozzolana Cement and Portland Fly-ash Cement (5.7 in Version 1988; 6.3.4 in this Version);

---Cement strength test method adopts GB/T 17671-1999 Method of Testing Cements - Determination of Strength (6.5 in Version 1988; 7.7 in this Version);

---The requirement of chloride ion content and alkali content in cement is added (6.7 and 6.8 in this Version);

---The stipulation of granulated electric furnace phosphorous slag in cement is added (Appendix A in this Version);

---The radioactivity detection of granulated electric furnace phosphorous slag is added (Appendix A.3.4 in this Version);

Portland Phosphorous Slag Cement

1 Scope

This Standard specifies the terms and definitions, material requirements, strength grade, technical requirements, test methods, inspection rules, packaging, marking, transportation and storage of Portland phosphorous slag cement.

This Standard is applicable to Portland phosphorous slag cement, which takes granulated electric furnace phosphorous slag as the primary mixed material.

2 Normative References

Through the reference in this Standard, clauses in the following documents become clauses of this Standard. In terms of references with a specific date, all the subsequent modification lists (excluding corrected content) or revised editions are not applicable to this Standard. However, all parties that reach an agreement in accordance with this Standard are encouraged to explore the possibility of adopting the latest version of these documents. In terms of references without a specific date, the latest version is applicable to this Standard.

GB 175 Portland Cement and Ordinary Portland Cement

GB/T 176 Methods for Chemical Analysis of Cement (GB/T 176-1996, eqv ISO 680: 1990)

GB/T 203 Granulated Blast-furnace Slag Used for Cement Production

GB/T 750 Autoclave Method for Soundness of Portland Cement

GB/T 1345 The Test Sieving Method for Fineness of Cement

GB/T 1346 Test Methods for Water Requirement of Normal Consistency, Setting Time and Soundness of the Portland Cement (GB/T 1346-2001, eqv ISO 9597: 1989)

GB/T 1596 Fly Ash Used for Cement and Concrete

GB/T 2847 Pozzolanic Materials Used for Cement Production (GB/T 2847-1996, neq ISO 863: 1990)

GB/T 5483 Gypsum and Anhydrite (GB/T 5483-1996, neq ISO 1587: 1975)

GB/T 1871.1 Phosphate Rock and Concentrate - Determination of Phosphorous Pentoxide Content - Quinoline Phosphomolybdate Gravimetric and Volumetric

8% of the total mass of cement. After the replacement, the mixing amount of granulated electric furnace phosphorous slag in cement shall not be less than 20%.

4.2 Materials

4.2.1 Plaster

Natural plaster shall comply with Type-G or Type-A Level-2 (or above) plaster or anhydrite stipulated in GB/T 5483.

When by-product plaster, whose main ingredient is calcium sulfate in industrial production, is adopted, the performance of cement shall be proved by tests to be harmless.

4.2.2 Granulated electric furnace phosphorous slag

Granulated electric furnace phosphorous slag shall comply with relevant stipulations in Appendix A and Appendix B in this Standard.

4.2.3 Granulated blast-furnace slag

Granulated blast-furnace slag shall comply with relevant stipulations in GB/T 203.

4.2.4 Pozzolanic material

Pozzolanic material shall comply with relevant stipulations in GB/T 2847.

4.2.5 Fly ash

Fly ash shall comply with relevant stipulations in GB/T 1596.

4.2.6 Limestone

In limestone, the content of aluminum oxide shall not exceed 2.5%.

4.2.7 Kiln dust

Kiln dust shall comply with relevant stipulations in JC/T 742.

4.2.8 Grinding aid

Grinding aid may be added in the grinding of phosphorous slag cement; the adding amount shall not exceed 0.5% of the mass of cement. Grinding aid shall comply with relevant stipulations in JC/T 667.

5 Strength Grade

Strength grade of phosphorous slag cement is divided into 32.5, 32.5R, 42.5, 42.5R,

52.5 and 52.5R.

6 Technical Requirements

6.1 Chemical Composition

6.1.1 Magnesium oxide

In clinker, the content of magnesium oxide shall not exceed 5.0%. If cement is qualified in soundness test conducted through the autoclave method, the content of magnesium oxide in clinker is allowed to become 6.0%.

6.1.2 Sulphur trioxide

In cement, the content of sulphur trioxide shall not exceed 4.0%.

6.1.3 Chloride ion content

In cement, the content of chloride ion shall not exceed 0.06%.

6.1.4 Alkali content

Alkali content in cement shall be expressed in the calculated value of Na_2O + 0.658 K_2O. When the use of active aggregate needs to restrict alkali content in cement, it shall be negotiated and determined by the supply-side and the demand-side.

6.2 Physical Performance

6.2.1 Fineness

Cement fineness shall be expressed in 0.080 mm square-hole sieve residue; it shall not exceed 6.0%.

6.2.2 Condensation time

Initial cement condensation shall not be earlier than 45 min; final cement condensation shall not be later than 10 h.

6.2.3 Soundness

Cement soundness shall be tested through the autoclave method. Cement must be qualified in soundness.

6.2.4 Strength

In terms of phosphorous slag cement, the strength of various ages of concrete of different strength grades shall not be lower than the requirements in Table 2.

marking, when cement type, strength grade, manufacturer's name and exit-factory serial number are incomplete, the product shall also be determined as unqualified.

8.4 Test Report

The content of test report shall include the various technical requirements stipulated in this Standard, as well as test results, the name and mixing amount of mixed materials, and the production by rotary kiln or shaft kiln clinker. When users demand exit-factory test report, cement factory shall send out the various test results, except from the 28-day strength test, within 7 days since the date of cement shipment. A supplementary report of the 28-day strength test shall be submitted within 32 days since the date of cement shipment.

8.5 Delivery, Acceptance-check and Arbitration Test

8.5.1 Delivery

In quality acceptance-check of cement in delivery, physical samples may be extracted, and the test result of the samples shall be taken as the basis. The test report of the same serial number of cement from cement factory may also be taken as the basis. Which method shall be adopted for the acceptance-check shall be negotiated and determined by the supply-side and the demand-side; this content shall be clearly indicated in contract or agreement.

8.5.2 Acceptance-check and arbitration test

8.5.2.1 The test result of the extracted physical samples shall be taken as the basis of the acceptance-check. The buyer and the seller shall jointly take samples, and sign-seal the samples before the shipment or during the delivery. Sampling method shall comply with GB 12573; sampling size shall be 20 kg, which is divided into two equal sizes. One shall be preserved by the seller for 40 days; the other shall be tested by the buyer in accordance with the test items and methods stipulated in this Standard.

Within 40 days, when the buyer conducts the tests and believes that product quality does not comply with the requirements in this Standard, and the seller dissents, both parties shall submit the other sample preserved by the seller to a nationally approved provincial-level (or above) cement quality supervision and inspection institution for arbitration test.

8.5.2.2 When the test report of the same serial number of cement from cement factory is taken as the basis of acceptance-check, before the shipment or during the delivery, the buyer (or entrusted seller) shall take samples from the same serial number of cement. After both parties jointly sign and seal the sample, the sample shall be preserved for 3 months.

Within 3 months, when the buyer have doubts about cement quality, both parties shall submit the jointly signed and sealed sample to a nationally approved provincial-level

Appendix A

(Normative)

Granulated Electric Furnace Phosphorous Slag for Cement Production

A.1 Scope

This Appendix specifies the definition, technical requirements, test methods and inspection rules of granulated electric furnace phosphorous slag for cement production.

A.2 Granulated Electric Furnace Phosphorous Slag

When electric furnace method is used to make yellow phosphorous, the obtained molten material, whose primary ingredient is calcium silicate, goes through quenching and granulation, and becomes granulated electric furnace phosphorous slag (short for phosphorous slag).

NOTE: by adding a little amount of calcium materials and silicon-aluminum materials, which are proved by tests to be harmless to the performance of cement and concrete, to phosphorous slag, phosphorous slag can be modified.

A.3 Technical Requirements

A.3.1 Mass coefficient K value shall not be less than 1.10.

A.3.2 In phosphorous slag, the content of phosphorous pentoxide, shall not be more than 3.5%.

A.3.3 The loose bulk density (short for bulk weight) of dry phosphorous slag shall not be more than 1.30×10^3 kg/m^3; the maximum dimension of bulk phosphorous slag shall not be more than 50 mm; granules which are more than 10 mm shall not exceed 5%, counted by mass percentage.

A.3.4 Conduct the test in accordance with A.4.6; after adding phosphorous slag to cement, the radioactivity specific activity degree of natural radionuclide radium-226, thorium-232 and potassium-40 shall simultaneously satisfy $I_{Ra} \leq 1.0$; $I_r \leq 1.0$.

A.4 Test Methods

A.4.1 Calcium oxide, magnesium oxide, silicon dioxide, aluminum oxide and fluorine content

Conduct the test in accordance with GB/T 176. If the content of phosphorous pentoxide in phosphorous slag is more than 0.5%, adopt EDTA complexometric titration calcium salt back titration method for the test.

The calculation result shall retain to integer.

A.4.6 Radioactivity

Firstly, grind phosphorous slag into powder. Then, take Portland cement, which is produced by an enterprise that plans to use phosphorous slag as a mixed material and complies with the requirements in GB 175; evenly mix the Portland cement with phosphorous slag powder by the mass ratio of 1:1. Then, comply with the methods in GB 6566 to test the radioactivity of the mixed sample.

A.5 Inspection Rules

A.5.1 Sampling method

Phosphorous slag which is discharged everyday shall be considered as a serial number. Sampling shall be representative. Sampling may be consecutive; or an equivalent amount of sample may be taken from over 20 different parts. The total amount of sample shall be around 20 kg. After evenly mixing up the sample, use quartering to divide the sample into 5 kg for the tests. During the sampling, remove 150 mm ~ 200 mm external layer.

A.5.2 Determination rules

A.5.2.1 Exit-factory inspection

A.5.2.1.1 The supplier of phosphorous slag shall inspect each batch of phosphorous slag in accordance with the requirements in A.3.1 ~ A.3.3. Exit-factory inspection report shall be provided to phosphorous slag users along with phosphorous slag.

A.5.2.1.2 When the mass coefficient of phosphorous slag or any item of phosphorous pentoxide does not comply with the technical requirements in this Standard, the product shall be deemed as rejected and shall not be used as mixed material for cement production.

A.5.2.1.3 When any item of the loose bulk density of dry phosphorous slag, the maximum dimension of bulk phosphorous slag and the mass of granules over 10 mm does not comply with the technical requirements in this Standard, the product shall be deemed as rejected.

A.5.2.2 Type inspection

A.5.2.2.1 When the result of the inspection complies with all the technical requirements in A.3, the product shall be deemed as qualified in type inspection.

A.5.2.2.2 When there are changes in raw materials and production techniques, type inspection of phosphorous slag shall be necessary.

A.5.2.2.3 In normal production, type inspection shall be conducted once a year.

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