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Test method for compatibility of cement and water-reducing agent

水泥与减水剂相容性试验方法

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Test method for compatibility of cement and water-reducing agent

1 Scope

This standard specifies the terms and definitions, method principle, laboratory and equipment, composition of cement paste, test procedure, data processing, result presentation, test report of the test method for the compatibility of cement and water-reducing agent.

This standard is suitable for evaluating the compatibility of cement and water-reducing agent.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 8077 Methods for testing uniformity of concrete admixture

JC/T 729 Mixer for cement paste

3 Terms and definitions

The following terms and definitions apply to this standard.

3.1

Compatibility of cement and water-reducing agent

When using the same water-reducing agent or cement, the fluidity of cement paste, the degree of change over time loss due to the quality of cement or water-reducing agent, the degree of change in the amount of water-reducing agent used to obtain the same fluidity.

3.2

4 Principles of the method

4.1 Marsh method (referred to as Marsh tube method, standard method)

The Marsh tube is a conical funnel with a circular tube below it, which was first used to measure the fluidity of drilling mud, later proposed by Sherbrooke University in Canada to measure the fluidity of cement paste with water-reducing agents added, to evaluate the adaptability of cement and water-reducing agents. The specific method is to let the cement paste, which is injected into the funnel, flow down freely; then record the time when the 200 mL tube is filled, that is, the Marsh time. The length of this time reflects the fluidity of the cement paste.

4.2 Net paste fluidity method (alternative method)

After filling the prepared cement paste into a circular mold with a certain capacity, lift the circular mold stably, so that the paste expands freely on the glass plate, under the action of gravity. The diameter after stabilization is the fluidity; the fluidity reflects the fluidity of the cement paste.

4.3 In case of dispute, the standard method shall prevail.

5 Laboratory and equipment

5.1 Laboratory

The temperature of the laboratory shall be maintained at 20 °C ± 2 °C. The relative humidity shall not be lower than 50%.

5.2 Equipment

5.2.1 The cement paste mixer: meets the requirements of JC/T 729 and is equipped with 6 mixing pots.

5.2.2 Round mold: A round mold is a metal product, which has an upper opening diameter of 36 mm, a lower opening diameter of 60 mm, a height of 60 mm, a smooth inner wall without hidden seams.

5.2.3 Glass plate: Φ400 mm x 5 mm

5.2.4 Scraper

5.2.5 Caliper: The measuring range of the caliper is 300 mm; the division value is 1 mm.

5.2.6 Stopwatch: The division value of the stopwatch is 0.1 s.

5.2.7 Balance: The balance has a range of 100 g and a division value of 0.01 g; OR a range of 1000 g and a division value of 1 g.

5.2.8 Beaker: 400 mL.

5.2.9 Marsh tube: The straight tube part of the Marsh tube is made of stainless steel; the tapered funnel part is made of stainless steel or a smooth surface corrosion-resistant material. The mechanical requirements are as shown in Figure 1.

5.2.10 Graduated cylinder: 250 mL, 1 mL division value.

6 Composition of cement paste

6.1 Cement

Before the test, the cement shall be passed through a 0.9 mm square hole sieve and mixed evenly. When the test cement is to be kept for more than 24 hours from the sampling to the test, the cement shall be stored in an airtight container; the container material shall not react with the cement.

6.2 Water

Clean drinking water.

6.3 Control water-reducing agent

It shall comply with the provisions of Appendix A. When the tester chooses the control water-reducing agent by himself, it shall ensure that the quality of the water-reducing agent is stable and uniform.

6.4 The temperature of cement, water, water-reducing agent, test equipment shall be consistent with that of the lab.

8 Test procedures

8.1 Marsh tube method (standard method)

8.1.1 Each pot of paste is mechanically stirred by a mixer. Make the mixer in working condition, before the test.

8.1.2 Use a damp cloth, to wet the Marsh tube, beaker, stirring pot, stirring blades. Place the beaker in the middle below the discharge port of the Marsh tube. Cover it with a damp cloth.

8.1.3 ADD the standard water-reducing agent and about 1/2 of the water INTO the pot at the same time. Then use the remaining water, to repeatedly rinse the container which contains the standard water-reducing agent, until it is clean. Add it all into the pot. Add cement. Fix the pot on the mixer. Stir it, according to the mixing procedure of JC/T 729.

8.1.4 Take off the pot. Pour the paste into the Marsh tube immediately, while stirring with a stirring spoon. Open the valve, to let the paste flow down freely. Start timekeeping. Stop the timekeeping when the paste is poured into the beaker to 200 mL, this time is the initial Marsh time.

8.1.5 Let the paste in the Marsh tube flow down completely. Recover it to the stirring pot without any residue. Take an appropriate method to seal it and let it stand, to prevent moisture from evaporating.

8.1.6 Clean the Marsh tube and beaker.

8.1.7 Adjust the addition of the control water-reducing agent. Repeat the above steps. Measure the initial Marsh time at each addition of the control water-reducing agent, in turn.

8.1.8 From the time of adding cement to 60 minutes, re-stir the cement paste that has been standing still, according to the mixing procedure of JC/T 729. Repeat the operations in 8.4.1. Determine the 60 min Marsh time of the control water-reducing agent, at each addition.

8.2 Clean paste fluidity method (alternative method)

8.2.1 Each pot of paste is mechanically stirred by a mixer. Make the mixer in working condition, before the test.

8.2.2 Place the glass plate on the workbench. Keep its surface level.

8.2.3 Use a damp cloth, to wet the glass plate, the inner wall of the round mold, the stirring pot, the stirring blades. Place the round mold in the middle of the glass plate. Cover with a damp cloth.

8.2.4 Add the control water-reducing agent and about 1/2 of the water into the pot at the same time. Then use the remaining water, to repeatedly rinse the container containing the control water-reducing agent, until it is clean. Then add all of it to the pot. Add cement. Fix the pot on the mixer. Stir it according to the stirring procedure of JC/T 729.

8.2.5 Take off the pot. Pour the paste into the round mold, which is placed in the middle of the glass plate, while stirring with a stirring spoon. For the paste with poor fluidity, use a scraper to insert and tamp it, so that the paste fills the round mold. Use a scraper, to scrape off and smoothen the paste, that is higher than the round mold. Immediately lift the round mold stably. After the round mold is lifted, use a scraper to scrape off the paste adhering to the inner wall of the round mold as much as possible, to ensure that the amount of paste in each test is basically the same. After extracting the circular mold for 1 min, use a caliper, to measure the longest diameter and the diameter in the vertical direction. The average value of the two measurements is the initial fluidity value.

8.2.6 Quickly recover the paste on the glass plate to the stirring pot by a scraper, without leaving any residue. Adopt an appropriate method to seal it and let it stand, to prevent moisture from evaporating.

8.2.7 Clean the glass plate and round mold.

8.2.8 Adjust the addition of the control water-reducing agent. Repeat the above steps. Measure the initial fluidity value of each addition of the control water-reducing agent, in turn.

8.2.9 When 60 minutes have elapsed since adding cement, re-stir the cement paste that has been standing still, according to the mixing procedure of JC/T 729. Repeat the operations of 8.2.5. Measure the 60-min fluidity of the control water-reducing agent in sequence, at each addition.

9 Data processing

9.1 Calculation of loss rate of fluidity as time

The loss rate of fluidity as time is expressed, using the relative value of the initial fluidity Marsh time and 60 min fluidity Marsh time, namely:

$$FL = \frac{T_{60} - T_{in}}{T_{in}} \times 100 \quad \cdots\cdots (1)$$

$$FL = \frac{F_{in} - F_{60}}{F_{in}} \times 100 \quad \cdots\cdots (2)$$

Where:

FL - Loss rate of fluidity as time, in percentage (%);

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