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**NATIONAL STANDARD OF THE
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Test method for viscosity of cement paste

水泥净浆黏度测定方法

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1 Scope and defined term

The document gives the principle of the method for determining the viscosity of neat cement paste and fixes the apparatus, the materials, the laboratory temperature and humidity, the preparation of the paste, the determination of the viscosity, the test result and the repeatability and reproducibility limits. It applies to the determination of the viscosity of neat cement paste.

One term is defined: viscosity of cement paste, the resistance the cement paste shows to flow. A note adds that the property is also called by a second Chinese name with the same meaning.

4 Principle of the test method

The rotor of a single cylinder rotational viscometer turns at constant speed in the cement paste. The paste is sheared and produces a viscous moment, which deflects the elastic element of the viscometer and so produces a torque. When the viscous moment and the deflecting torque balance, the shear stress is obtained by measuring the deflection angle of

the elastic element, and the quotient of that shear stress and the shear rate is the viscosity of the cement paste.

5 Apparatus and materials

The viscometer is a single cylinder rotational viscometer conforming to JJG 1002. Its measuring system is made up of a motor, gears, a dial or display screen, bearings, a coupling, a rotor and a guard, and its measuring range is 0.001 Pa.s to 1000 Pa.s with a measuring error of $\pm 5\%$ on Newtonian fluids; its structure is shown in Figure 1. Before the determination the viscometer is verified with the series of silicone oil reference samples used for cement paste viscosity.

The cement paste mixer meets JC/T 729. The constant temperature water bath holds the water temperature within $20\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$. The thermometer covers $0\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ with a scale division of not more than $0.5\text{ }^{\circ}\text{C}$. The glass beaker is a 500 mL low form beaker conforming to GB/T 15724. The balance has a range of not less than 1000 g and a scale division of not more than 1 g.

The cement sample is mixed until it is uniform. The test water is drinking water; for an arbitration test it is grade three water conforming to GB/T 6682.

The laboratory is held at a temperature of $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and a relative humidity of not more than 75 %.

8 Preparation of the cement paste

Three batches of paste are prepared from each cement sample at a water to cement ratio, by mass, of 0.50.

Each batch is made up of 600 g ± 2 g of cement and 300 mL ± 1 mL, or 300 g ± 1 g, of water. The paste is mixed in accordance with GB/T 1346.

9 Determination of the viscosity

The viscometer is kept for more than 2 h in the laboratory temperature and humidity. The spindle, the rotor, the guard and the glass beaker are washed with water or a cleaning agent and their surfaces dried with a hair dryer or a sponge cloth. The measuring head is levelled with the levelling device, the guard is connected to the machine and the instrument is switched on and warmed up for more than 20 min.

The rotor number and the rotational speed are found on a trial batch. The glass beaker is filled with 400 mL ± 20 mL of cement paste, the surface levelled and the air inside released; the beaker is put into the constant temperature water bath and left to stand for 3 min before a trial measurement. The rotor is lowered slowly into the paste at about 45 degrees so as not to carry air in, then connected to the coupling; when it is fitted the spindle

is held up and the rotor turned clockwise onto it as seen from above the head. The rotor stands at the centre of the level surface of the paste, and the rotor or the level of the paste is adjusted so that the immersion mark on the rotor lines up with the surface of the paste.

The zero of the viscometer is set accurately, the test programme is started, and the viscosity value is read once the reading has become steady. The rotor number and the rotational speed are recorded when the viscosity reading falls between 20 % and 90 % of the maximum range of the viscometer.

For the measurement proper a fresh cement paste is prepared, the instrument is set to the rotor number and rotational speed found in the trial, the test programme is started and the viscosity is read once the reading has become steady, until three successive readings differ by a relative deviation of not more than 5 %; their arithmetic mean is the viscosity of that batch of paste. The determination of the viscosity of one batch of paste is not to take more than 15 min.

10 Test result and precision

The test result is the arithmetic mean of the viscosity results of the three batches of paste. Where one of the three results lies outside the mean by more than $\pm 10\%$, it is discarded and the mean of the rest is taken as the test result; where two of the three lie outside the mean by more than $\pm 10\%$, the test result is void. A single batch result and the arithmetic mean are both given to the nearest 0.001 Pa.s.

The report carries the type, code and strength grade of the cement; the model of the single cylinder rotational viscometer with the rotor number and the rotational speed; the test temperature and humidity; the viscosity of the cement paste; and the time from the moment all the cement has been added to the water to the start of the determination.

The repeatability limit is a relative deviation of not more than 10 % for the viscosity of the same sample measured in the same laboratory by the same operator on the same equipment. The reproducibility limit is a relative deviation of not more than 15 % for the same sample measured in different laboratories by different operators on different equipment.