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**Test methods for polymer-modified
mortar**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Land, Infrastructure, Transport and Tourism through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Testing Center for Construction Materials (JTCCM)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS A 1171**:2000 is replaced with this Standard.

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Test methods for polymer-modified mortar

Introduction

This Japanese Industrial Standard was established in 1978 and has gone through two revisions since then. The last revision was made in 2000, and the revision at this time was initiated to achieve consistency with related standards and to modify test method provisions in line with the current situation around the polymer-modified mortar. The comparison table between previous and current editions of this Standard on technically significant revisions is given in Annex A.

No corresponding International Standard has been established at this point.

1 Scope

This Standard specifies the test methods for polymer-modified mortar.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 1128 *Method of test for air content of fresh concrete by pressure method*

JIS A 1129-1 *Methods of measurement for length change of mortar and concrete—Part 1: Method with comparator*

JIS A 1129-2 *Methods of measurement for length change of mortar and concrete—Part 2: Method with contact-type strain gauge*

JIS A 1129-3 *Methods of measurement for length change of mortar and concrete—Part 3: Method with dial gauge*

JIS A 1132 *Method of making and curing concrete specimens*

JIS A 1148 *Method of test for resistance of concrete to freezing and thawing*

JIS A 1404 *Method of test for waterproof agent of cement for concrete construction*

JIS A 5308 *Ready-mixed concrete*

JIS A 6203 *Polymer dispersions and redispersible polymer powders for cement modifiers*

JIS A 6205 *Corrosion inhibitor for reinforcing steel in concrete*

JIS K 8123 *Calcium chloride (Reagent)*

JIS R 5201 *Physical testing methods for cement*

JIS R 6252 *Abrasive papers*

3 Terms and definitions

For the purposes of this Standard, the following terms and definitions apply.

3.1 polymer-modified mortar

mortar in which a mixture of cement and a cement modifier or polymeric admixture is used as a binder

3.2 cement modifier or polymeric admixture

the generic term for polymer dispersions and redispersible polymer powders to be mixed in cement mortar or concrete for the purpose of modification

3.3 polymer dispersion for cement modifier or polymeric admixture

the system in which polymeric particles are dispersed in water

It is classified into the following two types.

NOTE 1 In this Standard, polymer dispersion for cement modifier or polymeric admixture is hereafter referred to as dispersion.

- a) **Rubber latex for cement modifier or polymeric admixture**, prepared by adding a stabilizer, antifoaming agent, etc. to rubber latex such as synthetic rubber latex, natural rubber latex or rubberized asphalt latex, and making them thoroughly dispersed and uniform.

NOTE 2 In this Standard, rubber latex for cement modifier or polymeric admixture is hereafter referred to as rubber latex.

- b) **Resin emulsion for cement modifier or polymeric admixture**, prepared by adding a stabilizer, antifoaming agent and others to resin emulsion such as poly(ethylene-vinyl acetate) emulsion, polyacrylic ester emulsion or resin-modified asphalt emulsion, and making them thoroughly dispersed and uniform.

NOTE 3 In this Standard, resin emulsion for cement modifier or polymeric admixture is hereafter referred to as resin emulsion.

3.4 redispersible polymer powder for cement modifier or polymeric admixture

redispersible polymer powder obtained by adding a stabilizer etc. to rubber latex or resin emulsion and then drying it

NOTE : In this Standard, redispersible polymer powder for cement modifier or polymeric admixture is hereafter referred to as powder.

3.5 polymer-cement ratio

mass ratio of total solids content in dispersions and powders to cement in polymer-modified mortar and concrete

3.6 total solids content

non-volatile content in dispersions or a component other than volatile content in powders

4 General conditions for tests

4.1 Rounding of numbers

Numerical values shall be rounded up or rounded down to the specified number of decimal places.

4.2 Laboratory and curing chamber conditions

The temperature and relative humidity of the laboratory shall be $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and $(65 \pm 20)\%$, respectively. Curing chambers are classified into general curing chambers and humidified curing chambers, the temperature and relative humidity conditions for the former being $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $(65 \pm 10)\%$, respectively, and for the latter being $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and minimum 80 %, respectively. However, in the case where temperature and humidity conditions are specified in the individual test subclause, those specified conditions shall apply. If test has been performed using any other conditions than the above, the used conditions shall be recorded in the test report.

Preparation of polymer-modified mortar, tests of fresh polymer-modified mortar other than the setting time test, and moulding, surface finishing and demoulding of specimens of hardened polymer-modified mortar shall always be carried out in the laboratory, in which appropriate humidity and circulation of air is ensured.

5 Preparation of polymer-modified mortar

5.1 Apparatus and instruments

The mixer for mechanical mixing shall be as specified in 9.2.3 in **JIS R 5201**, and the spoon to be used for mechanical mixing and the bowl and spoon to be used for hand mixing shall be as specified in 9.2.4 of **JIS R 5201**.

5.2 Preparation of materials to be used for test

Preparation of materials to be used for test shall be as follows.

- a) All the materials to be used for tests shall be placed in the laboratory prior to the test, and brought to a temperature of the laboratory.
- b) Cement shall be tightly stored in moisture-proof containers.

Cement in which lumps have formed due to weathering shall not be used.
- c) Fine aggregate shall be prepared to ensure that grading and moisture conditions do not vary over different batches.
- d) A cement modifier or polymeric admixture shall be stored in a tightly sealed container to prevent its total solids content from changing.
- e) Water for mixing shall be as specified in Annex C to **JIS A 5308**.
- f) A premixed liquid material containing a specified amount of dispersion shall be stored in a tightly sealed container to prevent the concentration from changing.
- g) A premixed powder material consisting of cement, powder, etc. shall be stored in a tightly sealed moisture-proof container.

5.3 Batching of materials

Materials shall be separately weighed by mass by means of a balance having a minimum precision of 1 g, based on the specified mix proportion of the polymer-modified mortar. However, the water may be measured by using a volumetric meter capable of taking the specified amount.

NOTE : The specified mix proportion of the polymer-modified mortar is usually expressed by the cement-fine aggregate ratio, polymer-cement ratio and water-cement ratio. From these factors, the masses of the materials required for each batch shall be calculated in consideration of the moisture content of the fine aggregate, the total solids content of the cement modifier or polymeric admixture, etc.

5.4 Mixing of polymer-modified mortar

The mixing of polymer-modified mortar shall be carried out by the mechanical mixing specified in **a)** below. Where mechanical mixing is not applicable, the hand mixing specified in **b)** may be applied.

The apparatus for mixing shall be prepared in the laboratory beforehand.

However, the polymer-modified mortar using a premixed liquid material or premixed powder material may be prepared according to the method specified by its manufacturer. In this case, the procedure and method used for mixing shall be recorded.

a) **Mechanical mixing methods** The mixing by mechanical means shall be as follows.

The mechanical mixing of the polymer-modified mortar shall be carried out at a low speed (rotation speed: $140 \text{ r/min} \pm 5 \text{ r/min}$, revolution speed: $62 \text{ r/min} \pm 5 \text{ r/min}$).

- 1) **When mixing dispersion** Put the batched cement and fine aggregate in a mixing bowl, start the mixer and mix for 2 min. Add the batched dispersion and water, immediately mix and continue for 1 min. Stop mixing for a duration of 30 s, which is used to scrape off the mortar adhering to the paddles and then the mortar adhering to the wall of the mixing bowl with a spoon, mix the scraped mortar three times with the spoon and gather it at the centre of the bowl. After the stop of the mixer, start again, and mix for 2 min. Upon completion of the mixing, remove the mixing bowl from the mixer, and stir the mortar 10 times with the spoon.
- 2) **When mixing powder** Put the batched cement, powder and fine aggregate in a mixing bowl, start the mixer and mix for 2 min. Add the batched water, immediately mix and continue for 1 min. Stop mixing for a duration of 30 s, which is used to scrape off the mortar adhering to the paddles and then the mortar adhering to the wall of the mixing bowl with a spoon, mix the scraped mortar three times with the spoon and gather it at the centre of the bowl. After the stop of the mixer, start again, and mix for 2 min. Upon completion of the mixing, remove the mixing bowl from the mixer, and stir the mortar 10 times with the spoon.

b) **Hand mixing methods** The mixing methods by hand shall be as follows.

- 1) **When mixing dispersion** Put the batched cement and fine aggregate in a bowl, and mix with a spoon for 2 min. Add the batched dispersion and water, immediately mix and continue for 3 min.
- 2) **When mixing powder** Put the batched cement, fine aggregate and powder in a bowl, and mix with a spoon for 2 min. Add the batched water, immediately mix and continue for 3 min.

6 Tests for fresh polymer-modified mortar

6.1 General

The types and applicable subclauses of tests for fresh polymer-modified mortar are shown in Table 1.

Table 1 Types and applicable subclauses of tests for fresh polymer-modified mortar

Type of test	Applicable subclause
Flow test	6.2
Slump test	6.3
Bulk density (mass per unit volume) test	6.4
Air content test	6.5
Setting time test	6.6

6.2 Flow test

The flow test shall be carried out in accordance with clause **12** of **JIS R 5201**.

6.3 Slump test

6.3.1 Apparatus

The apparatus shall be as follows.

- a) A slump cone made of steel, having a top inside diameter of $50 \text{ mm} \pm 0.5 \text{ mm}$, a base inside diameter of $100 \text{ mm} \pm 0.5 \text{ mm}$ and a height of $150 \text{ mm} \pm 0.5 \text{ mm}$, and with a machine-finished interior surface.

The slump cone shall be provided with handles at suitable positions, and its total mass shall be approximately 2 kg (see Figure 1).

- b) A steel tamping rod 9 mm in diameter and approximately 30 cm in length, of which the tamping end is rounded to a hemispherical tip.