

## **JSCE-K 521-1999**

# **Test method for oxygen permeability of concrete surface coating materials**

**JSCE-K 521-1999****Test method for oxygen permeability of concrete surface coating materials****1. Scope**

This JSCE standard describes the method for determining oxygen permeability of surface coating materials used in repairing concrete structures.

**2. Normative References**

This standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in this text and the publications are listed hereafter.

- JSCE-K 511 Test methods for weathering resistance of concrete surface coating materials
- JIS K 5600 Testing methods for paints – part 1: general rule  
–section 7: determination of film thickness
- JIS K 7100 Standard atmospheres for conditioning and testing of plastics
- JIS K 7126 Testing method for gas transmission rate through plastic film and sheeting

**3. Definition**

Term used in this standard is defined as follows.

**Free films:** Surface coating materials coated on tin plates or glass plates with mould release paper or film as same specification as coating to real concrete structures, and peeled in a certain way. Main and finish materials are included, however, surface preparations and leveling materials are excluded.

**4. Adjustments of Specimens and Test Temperature****4.1 Adjustments of condition**

Dry specimens are kept at same temperature as test temperature over 48 hours using calcium chloride or other desiccants in a desiccator before test.

## 4.2 Test temperature

Generally, the test is carried out in a room, with a specified temperature provided in JIS K 7100, Standard Atmospheric Conditions for Testing, Class 2 temperature of  $23\pm 2$  .

## 5. Types of Specimens

Standard specimens and specimens after accelerated weathering test are prepared as follows.

### 5.1 Preparation of standard specimens

Specimens are free films, prepared in the following procedures.

#### 5.1.1 Preparation of films

The surface coating materials are coated on tin plates as same specification applied to real structures, and cured at a temperature of  $23\pm 2$  , a relative humidity of  $50\pm 5\%$  for 28 days. At the time of coating, three points of film thickness are measured with a wet film gauge as provided in JIS K 5400 3.4 (measurement of coating film thickness). In case of using Japanese paper, it is difficult to measure film thickness by wet film gauge, therefore only specimen's thickness is measured as provided in Section 5.1.4.

#### 5.1.2 Free films

Free films from the coated tin plates are obtained by amalgam method.

Note (1): Mercury used in this test possesses toxicity, so it requires careful treatment. Therefore, if there is no problem in the property of free films, be-tested coating materials are coated on glass plates covered with mould release papers or films, according to same specification provided in JIS K 5400 8.8, 8.17 and 8.18. As mould release papers or films, tack papers, polyethylene terephthalate (PET) and fluorine resin film can be used.

Note (2): In case of PET films, solvent type surface coating materials are difficult to be peeled in some cases.

Note (3): Mould release paper has a surface treatment with silicon resin, so it is better to use fluorine film for silicon type surface coating materials.

Note (4): If smooth free film cannot be obtained because repelling occurs on the mould release

paper or film, both mould release paper and Japanese paper (100 $\mu$ m: paper mulberry 60%, 40% in pulp, machine made) shall be used together.

### **5.1.3 Number of specimens**

It is confirmed that prepared free films should not have any deformations such as curves or bends, and pinholes should not be observed by the visual observation under the natural light. The required number of specimens is obtained from one coated plate. The required number of specimens is three. Specimens should be larger than permeable area of cell that is used for measurement, and be attached to the cell with complete sealing.

### **5.1.4 Thickness of specimens**

Three points of thickness on one surface of specimens are measured, and the mean value is obtained as provided in JIS K 5400 3.5.

## **5.2 Preparation of specimens after accelerated weathering test**

### **5.2.1 Accelerated weathering test**

Using specimens prepared by the method of Section 5.1, accelerated weathering test for specified time is carried out, as provided in JSCE-K511. In order to prevent deformation of specimens, an adhesive tape is used to attach specimens on stainless plates.

### **5.2.2 Number of specimens**

The specimens from Section 5.2.1 are used as the specimens after accelerated weathering test. The number of specimens is three.

## **6. Oxygen Permeability Test**

Using above specimens, the oxygen permeability test is carried out, as provided in JIS K 7126 the method A (differential pressure method) or the method B (isobaric method), and oxygen permeability ( $\text{mol}/\text{m}^2 \cdot \text{s} \cdot \text{Pa}$ ) and oxygen permeability coefficient ( $\text{mol} \cdot \text{m}/\text{m}^2 \cdot \text{s} \cdot \text{Pa}$ ) are obtained.

## 7 Test Results

The calculated data rounding off to two significant figures as provided in JIS Z 8401 is obtained.

## 8. Report

The following items shall be reported.

- a) Type and coating specification of the surface coating material, expressed in JSCE-511 Table-3.
- b) Preparation method of free films.
- c) Names of test instruments.
- d) Permeability area of cell.
- e) Type of specimen.
- f) Type of accelerated weathering test machine, operating condition and test duration. The operating conditions shall be based on JSCE-K 511 Table 2.
- g) Type of pressure sensor (differential pressure method) or Type of oxygen sensor (isobaric method).
- h) Thickness of specimens (each specimen's value and the mean value).
- i) Oxygen permeability and/or oxygen permeability coefficient.
- j) Date of test.
- k) Testing organization.