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Optical coated glass

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Flat Glass Manufacturers Association of Japan (FGMAJ)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS R 3221 : 2002**), which has been technically revised.

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Optical coated glass

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 11479-1** : 2011, Edition 1 and **ISO 11479-2** : 2011, Edition 1 with some modifications of the technical contents to meet the practical market situations in Japan.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standards. A list of modifications with the explanations is given in Annex JA. The comparison table between previous and current editions of this Standard on technically significant revisions is given in Annex JB.

1 Scope

This Standard mainly specifies the requirements for optical coated glass for use in building glazing.

NOTE The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 11479-1 : 2011 *Glass in building — Coated glass — Part 1 : Physical defects*

ISO 11479-2 : 2011 *Glass in building — Coated glass — Part 2 : Colour of façade* (overall evaluation : MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

Part or all of the provisions of the following standards, 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 B 7502 *Micrometers*

JIS B 7512 *Steel tape measures*

JIS B 7516 *Metal rules*

JIS C 1609-1 *Illuminance meters Part 1 : General measuring instruments*

JIS R 3106 *Testing method for transmittance, reflectance and emissivity of flat glass and calculation of total solar energy transmittance of glazing*

JIS R 3202 *Float glass and polished plate glass*

JIS R 3205 *Laminated glass*

JIS R 3206 *Tempered glass*

JIS R 3208 *Heat absorbing glass*

JIS R 3212 *Test methods of safety glazing materials for road vehicles*

JIS R 3222 *Heat-strengthened glass*

JIS Z 8401 *Rounding of numbers*

JIS Z 8722 *Methods of colour measurement — Reflecting and transmitting objects*

3 Terms and definitions

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

3.1 Basic definitions

3.1.1

optical coated glass

glass to which a wavelength-selective optical coating is applied on one side or both sides in order to improve optical, thermal or other properties

Note 1 to entry Optical coated glass includes solar reflective glass, low emissivity glass and anti-reflective glass (see 4.1).

3.1.2

optical coating

coating of one or more layers applied to the glass using either the pyrolytic method or the sputtering (vacuum deposition) method

3.1.3

solar reflective glass

glass to which optical coating is applied on its surface, having high reflectance primarily in the wavelength band of solar radiation

Note 1 to entry Solar reflective glass refers to the glass having a function to suppress the thermal load caused by solar radiation.

Note 2 to entry The solar radiation herein means the direct solar radiation, i.e., the radiation within the wavelength band (300 nm to 2 500 nm) of near ultraviolet, visible and near infrared, directly reaching the earth surface through the atmospheric layer (Source : 3.2 of JIS R 3106 : 2019).

Note 3 to entry The definition specified in JIS R 3221 : 2002 is followed.

3.1.4

low emissivity glass

glass to which optical coating is applied on its surface, having high reflectance primarily in the wavelength band of ambient temperature radiation

Note 1 to entry Low emissivity glass refers to the glass having a function to raise

the heat insulating performance of insulating glass.

Note 2 to entry Also referred to as Low-E glass.

3.1.5

anti-reflective glass

glass to which optical coating is applied on its surface, having low reflectance primarily in the visible light wavelength band

Note 1 to entry Anti-reflective glass refers to the glass of which visibility through the glass is improved by reducing the reflectivity of glass surface.

3.1.6

method of deposition

method of applying a single or multilayer coating consisting of single metal, metal oxide, metal nitride, metal fluoride or other compound to the surface of glass

3.1.7

pyrolytic deposition

method of deposition in which the coating is applied to glass at the time of float glass manufacturing

3.1.8

sputter deposition

method of deposition in which the coating is applied to glass in a vacuum chamber

Note 1 to entry The definition is the same as that specified in the corresponding International Standard for “vacuum deposition.”

3.1.9

finished size glass

flat glass sheet cut to the dimensions required for final fabrication or use

3.1.10

stock size glass, jumbo size glass

standard size of annealed flat glass sheet that may be cut down to a smaller finished size for fabrication

3.1.11

solar radiation shielding performance

performance of glass to shield solar radiation of the incident solar radiation onto the glass

Note 1 to entry The solar radiation shielding performance is expressed by the total solar energy transmittance or the solar heat cut property.

3.1.12

total solar energy transmittance

ratio of the sum of the radiant energy flux of solar radiation transmitting the glass part and the thermal current flux absorbed in the glass then transmitted to indoor side, to the radiant energy flux of incident solar radiation, regarding the incident solar radiation perpendicular to the window glass surface

(Source : 3.5 of JIS R 3106 : 2019)

Note 1 to entry The value obtained by subtracting the total solar energy transmittance from “1” is sometimes referred to as the “solar heat cut property.”

3.1.13

emissivity

ratio of the radiant energy flux of thermal radiation into the space to the radiant energy flux of thermal radiation from a blackbody at the temperature same as that of flat glass

(Source : 3.4 of JIS R 3106 : 2019)

3.1.14

light reflectance

ratio of the reflected luminous flux to the incident luminous flux, regarding the luminous flux of incident daylight perpendicular to the glass surface

(Source : 3.1 of JIS R 3106 : 2019)

Note 1 to entry The daylight means the CIE daylight which has been established by the International Commission on Illumination (CIE).

Note 2 to entry The luminous flux means the integration, regarding the wavelength of the product of the radiant energy flux of each wavelength of radiation and the value of spectral luminous efficacy.

3.2 Definition of physical defects

3.2.1

coating rub

surface abrasion of appreciable width that has a partial or complete removal of the coating, producing a hazy appearance

3.2.2

corrosion

change in the colour or level of reflected and/or transmitted light over all or part of the glass surface as a result of degradation of the coating from external sources

3.2.3

crazing

defects in optical coating discoloured in single or multiple lines or cracks due to ab-

normal discharges in the sputtering deposition

3.2.4

spot

defects in optical coating that looks dark against the surrounding coating, which are formed by the drop of microparticles generated in a vacuum chamber onto glass in the sputtering method, or by an abnormal local discharge generated in the sputtering method

3.2.5

pinhole

punctual void in the optical coating with partial or total absence of optical coating

3.2.6

white dot

white appearance due to localized diffuse reflection of light when low emissivity glass is visually observed from the front

Note 1 to entry A white dot is a defect specific to low emissivity glass.

3.2.7

scratch

partial or complete removal of the optical coating along a thin, straight or curved line

3.2.8

stain

foreign matter adhering to the surface of optical coating

Note 1 to entry Stain is a defect larger than a spot and pinhole, often irregularly shaped and partially of a mottled or patchy structure.

3.2.9

colour difference

difference defined as the gap perceived between two colour stimuli within one glass surface or between two glass panes

(Source : 2057 of JIS Z 8105 : 2000 is modified)

3.2.10

colour unevenness

condition in which a colour gap is perceived between different parts within one glass surface

4 Classification

4.1 Classification of optical coated glass

The optical coated glasses are classified into solar reflective glass, low emissivity glass and anti-reflective glass according to the optical coating functions.

4.2 Classification according to thickness

The classification of optical coated glass according to thickness is as shown in Table 1, in which the thickness given ○ is applicable.

Table 1 Classification according to thickness

Classification according to nominal thickness ^{a)}	Solar reflective glass	Low emissivity glass	Anti-reflective glass
3 mm	—	○	○
4 mm	○	○	○
5 mm	—	○	○
6 mm	○	○	○
8 mm	○	○	○
10 mm	○	○	○
12 mm	○	○	—
Note ^{a)} The nominal thickness is a symbol indicating the thickness of glass, which is a numerical value of an integer or that down to the first decimal place, expressed in millimetres.			

4.3 Classification according to shading performance for solar radiation

The classification of solar reflective glass according to the shading performance for solar radiation shall conform to Table 2, based on the test results of total solar energy transmittance specified in 7.5.1.

NOTE The classification according to the shading performance for solar radiation is not applicable to low emissivity glass and anti-reflective glass.

Table 2 Classification according to shading performance for solar radiation

Type	Total solar energy transmittance η
Class 1	0.70 max.
Class 2	0.55 max.
Class 3	0.40 max.

5 Quality

5.1 Appearance

The appearance of optical coated glass shall conform to Table 3 and Table 4, when tested in accordance with 7.2. The defects shall be deemed to be those visible by observing the specimen using transmitted and/or reflected light.

Table 3 Appearance (solar reflective glass and anti-reflective glass)

Defect	Appearance	
	Central area	Edge area
Spot, pinhole	There shall be no one exceeding 2.0 mm in size. There shall be no more than six pieces for the size of over 1.0 mm up to and incl. 2.0 mm within a square of 30 cm.	
Scratch	There shall be no one exceeding 75 mm in length nor exceeding 0.5 mm in width.	There shall be no one that impairs visibility of reflected and/or transmitted images.
Coating rub	There shall be no one.	There shall be no one exceeding 20 mm in size.
Crazing	There shall be no one.	
Corrosion	There shall be no one.	
Stain	There shall be no one.	
Density	There shall not be six pieces or more of spots and pinholes of over 1.0 mm up to and incl. 2.0 mm in size and scratches of 75 mm or under in length or 0.5 mm or under in width, within a square of 30 cm in total.	
See 7.2.3 for the central and edge areas.		

Table 4 Appearance (low emissivity glass)

Defect	Appearance	
	Central area	Edge area
Spot, pinhole, white dot	There shall be no one exceeding 3.0 mm in size. There shall be no more than six pieces for the size of over 2.0 mm up to and incl. 3.0 mm within a square of 30 cm.	
Scratch	There shall be no one exceeding 75 mm in length nor exceeding 0.5 mm in width.	There shall be no one that impairs visibility of reflected and/or transmitted images.
Coating rub	There shall be no one.	There shall be no one exceeding 20 mm in size.
Crazing	There shall be no one.	
Corrosion	There shall be no one.	
Stain	There shall be no one.	
Density	There shall not be six pieces or more of spots, pinholes and white dots of over 2.0 mm up to and incl. 3.0 mm in size, and scratches of 75 mm or under in length or 0.5 mm or under in width, within a square of 30 cm in total.	
See 7.2.3 for the central and edge areas.		

5.2 Colour difference

The colour difference of optical coated glass shall conform to Table 5, when tested in accordance with 7.3.

Table 5 Colour difference

Index concerning colour difference	Tolerance
ΔL^*	≤ 5.0
Δa^*	≤ 5.0
Δb^*	≤ 5.0
ΔE_{ab}^*	≤ 6.0

5.3 Shapes and dimensions

5.3.1 Shapes

The optical coated glass shall be a flat plate, generally in the shape of square or rectangle. The shape other than square or rectangular shall be as agreed between the interested parties.

5.3.2 Thickness and its tolerance

The thickness of optical coated glass shall be measured in accordance with 7.4, and the result shall be expressed in millimetres. The thicknesses and their tolerances shall be in accordance with 6.1.2 of JIS R 3202, 5.5 of JIS R 3205, 6.2 of JIS R 3206, 5.2 of JIS R 3208 and 6.2 a) of JIS R 3222.

5.3.3 Length and width and their tolerances

The length and width of optical coated glass shall be measured in accordance with 7.4 and shall be as agreed between the interested parties, and the results shall be expressed in millimetres. The tolerances on length and width shall conform to those specified in each JIS of base material of plate glass (see Table 6).

5.4 Performances

5.4.1 Shading performance for solar radiation

The shading performance for solar radiation of solar reflective glass shall conform to Table 2, when calculated in accordance with 7.5.1.

NOTE The requirements for shading performance for solar radiation shall not apply to low emissivity glass and anti-reflective glass.

5.4.2 Emissivity

The emissivity of low emissivity glass shall be measured in accordance with 7.5.2, and the value obtained in 7.5.2 b) 2) shall be 0.20 or under.

NOTE The requirements for emissivity shall not apply to solar reflective glass and anti-reflective glass.

5.4.3 Light reflectance

The light reflectance of anti-reflective glass shall be measured in accordance with 7.5.3, and the value obtained in 7.5.3 b) shall be 6 % or under when the deposition is formed only on one face and 3 % or under when formed on both faces.

NOTE The requirements for light reflectance shall not apply to solar reflective glass and low emissivity glass.

5.5 Durability

5.5.1 General

The requirements for the durability specified in 5.5.2 to 5.5.5 shall apply to solar reflective glass and anti-reflective glass, and shall not apply to low emissivity glass.

5.5.2 Light fastness