

TITLE OF THE INVENTION

LAMINATED GLASS

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The disclosure herein generally relates to a laminated glass.

2. Description of the Related Art

According to the recent increase in the
10 awareness of energy saving, there are more and more examples of application of multilayered glass as window glasses of buildings or the like. Multilayered glass is configured by laminating two glass plates each other via an air layer. In the multilayered glass, heat is
15 prevented from transferring from one glass plate to the other glass plate according to the presence of the internal air layer, and a heat shielding performance and a heat insulating performance can be enhanced.

[Citation List]

20 [Patent Literature]

[PTL 1] Japanese Unexamined Patent Application
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SUMMARY OF THE INVENTION

25 [Technical Problem]

However, there is a problem that generally it is difficult to reduce a thickness of a multilayered glass structurally. For example, in a typical multilayered glass, when a thickness of the air layer is reduced, a
30 heat shielding function and a heat insulating function become unable to be provided sufficiently, and the air layer has the thickness of at least 10 mm to 15 mm. Due to the above-described limitation of thickness, the

multilayered glass may be difficult to be applied depending on its usage.

Thus, in order to respond to the above-described demand, a laminated glass is considered to be applied instead of the multilayered glass. This is because the laminated glass includes two glass plates and an intermediate film between the glass plates (i.e. without a thick air layer), and a thinner structure can be easily constructed.

For example, Patent Document 1 discloses a laminated glass provided with a sun protection function and a heat insulating function. However, in the laminated glass, compared with the multilayered glass, it is difficult to satisfy both of sufficiently providing the heat shielding function and the heat insulating function and solving a problem due to appearance, such as a glare by a decrease in transmittance or by reflection. At the present time, the application as a window glass of a building has not been progressed.

The present invention was made in view of such a background, and it is an object of the present invention to provide a laminated glass that satisfies both of the heat shielding function and the heat insulating function, and of the appearance performance.

[Solution to Problem]

According to an aspect of an embodiment, a laminated glass including a first glass plate; and a second glass plate that is bonded to the first glass plate via an intermediate film,

the first glass plate having a first surface and a second surface opposite to each other, the second glass plate having a third surface and a fourth surface opposite

to each other, the first surface being arranged farther from the intermediate film than the second surface, and fourth surface being arranged farther from the intermediate film than the third surface,

5 a first coating film being arranged on the first surface or the second surface,

 a second coating film being arranged on the fourth surface,

 from the first glass plate of the laminated
10 glass side, a visible light reflectance represented as $R_{v_{out}}$ (%) that is measured in conformity with ISO 9050:2003, a solar radiation heat reception rate represented as a g-value, a visible light transmittance represented as T_v (%), and a shielding coefficient represented as SC that is
15 obtained by formula (1)

$$SC = g\text{-value} / 0.88 \quad (\text{formula (1)})$$

satisfying $R_{v_{out}} \leq 30\%$, $T_v > 26\%$, and $SC \leq 0.35$, and

 when quantifying reflected light obtained, in conformity with ISO 9050:2003, for light incident with
20 angles of 5 degrees and 55 degrees from the first glass plate side by expressing with CIE1976L*a*b* chromaticity coordinates, values of a^* and b^* being both 3 or less, is provided.

 According to another aspect of the embodiment, a
25 laminated glass including a first glass plate; and a second glass plate that is bonded to the first glass plate via an intermediate film,

 the first glass plate having a first surface and a second surface opposite to each other, the second glass
30 plate having a third surface and a fourth surface opposite to each other, the first surface being arranged farther from the intermediate film than the second surface, and the fourth surface being arranged farther from the

intermediate film than the third surface,

a first coating film being arranged on the second surface,

5 a second coating film being arranged on the fourth surface,

the first coating film including two layers mainly including silver or a silver alloy, and

10 the layer of the two layers that is closer to the second surface being thicker than the other layer, is provided.

According to yet another aspect of the embodiment, a laminated glass including a first glass plate; and a second glass plate that is bonded to the first glass plate via an intermediate film,

15 the first glass plate having a first surface and a second surface opposite to each other, the second glass plate having a third surface and a fourth surface opposite to each other, the first surface being arranged farther from the intermediate film than the second surface, and
20 the fourth surface being arranged farther from the intermediate film than the third surface,

a first coating film being arranged on the second surface,

25 a second coating film being arranged on the fourth surface,

the first coating film including two layers mainly including silver or a silver alloy, and

30 the thickness of a layer of the two layers closer to the second surface being less than 10 nm, and a ratio of a thickness of the other layer to the thickness of the layer closer to the second surface being 2.5 or more, is provided.

[Advantageous effect of Invention]

According to an aspect of the present invention,
a laminated glass that satisfies both of the heat
shielding function and the heat insulating function, and
5 of the appearance performance, can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[FIGURE 1]

FIG. 1 is a diagram schematically depicting a
10 cross section of a laminated glass according to an
embodiment.

[FIGURE 2]

FIG. 2 is a diagram schematically depicting an
example of a configuration of a first coating film in the
15 laminated glass according to the embodiment.

[FIGURE 3]

FIG. 3 is a diagram schematically depicting an
example of a configuration of a second coating film in the
laminated glass according to the embodiment.

20 [FIGURE 4]

FIG. 4 is a diagram schematically depicting a
cross section of another laminated glass according to an
embodiment.

[FIGURE 5]

25 FIG. 5 is a diagram schematically depicting an
example of a configuration of a third coating film in the
other laminated glass according to the embodiment.

[FIGURE 6]

FIG. 6 is a diagram schematically depicting
30 another example of the configuration of the third coating
film in the other laminated glass according to the
embodiment.

[FIGURE 7]

FIG. 7 is a graph in which relations between visible light transmittance T_v (%) and shielding coefficients SC obtained for the respective laminated glasses are plotted.

5 [FIGURE 8]

FIG. 8 is a graph in which relations between visible light transmittance T_v (%) and visible light reflectance $R_{v_{out}}$ (%) obtained for the respective laminated glasses are plotted.

10 [FIGURE 9]

FIG. 9 is a graph in which relations between energy transmittance T_e (%) of a first glass and the shielding coefficients, SC, obtained for the respective laminated glasses are plotted.

15 [FIGURE 10]

FIG. 10 is a graph in which relations between energy reflectance $R_{e_{out}}$ (%) obtained for the respective laminated glasses and the shielding coefficients, SC, are plotted.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, with reference to drawings, an embodiment of the present invention will be described.

(Laminated glass according to embodiment)

25 First, with reference to FIG. 1, a laminated glass according to the embodiment will be described.

FIG. 1 schematically illustrates a cross section of the laminated glass according to the embodiment (in the following, referred to as a "first laminated glass").

30 As illustrated in FIG. 1, the first laminated glass includes a first glass plate 110, a second glass plate 120, and an intermediate film 130 arranged between both the glass plates 110, 120.

The first glass plate 110 has a first surface 112 and a second surface 114 opposite to each other. The second glass plate 120 has a third surface 122 and a fourth surface 124 opposite to each other.

5 The intermediate film 130 is arranged between the second surface 114 and the third surface 122 in order to bond the first glass plate 110 and the second glass plate 120. The first surface 112 of the first glass plate 110 is arranged so as to be closer to a first "outside" 101 of the first laminated glass 100, than the second surface 114. The fourth surface 124 of the second glass plate 120 is arranged so as to be closer to a second "outside" 102 of the first laminated glass 100, than the third surface 122.

15 Note that the above-described terms "outside" are different from the term "outdoor side"/"indoor side" which will be used when the first laminated glass 100 is actually installed in an installation place such as a building. That is, in an environment where the first laminated glass 100 is used, the first "outside" 101 of the first laminated glass 100 corresponds to the "outdoor side", and the second "outside" 102 of the first laminated glass 100 corresponds to the "indoor side".

20 On the first surface 112 of the first glass plate 110, a first coating film 150 is arranged. Moreover, on the fourth surface 124 of the second glass plate 120, a second coating film 170 is arranged. The first coating film 150 and the second coating film 170 may be single layered films or may be laminated layered films.

30 By arranging the first coating film on the first surface of the first glass plate, it becomes possible to add a stain proofing function to the first laminated glass 100. In order to add a preferable stain proofing function,

an arithmetic average roughness Ra of a surface of the first coating film is preferably 1 nm or more and 13 nm or less, and a ratio of a Peak-valley value (PV value) of the surface of the first coating film to the arithmetic

5 average roughness Ra, i.e. PV/Ra, is preferably 15 or less.

Moreover, by arranging the second coating film on the fourth surface of the second glass plate, it becomes possible to add a heat insulating function/heat shielding function to the first laminated glass 100.

10 Moreover, the second coating film is preferably provided with durability. For example, in the second coating film, after a perspiration resistance test in conformity with ISO 12870 for three days, a number of defects within a range of 1 mm × 1 mm measured by observing a surface of
15 the second coating film with a microscope of 50 times magnification is preferably 50 or less.

According to the presence of the coating films 150, 170, in the first laminated glass 100, the following feature is obtained. That is, from the first outside 101,
20 i.e. the first glass plate 110 side, a visible light reflectance represented as $R_{v_{out}}$ (%) that is measured in conformity with ISO 9050:2003, a solar radiation heat reception rate represented as a g-value, and a shielding coefficient represented as SC that is obtained by dividing
25 g-value by 0.88, as expressed by the following formula (1)

$$SC = g\text{-value} / 0.88, \quad (\text{formula (1)})$$

satisfy $R_{v_{out}} \leq 30\%$, $T_v > 26\%$, and $SC \leq 0.35$.

The solar radiation heat reception rate, g-value, is expressed by a percentage of an entire solar heat
30 entering from one outside of the laminated glass, of a sum of heat directly transmitted to the second outside (transmission heat) and heat absorbed inside the laminated glass and afterwards emitted to the second outside.

Moreover, the shielding coefficient, SC, is an index indicating the heat shielding function of the laminated glass. The smaller the value of SC is, the higher the heat shielding function of the laminated glass is.

5 The shielding coefficient SC of the first laminated glass 100 is 0.35 or less, and is sufficiently small. A sufficient heat shielding characteristic can be obtained. The shielding coefficient SC is preferably 0.33 or less.

10 Moreover, in the first laminated glass 100, because the visible light reflectance $R_{v_{out}}$ is controlled to less than or equal to 30%, when the first laminated glass 100 is viewed from the first outside 101, a noticeable glare is not likely to occur, and the design
15 property can be prevented significantly from degrading.

 According to the above-described features, the first laminated glass 100 can exert an excellent heat shielding characteristic without degrading the design property, when the first laminated glass 100 is applied as
20 a window of a building, for example.

 Note that, in the laminated glass described in the embodiment, only from its appearance, it is difficult to determine which outside is the first outside 101 or the second outside 102. Actually, when an intended laminated
25 glass has the above-described configuration, and furthermore a visible light reflectance $R_{v_{out}}$ (%) measured from either one of the outsides and a shielding coefficient SC satisfy the above-described conditions, such laminated glass is regarded as the laminated glass
30 according to the embodiment.

(Respective members configuring laminated glass)

 Next, respective members configuring the first laminated glass 100 having the above-described features

will be described in more detail. Note that in the following description, when indicating the respective members, for clarification, the reference numerals used in FIG. 1 will be used.

5 (Glass plates 110, 120)

The first glass plate 110 is, for example, configured of a soda lime glass, a borosilicate glass, an alkali-free glass, or an aluminosilicate glass.

Moreover, the glass plate 110 may be transparent
10 or may be colored. A color of the glass plate 110 is not particularly limited. The glass plate 110 may be green or blue, for example.

The same applies to the second glass plate 120 as the first glass plate 110. Note that the second glass
15 plate 120 may have different composition and/or different color from the first glass plate 110.

Thicknesses of the glass plates 110, 120 are not particularly limited. The thicknesses fall, for example, within the range of 2 mm to 12 mm. Note that the first
20 glass plate 110 may have a different thickness from the second glass plate 120. The glass plates 110, 120 may be a strengthened glass, particularly a chemically strengthened glass. By using the chemically strengthened glass, the strength of the laminated glass can be enhanced,
25 and the laminated glass can be preferably used in upper floors of a building or the like.

(Intermediate film 130)

In the first laminated glass 100, as long as the above-described features are satisfied, as the
30 intermediate film 130, any intermediate film that has been conventionally used can be used.

Typical intermediate film 130 includes a thermoplastic resin and a plasticizing agent.

The thermoplastic resin includes, for example, a polyvinyl butyral resin, a polyvinyl acetal resin, an ethylene-vinyl acetate copolymer resin, an ethylene-acrylic copolymer resin, a polyurethane resin, or a
5 polyvinyl alcohol resin. A thermoplastic resin other than the above may be used.

The plasticizing agent includes, for example, an organic ester plasticizing agent, such as a monobasic organic acid ester or a polybasic organic acid ester, a
10 phosphoric acid plasticizing agent, such as an organic phosphate plasticizing agent, or an organic phosphite plasticizing agent. A plasticizing agent other than the above may be used.

A thickness of the intermediate film 130 is not
15 particularly limited. The thickness falls, for example, within a range of 0.1 mm to 3 mm.

(Coating films 150, 170)

The coating films 150 and 170 are configured so as to obtain the above-described visible light reflectance
20 $R_{v_{out}}$ (%) and the shielding coefficient SC, when being applied to the glass plates 110 and 120, respectively.

In the following, with reference to FIGs. 2 and 3, respective configuration examples of the first coating film 150 and the second coating film 170 will be described.

25 (Configuration example of first coating film 150)

FIG. 2 schematically depicts an example of the configuration of the coating film 150.

As illustrated in FIG. 2, in this configuration,
30 the coating film 150 includes three layers: an undercoat layer 152, a conductive oxide layer 153, and a high refractive index layer 154. The high refractive index layer means a layer having a refractive index of greater

than 2.

The undercoat layer 152 has a role of preventing predetermined elements from mutually diffusing between the first glass plate 110 and the conductive oxide layer 153.

5 The undercoat layer 152 is, for example, configured of a silicon oxide (SiO_x) that is a material mainly including silica. In the present application, "mainly including a material 'A'" means that an intended layer includes at least 50 mass% of the material 'A'.

10 A thickness of the undercoat layer 152 falls, for example, within a range of 10 nm to 100 nm.

In addition, the undercoat layer is not necessarily a single layer, but may include a plurality of layers. By preparing a multilayered configuration for the
15 undercoat layer, an alkali barrier performance becomes higher, and an effect that adjusting a reflection color tone becomes easier can be obtained, and it is preferable from a viewpoint of an excellent appearance performance and enhancement of the durability.

20 The conductive oxide layer 153 is, for example, configured of a material mainly including conductive tin oxide. The conductive oxide layer 153 may be, for example, configured of tin oxide doped with antimony and/or fluorine. The term "conductive layer" means a film with
25 an emissivity of 0.4 or less.

A thickness of the conductive oxide layer 153 falls, for example, within a range of 50 nm to 500 nm.

The high refractive index layer 154 has a role of adjusting a reflection characteristic for light
30 entering the coating film 150.

A thickness of the high refractive index layer 154 falls, for example, within a range of 10 nm to 70 nm.

In the configuration example illustrated in FIG.

2, the undercoat layer 152 and the high refractive index layer 154 are not required components, and may be omitted. Moreover, in the first coating film 150, as long as the above-described visible light reflectance $R_{v_{out}}$ (%) and the
5 shielding coefficient SC are obtained, on interfaces of the respective layers 152, 153 and 154, or in an upper part of the high refractive index layer 154, a different layer may be present.

A method of forming the first coating film 150
10 having the above-described configuration is not particularly limited. The first coating film 150 is configured, for example, by serially depositing the respective layers using a method selected from a physical deposition method (e.g. a vacuum deposition method, an ion
15 plating method, and a sputtering method), a chemical deposition method (e.g. thermal CVD method, a plasma CVD method, and an optical CVD method), and an ion beam sputtering method.

An entire thickness of the first coating layer
20 150 falls, for example, within a range of 70 nm to 670 nm, preferably within a range of 100 nm to 500 nm.

Energy transmittance T_e (%) obtained in conformity with ISO 9050:2003 for laminated layers of the first glass plate and the first coating film is preferably
25 50% or less.

(Configuration example of Second coating film 170)

FIG. 3 schematically depicts an example of the configuration of the coating film.

30 As illustrated in FIG. 3, in this configuration, the second coating film 170 includes two layers: an undercoat layer 172 and a conductive oxide layer 173.

The undercoat layer 172 has a role of preventing

predetermined elements from mutually diffusing between the second glass plate 120 and the conductive oxide layer 173. The undercoat layer 172 is, for example, configured of a silicon oxide (SiO_x) that is a material mainly including silica.

A thickness of the undercoat layer 172 falls, for example, within a range of 10 nm to 100 nm.

The conductive oxide layer 173 is, for example, configured of a material mainly including conductive tin oxide. The conductive oxide layer 173 may be, for example, configured of tin oxide doped with antimony and/or fluorine. In the case of the conductive oxide layer 173 configured of tin oxide doped with antimony, because a transmission color tone is not likely to become yellow, it is especially preferable according to an excellent appearance performance. Moreover, in the case of the conductive oxide layer 173 configured of tin oxide doped with fluorine, because a durability of the film becomes higher, it is especially preferable for use that requires higher durability.

A thickness of the conductive oxide layer 173 falls, for example, within a range of 50 nm to 500 nm.

In the configuration example illustrated in FIG. 3, the undercoat layer 172 is not a required component, and may be omitted. Moreover, in the second coating film 170, as long as the above-described shielding coefficient SC is obtained, on interfaces of the respective layers 172, and 173, or in an upper part of the conductive oxide layer 173, a different layer may be present.

A method of forming the second coating film 170 having the above-described configuration is not particularly limited. The second coating film 170 is configured, for example, by serially depositing the

respective layers using a method selected from a physical deposition method (e.g. a vacuum deposition method, an ion plating method, and a sputtering method), a chemical deposition method (e.g. thermal CVD method, a plasma CVD method, and an optical CVD method), and an ion beam sputtering method.

For example, the second coating film 170 may be formed using an online CVD method.

The term "online (deposition method)" means a method in which a film is deposited on a surface of a glass during a manufacturing process of the glass. More specifically, upon manufacturing the glass, a glass ribbon moves on a molten tin bath and is slowly cooled, and thereby glass is continuously manufactured. In the "online (deposition method)", during a glass ribbon moving, a film is deposited on an upper surface of the glass ribbon. That is, in the "online (deposition method)", the manufacturing process of glass and the deposition process of film are performed consecutively.

An entire thickness of the second coating layer 170 falls, for example, within a range of 60 nm to 600 nm, preferably within a range of 100 nm to 500 nm.

In addition, the second coating film is preferably a film with an emissivity of 0.4 or less.

(First laminated glass 100)

In addition to the above, the first laminated glass 100 has the following characteristics.

(Visible light transmittance)

In the first laminated glass 100, a visible light transmittance T_v (%) measured from the first side 101 using the method in conformity with ISO 9050:2003 satisfies the following relation:

$$T_v (\%) > 26\%.$$

With the first laminated glass 100 having such a visible light transmittance T_v (%), when applied as a window glass of a building, sufficient daylighting can be obtained.

5 Particularly, the visible light transmittance T_v (%) is greater than 28%, and preferably greater than 30%. From a viewpoint of an anti-glare property, the visible light transmittance T_v (%) is preferably less than or equal to 60%.

10 (Reflected color)

 In the first laminated glass 100, when quantifying reflected light obtained in conformity with ISO 9050:2003 for light incident with angles of 5 degrees and 55 degrees from the first side 101 by expressing with
15 CIE1976L*a*b* chromaticity coordinates, values of a^* and b^* satisfy the following relations:

$$a^* < 3 \text{ and } b^* < 3.$$

 Typically, from an aesthetic perspective, for a reflected color, light blue color to light green color are
20 preferred, and red color to yellow color tend to be avoided. In the first laminated glass 100, a^* and b^* are within the above-described ranges, the reflected color is prevented from becoming a red color to yellow color, and the reflected color excellent in design effect can be
25 provided.

 Particularly, at least any one of a^* and b^* preferably satisfies the following relations:

$$a^* > -30 \text{ or } b^* > -30.$$

 In this case, an obtained reflected color is in a region
30 of light blue color to light green color, and the design effect is further improved. In the region, particularly, by adjusting color so as to satisfy the following relations:

$$a^* > -10 \text{ and } b^* > -20,$$

it becomes possible to adjust to a color that can be easily harmonized with an exterior wall of a building.

(Energy reflectance)

5 The first laminated glass 100 has a feature that, from the first side 101, a visible light reflectance represented as $R_{v_{out}}$ (%) that is measured in conformity with ISO 9050:2003, a solar radiation heat reception rate represented as a g-value, and a shielding coefficient
10 represented as SC that is obtained by formula (1)

$$SC = g\text{-value} / 0.88 \quad (\text{formula (1)})$$

satisfy $R_{v_{out}} \leq 30\%$ and $SC \leq 0.35$.

Typically, in order to reduce the SC value, decreasing the energy transmittance T_e and increasing the
15 energy reflectance $R_{e_{out}}$ are both effective. Particularly, when the energy transmittance T_e of the laminated layers of the first glass plate and a first coating film is 50% or less, and the second coating film is a film with an emissivity of 0.4 or less, the relation $SC \leq 0.35$ can be
20 obtained.

Moreover, particularly, when the energy reflectance from the first glass plate side of the first laminated glass 100 satisfies $4\% \leq R_{e_{out}}$, the feature that $SC \leq 0.35$ is obtained. In addition, when it is configured
25 so that $15\% \leq R_{e_{out}}$, it becomes easier to adjust the shielding coefficient SC to $SC \leq 0.33$, and is preferable. Note that, the energy reflectance $R_{e_{out}}$ is more preferably 15% or more.

As described above, by satisfying the relations
30 for the shielding coefficient SC, the visible light reflectance $R_{v_{out}}$, the visible light transmittance T_v , and the reflected color a^* and b^* , simultaneously, a laminated glass, for which particularly a heat shielding performance,

a heat insulating performance and an appearance performance are satisfied, can be prepared.

(Another laminated glass according to the embodiment of the present invention)

5 Next, with reference to FIG. 4, a laminated glass according to another embodiment of the present invention will be described.

FIG. 4 schematically illustrates a cross section of a laminated glass according to another embodiment of
10 the present invention (in the following, referred to as a "second laminated glass").

As illustrated in FIG. 4, the second laminated glass 200 includes a first glass plate 210, a second glass plate 220, and an intermediate film 230 arranged between
15 both glass plates 210, 220.

The first glass plate 210 has a first surface 212 and a second surface 214 that are opposite to each other. The second glass plate 220 has a third surface 222 and a fourth surface 224 that are opposite to each other.

20 The first glass plate 210 and the second glass plate 220 are bonded to each other via the intermediate film 230. The first glass plate 210 and the second glass plate 220 are arranged so that the first surface 212 of the first glass plate 210 is closer to the first "outside"
25 201 of the second laminated glass 200 than the second surface 214, and the fourth surface 224 of the second glass plate 220 is closer to the second "outside" 202 of the second laminated glass 200 than the third surface 222.

On the fourth surface 224 of the second glass
30 plate 220, a second coating film 270 is arranged.

In the second laminated glass 200, different from the above-described first laminated glass 100, on the second surface 214 of the first glass plate 210 a coating

film (in the following, referred to as a "third coating film") 280 is arranged. The second coating film 270 and the third coating film 280 may be single layered films or may be multi-layered films. By arranging a coating film
5 on the second surface of the first glass plate, a haze can be controlled, which is preferable. Moreover, because a coating film is arranged on the second surface 214 of the first glass plate 210, even if a durability of the coating film is not high, the coating film can be preferably used.
10 Particularly, a silver film can be preferably used.

According to the presence of the coating films 270 and 280, in the second laminated glass 200, features that from the first outside 101 i.e. from the first glass plate 210 side, a visible light reflectance represented as
15 $R_{v_{out}}$ (%) that is measured in conformity with ISO 9050:2003, a solar radiation heat reception rate represented as a g-value, and a shielding coefficient represented as SC that is obtained by the above-described formula (1) satisfy
 $R_{v_{out}} \leq 30\%$ and $SC \leq 0.35$, are obtained.

20 Typically, in order to reduce the SC value, decreasing the energy transmittance T_e and increasing the energy reflectance Re_{out} are both effective. Particularly, when the energy transmittance T_e of the laminated layers of the first glass plate and the first coating film is 50%
25 or less, and the second coating film is a film with an emissivity of 0.4 or less, the feature $SC \leq 0.35$, and furthermore the feature $SC \leq 0.33$ are likely to be obtained.

Moreover, particularly, when the energy
30 reflectance from the first glass plate side of the first laminated glass 200 satisfies $4\% \leq Re_{out}$, the feature $SC \leq 0.35$ and furthermore the feature $SC \leq 0.33$ are likely to be obtained.

According to the above-described features, also in the second laminated glass 200, for example, upon applying as a window of a building, without degrading the design property, an effect of obtaining an excellent heat
5 shielding characteristic can be obtained.

Note that among the members configuring the second laminated glass 200, for the members other than the third coating film 280, indicated descriptions related to the members of the above-described first laminated glass
10 100 can be referred. Then, in the following, some configuration examples of the third coating film 280 of the second laminated glass 200 will be described.

(Configuration example of the third coating film 280)

15 (First configuration example)

The third coating film 280 may have the same configuration (first configuration) as the first coating film 150 illustrated in FIG. 2. Because the first configuration is apparent from the description related to
20 the above-described first coating film 150, the description will be omitted.

(Second configuration example)

FIG. 5 schematically depicts an example of a second configuration of the third coating film 280.

25 As illustrated in FIG. 5, in the configuration, the third coating film 280 is configured from three layers, i.e. a first dielectric layer 282, a functional layer 283, and a second dielectric layer 284.

The first dielectric layer 282 is configured of
30 a dielectric body including a metal oxide, a metal nitride, a metal oxynitride and/or the like. The metal includes zinc, tin, titanium, silicon, aluminum, chromium, nickel, niobium, an alloy thereof, and the like.

In addition, a dielectric body configuring the first dielectric layer 282 may be doped with an added material. The added material may include, for example, an oxide, a nitride and/or an oxynitride of tin, aluminum, chromium, titanium, silicon, boron, magnesium, gallium and the like.

Particularly, the first dielectric layer 282 is preferably configured of a material mainly including zinc oxide, or a material mainly including silicon nitride. In this case, in the first dielectric layer 282, at least one oxide selected from tin, aluminum, chromium, titanium, silicon, boron, magnesium, gallium and the like may be added.

A thickness of the first dielectric layer 282 falls, for example, within a range of 10 nm to 80 nm.

For example, the first dielectric layer 282 need not be a single layer, and may be configured of a plurality of layers.

The functional layer 283 includes a material mainly including silver or a silver alloy, or a nitride of at least one metal of niobium, tantalum, molybdenum and zirconium. When the functional layer 283 is configured of silver alloy, the functional layer 283 may include at least one kind of metal selected from silver, palladium, gold, chromium, cobalt, and nickel. These metals may be included at a fraction of 0.1 mass% or more with respect to the entirety of the functional layer 283.

A thickness of the functional layer 283 falls, for example, within a range of 7 nm to 30 nm, and falls preferably within a range of 10 nm to 25 nm.

For the second dielectric layer 284, the above-described description related to the first dielectric layer 282 can be referred. The second dielectric layer

284 may be configured of the same material as the first dielectric layer 282, or may be configured of a different material from the first dielectric layer 282.

5 A thickness of the second dielectric layer 284 falls, for example, within a range of 10 nm to 150 nm, and falls preferably within a range of 20 nm to 130 nm.

In addition, the second dielectric layer 284 need not be a single layer, and may be configured of a plurality of layers.

10 A method of forming the third coating film 280 having the above-described second configuration is not particularly limited. The third coating film 280 is configured, for example, by serially depositing the respective layers using a method selected from a physical
15 deposition method (e.g. a vacuum deposition method, an ion plating method, and a sputtering method), a chemical deposition method (e.g. thermal CVD method, a plasma CVD method, and an optical CVD method), and an ion beam sputtering method.

20 An entire thickness of the third coating layer 280 falls, for example, within a range of 50 nm to 300 nm, preferably within a range of 70 nm to 270 nm.

In addition, in the example illustrated in FIG. 5, the third coating film 280 has a three layer structure.
25 In the second configuration, the number of layers of the third coating film 280 is not particularly limited.

For example, the third coating film 280 may have a repeating structure of a dielectric layer and a metal layer. In this case, the third coating film 280 has a
30 structure of a first dielectric layer, a first metal layer, a second dielectric layer, a second metal layer, a third dielectric layer, and the like, from a side close to the glass plate 210. Particularly, the number of repetitions

is preferably two. When the functional layer 283 is configured of silver or a material mainly including a silver alloy and the number of repetitions is two, a functional layer in a lower layer is preferably thicker than a functional layer in an upper layer. Specifically, a ratio of a thickness of the upper layer to the lower layer is preferably 0.4 to 0.8. By setting the ratio within this region, it becomes possible to set a color tone preferable. Moreover, when the upper layer is thicker than the lower layer, it becomes possible to set a color tone more preferable also by setting the thickness of the lower layer to less than 10 nm, and by setting the ratio of thickness of the upper layer to the lower layer to 2.5 or more.

(Third configuration example)

FIG. 6 schematically depicts an example of a third configuration of a third coating film.

As illustrated in FIG. 6, in this configuration, the third coating film 280A includes seven layers, i.e. a first dielectric layer 282A, a first functional layer 283A, a first barrier layer 284A, a second dielectric layer 285A, a second functional layer 286A, a second barrier layer 287A, and a third dielectric layer 288A.

Among the layers, for the dielectric layers 282A, 285A, and 288A, and the functional layers 283A and 286A, the description related to the second configuration of the third coating film 280, illustrated in FIG. 5, can be referred. Therefore, detailed description of these layers will be omitted.

The first barrier layer 284A and the second barrier layer 287A are arranged upon depositing the second dielectric layer 285A and the third dielectric layer 288A in order to control oxidation of the first functional

layer 283A and the second functional layer 286A, respectively.

A configuration material of the first barrier layer 284A is not particularly limited as long as the
5 above-described roles are exerted. The first barrier layer 284A may include, for example, titanium, a zinc-aluminum alloy, a nickel chromium alloy, or oxides thereof. Particularly, the first barrier layer 284A is preferably configured of a material mainly including titanium, or
10 titanium oxide.

The first barrier layer 284A may include a configuration element other than titanium. The configuration element other than titanium includes, for example, niobium, tantalum, zirconium, silicon, tungsten,
15 and molybdenum. One element of these elements or two or more elements of these elements may be included. Titanium, niobium, tantalum, tungsten and molybdenum may be included in the barrier layer as, for example, TiO_x ($x < 2$), Nb_2O_x ($x < 5$), Ta_2O_x ($x < 5$), ZrO_x ($x < 2$), SiO_x ($x < 2$), WO_x ($x < 3$), MoO_x ($x < 3$), or a compound of them.
20

A thickness of the first barrier layer 284A is preferably 1 nm or more. When the thickness of the first barrier layer 284A is 1 nm or more, the first functional layer 283A is prevented from oxidizing effectively.

25 A thickness of the first barrier layer 284A is, for example, 10 nm or less. With such a thickness, a visible light transmittance T_v (%) of the laminated glass can be enhanced.

The same applies to the second barrier layer
30 287A as the first barrier layer 284A.

In the example illustrated in FIG. 6, the third coating film 280A has a seven layer structure. In the third configuration, the number of layers of the third

coating film 280A is not limited to this.

For example, in the third coating film 280A, among the layers illustrated in FIG. 6, a part from the second functional layer 286 to the third dielectric layer 288A may be omitted. Alternatively, the third coating film 280A may include a structure in which a part from the dielectric layer to the barrier layer is repeated three times or more.

It is obvious for a person skilled in the art that other various configurations can be assumed. Moreover, the above-described first to third coating films are not limited to be used only in the above-described forms, and can be used by properly changing within a range not deviating from the intent of the present invention. For example, in the above-described second laminated glass, on the fourth surface, the third coating film may be used instead of the second coating film. In the first laminated glass, on the first surface, the third coating film may be used instead of the first coating film.

20

EXAMPLE

Next, practical examples of the present invention will be described. Note that, in the following descriptions, Examples 1 to 5, Examples 11 to 18, Examples 51 to 58, and Examples 60 to 66 are practical examples. Examples 31 to 43 and Example 59 are comparative examples.

(Example 1)

According to the following method, a laminated glass was manufactured.

First, on one surface of the first glass plate, a first film was formed. For the first glass plate, a colored glass having a dimension of 300 mm (vertical) × 300 mm (horizontal) × 6 mm (thickness) (EverGreen

(trademark registered) by Pilkington Group Limited) was used.

The configuration of the first film was assumed to have a three layer structure, illustrated in FIG. 2.

5 The undercoat layer was a SiO_x layer (target thickness: 55 nm). The conductive oxide layer was a tin oxide layer in which antimony was doped (target thickness: 260 nm). The high refractive index layer was titanium oxide layer (target thickness: 40 nm).

10 These layers were formed by a thermal CVD method. For the deposition of the undercoat layer, a raw material gas, in which a silane (SiH_4) gas, a carbon dioxide (CO_2) gas, an ethylene (C_2H_4) gas were mixed, was used by attenuating with nitrogen. Mixture ratios (molar ratios)
15 of these raw material gases were about 6 for CO_2/SiH_4 and about 10 for $\text{C}_2\text{H}_4/\text{SiH}_4$. A temperature of the substrate upon deposition was about 650 °C.

For the deposition of the conductive oxide layer, a mixed gas, in which raw materials of mono butyl tin
20 chloride (MBTC), water, and antimony trichloride (SbCl_3) were evaporated, was used by attenuating with air. Mixture ratios (molar ratios) of these raw material gases were about 1.3 for $\text{H}_2\text{O}/\text{MBTC}$ and about 0.04 for $\text{SbCl}_3/\text{MBTC}$. A temperature of the substrate upon deposition was about
25 590 °C.

For the deposition of the titania layer, a mixed gas, in which raw materials of titanium tetra isopropoxide (TTIP) and MBTC were evaporated, was used by attenuating
30 with nitrogen. A mixture ratio (molar ratio) of these raw material gases was about 0.07 for MBTC/TTIP. A temperature of the substrate upon deposition was about 540 °C. After the deposition, the substrate was cut into pieces with a dimension of 70 mm (vertical) × 100 mm

(horizontal).

Next, a second glass plate with a surface, on which a second film was arranged, was prepared.

For the second glass plate, a glass plate
5 obtained by forming a second film with an online CVD method on a transparent float glass with a soda lime composition (Clear by Asahi Glass Company, Limited) and afterwards cutting into pieces with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 4 mm (thickness) was
10 used. The second film had a two layer structure with a SiO_x layer (undercoat layer) and a fluorine added tin oxide layer (conductive oxide layer), illustrated in FIG. 3.

A substrate temperature upon depositing the SiO_x
15 layer was about 670 °C. The fluorine added tin oxide layer was deposited with the substrate temperature of about 590 °C using a mixed gas, in which raw materials of MBTC, water, acetic acid trifluoride (TFA) were evaporated, by attenuating with air. Mixture ratios (molar ratios) of
20 these raw materials were about 6 for $\text{H}_2\text{O}/\text{MBTC}$ and about 0.3 for TFA/MBTC .

A thickness of the SiO_x layer was 55 nm (target value) and a thickness of a fluorine doped tin oxide layer was 320 nm (target value).

25 Two glass plates thus obtained were laminated via the intermediate film, and thereby a laminated body was configured. At this time, both the glass plates were arranged via the intermediate film so that a surface of the first glass plate, on which the first film was formed,
30 was the first outside and a surface of the second glass plate, on which the second film was formed, was the second outside. The fabrication of a laminated glass can be performed by temporarily bonding two glasses placed one on

top of the other and an intermediate film, and bonding by an autoclave. For a material of the intermediate film, typically polyvinyl butyral was used. In addition, ethylene-vinyl acetate copolymer may be used.

5 According to the above processes, the laminated glass (in the following, referred to as a laminated glass according to Example 1) was manufactured. In addition, in the laminated glass according to Example 1, a thickness of the intermediate film was 0.38 mm.

10 (Examples 2 to 5)

 Using the same method as Example 1, laminated glasses were manufactured. In Examples 2 to 5, for the first glass plate, a different type of glass (and thickness) from Example 1 was used. Moreover, in Examples 15 3 and 5, the thickness of the second glass plate was changed to 3.2 mm. In Example 5, the T_e value was less by 1% than that of Example 4, which was configured of the same glass plate as Example 5 and of the first coating film. However, this variation was within an extent of two 20 occurring factors: a variation in characteristic due to a variation in film thickness occurring in a sample surface, and a variation in measured values of a spectrophotometer.

 The laminated glasses thus obtained will be referred to as laminated glasses according to Examples 2 25 to 5, respectively.

 (Example 11)

 A laminated glass was manufactured using the same method as Example 1.

30 In Example 11, a first glass was arranged so that a surface of the first glass, on which a first film was formed, was adjacent to an intermediate film (in other words, on an inner side) upon laminating the first glass, the intermediate film and a second glass. The second

glass plate was arranged so that a surface, on which a second film was formed, was at the second outside.

The above-described configuration corresponds to the configuration of the second laminated glass 200,
5 illustrated in FIG. 4. Then, the first film will be referred to as a third film, here.

The laminated glass thus obtained will be referred to as a laminated glass according to Example 11.
(Examples 12 to 18)

10 Using the same method as Example 11, laminated glasses were manufactured. In Examples 12 to 18, for the first glass plate and/or the second glass plate, a different type of glass (and thickness) from Example 11 was used. The configuration of the second film and the
15 deposition condition for the second film were the same as the configuration of the second film and the deposition condition for the second film in Example 1. Moreover, in Examples 12 and 14, the thickness of the second glass plate was changed to 3.2 mm. In Example 14, the T_e value
20 was less by 1% than that of Example 15, which was configured of the same glass plate as Example 14 and of the first coating film. However, this variation was within an extent of two occurring factors: a variation in characteristic due to a variation in film thickness
25 occurring in a sample surface, and a variation in measured values of a spectrophotometer.

The laminated glasses thus obtained will be referred to as laminate glasses according to Examples 12 to 18, respectively.

30 TABLES 1 and 2, in the following, show the configurations of the laminated glasses according to Examples 1 to 5, and Examples 11 to 18 as a whole.

[TABLE 1]

Example	first glass plate	first coating film	third coating film	energy transmittance of first glass plate on which first or third coating film was laminated Te (%)	second glass plate	second coating film	emissivity of fourth surface
1	EverGreen (6 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	-	22	Clear (4 mm)	SiO _x layer + F doped tin oxide	0.14
2	Panasap Green (6 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	-	25	Clear (4 mm)	SiO _x layer + F doped tin oxide	0.14
3	Panasap Green (6 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	-	25	Clear (3.2 mm)	SiO _x layer + F doped tin oxide	0.14
4	Panasap Green (8 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	-	21	Clear (4 mm)	SiO _x layer + F doped tin oxide	0.14
5	Panasap Green (8 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	-	20	Clear (3.2 mm)	SiO _x layer + F doped tin oxide	0.14
11	EverGreen (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	22	Clear (4 mm)	SiO _x layer + F doped tin oxide	0.14
12	Panasap Green (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	25	Clear (3.2 mm)	SiO _x layer + F doped tin oxide	0.14

[TABLE 2]

5

Example	first glass plate	first coating film	third coating film	energy transmittance of first glass plate on which first or third coating film was laminated Te (%)	second glass plate	second coating film	emissivity of fourth surface
13	Panasap Green (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	25	Clear (4 mm)	SiO _x layer + F doped tin oxide	0.14

14	Panasap Green (8 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	20	Clear (3.2 mm)	SiO _x layer + F doped tin oxide	0.14
15	Panasap Green (8 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	21	Clear (4 mm)	SiO _x layer + F doped tin oxide	0.14
16	Clear (4 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	47	EverGreen (6 mm)	SiO _x layer + F doped tin oxide	0.14
17	Clear (4 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	47	Panasap Green (6 mm)	SiO _x layer + F doped tin oxide	0.14
18	Clear (4 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	47	Panasap Green (8 mm)	SiO _x layer + F doped tin oxide	0.14

(Example 31)

According to the following method, a laminated glass was manufactured.

5 First, on a surface of the first glass plate a first film was formed. For the first glass plate, a transparent float glass (Clear by Asahi Glass Company, Limited) was used.

10 The first film was set to have a single layer structure of a mixed oxide layer of titania and tin oxide. This layer was deposited using an online thermal decomposition spray method. Two types of raw materials, oxylen glycol titanate and dimethyl tin diacetate, and a solvent, dimethyl formamide, were mixed, atomized by
15 compressed air, and sprayed on a ribbon of float glass, and thereby an oxide layer was formed. A temperature of the substrate upon deposition was about 520 °C. A thickness of the mixed oxide layer was 45 nm (target value). After forming the film, the substrate was cut
20 into pieces with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 6 mm (thickness).

Next, the second glass plate with a second film arranged on one surface was prepared.

For the second glass plate, a glass plate

obtained by forming the second film using an online CVD method on a transparent float glass with a soda lime composition (Clear by Asahi Glass Company, Limited) and afterwards cutting into pieces with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 6 mm (thickness) was used. The configuration and the deposition condition for the second film were the same as the configuration and the deposition condition for the second film in Example 1.

Two glass plates thus obtained were laminated via the intermediate film, and thereby a laminated body was configured. At this time, both the glass plates were arranged via the intermediate film so that a surface of the first glass plate, on which the first film was formed, was at the first outside and a surface of the second glass plate, on which the second film was formed, was at the second outside.

In the subsequent processes, in the same way as Example 1, both the glass plates were bonded to each other.

According to the above-described processes, the laminated glass (in the following, referred to as a laminated glass according to Example 31) was manufactured. (Examples 32 to 35)

Laminated glasses were manufactured using the same method as the case of Example 31. In Examples 32 to 35, for the first glass plate, a different type of glass from Example 31 was used.

The laminated glasses thus obtained will be referred to as laminated glasses according to Examples 32 to 35, respectively. (Examples 36 and 37)

Using the same method as Example 31, a laminated glass was manufactured. In Examples 36 and 37, for the first glass plate, a different type of glass from Example

31 was used. Moreover, the first film was a mixed oxide layer of iron, chromium and cobalt formed using a spray method. The film was deposited using an online thermal decomposition spray method. An acetylacetonate of three
5 types of raw materials, iron, chromium and cobalt was prepared and dissolved in a solvent, dimethyl formamide. The solution thus obtained was atomized by compressed air, and sprayed on a ribbon of float glass, and thereby an oxide layer was formed. A thickness of the oxide layer
10 was 40 nm (target value).

The laminated glasses thus obtained will be referred to as laminated glasses according to Examples 36 and 37, respectively.

(Example 38)

15 Using the same method as Example 31, a laminated glass was manufactured.

In Example 38, the first film had a two layer structure with a SiO_x layer and a conductive tin oxide. A target thickness of the SiO_x layer was 55 nm. Moreover,
20 the conductive tin oxide was an antimony doped tin oxide layer, and a target thickness was 320 nm.

Moreover, in Example 38, the first glass was arranged so that a surface of the first glass, on which a first film was formed, was adjacent to an intermediate
25 film (i.e. on an inner side) upon laminating the first glass, the intermediate film and a second glass. The second glass plate was arranged so that a surface, on which a second film was formed, was at the second outside.

The above-described configuration corresponds to
30 the configuration of the second laminated glass 200, as illustrated in FIG. 4. The first film will be referred to as a third film, here.

The laminated glass thus obtained will be

referred to as a laminated glass according to Example 38.

(Examples 39 to 41)

Using the same method as Example 38, a laminated glass was manufactured. In Examples 39 to 41, for the
5 first glass plate, a different type of glass from Example 38 was used.

The laminated glasses thus obtained will be referred to as laminated glasses according to Examples 39 to 41, respectively.

10 (Example 42)

Using the same method as Example 31, a laminated glass was manufactured.

In Example 42, the first film of the first glass plate had a two layer structure with a SiO_x layer and a
15 conductive tin oxide. A target thickness of the SiO_x layer was 55 nm. Moreover, the conductive tin oxide was an antimony doped tin oxide layer, and a target thickness was 320 nm.

Afterwards, through the same processes as
20 Example 31, the first glass plate was bonded to the second glass plate in which a second film was arranged. According to the above-described processes, the laminated glass (in the following, referred to as a laminated glass according to Example 42).

25 (Example 43)

Using the same method as Example 31, a laminated glass was manufactured.

In Example 43, the first film had a three layer structure, in the same way as in Example 1, illustrated in
30 FIG. 2.

Afterwards, through the same processes as Example 31, the first glass plate was bonded to the second glass plate in which a second film was arranged.

According to the above-described processes, the laminated glass (in the following, referred to as a laminated glass according to Example 43).

5 TABLES 3 and 4, in the following, show the configurations of the laminated glasses according to Examples 31 to 43 as a whole.

[TABLE 3]

Examp le	first glass plate	first coating film	third coating film	energy transmittance of first glass plate on which first or third coating film was laminated Te (%)	second glass plate	second coating film	emissivity of fourth surface
31	Clear (6 mm)	mixed film of titania + tin oxide (spray method) (45nm)	-	67	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
32	Panasap Green (6 mm)	mixed film of titania + tin oxide (spray method) (45nm)	-	31	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
33	Panasap BlueGreen (6 mm)	mixed film of titania + tin oxide (spray method) (45nm)	-	25	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
34	Panasap Dark Blue (6 mm)	mixed film of titania + tin oxide (spray method) (45nm)	-	34	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
35	Panasap Euro Gray (6 mm)	mixed film of titania + tin oxide (spray method) (45nm)	-	39	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
36	Panasap Green (6 mm)	mixed oxide of Fe, Co and Cr (spray method) (40 nm)	-	21	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
37	Panasap Dark Blue (6 mm)	mixed oxide of Fe, Co and Cr (spray method) (40 nm)	-	23	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14

10

[TABLE 4]

Examp le	first glass plate	first coating film	third coating film	energy transmittance of first glass plate on which first or third coating film was laminated Te (%)	second glass plate	second coating film	emissivity of fourth surface
38	Clear (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide	51	Clear (6 mm)	SiO _x layer + F doped	0.14

			layer (320 nm)			tin oxide	
39	Panasap Green (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (320 nm)	27	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
40	Panasap BlueGreen (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (320 nm)	25	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
41	Panasap EuroGray (6 mm)	-	SiO _x layer (55nm) + Sb doped tin oxide layer (320 nm)	28	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
42	Clear (6 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (320 nm)	-	51	Clear (6 mm)	SiO _x layer + F doped tin oxide	0.14
43	Panasap Green (6 mm)	SiO _x layer (55nm) + Sb doped tin oxide layer (260 nm) + titania layer (40 nm)	-	25	Clear (6 mm)	-	0.84

(Examples 51 to 58)

Next, a laminated glass with a third film having a seven layer structure, illustrated in FIG. 6, was

5 manufactured (Examples 51 to 58). Moreover, a laminated glass with a third film having a ten layer structure was manufactured (Example 59). Furthermore, a laminated glass with a third film having an eight layer structure was manufactured (Examples 60 to 63).

10 Among the above-described laminated glasses, the laminated glass with the third film having a seven layer structure (Examples 51 to 54) was manufactured as follows.

First, a third film was formed on one surface of the first glass plate. For the first glass plate, a
15 transparent float glass (Clear by Asahi Glass Company, Limited) with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 4 mm (thickness) was used. Respective layers configuring the third film were formed continuously using an inline type sputtering device.

20 The first, second and third dielectric layers were aluminum doped zinc oxide layers (AZO layers). Upon deposition, an aluminum-zinc alloy target to which aluminum of 2 wt% was added was used, and as a discharge

gas, carbon dioxide of 100 sccm was introduced. At this time, a deposition pressure was 0.35 Pa.

5 The first and second functional layers were palladium added silver layers (AgPd layers). Upon deposition, a silver-palladium alloy target to which palladium of 1 wt% was added was used, and as a discharge gas, argon of 50 sccm was introduced. At this time, a deposition pressure was 0.14 Pa.

10 The first and second barrier layers were titanium layers. Upon depositing the titanium layers, a titanium target was used, and as a discharge gas, argon of 100 sccm was introduced. At this time, a deposition pressure was 0.25 Pa.

15 For the second glass plate, a glass plate obtained by forming the second film using an online CVD method on a transparent float glass with a soda lime composition (Clear by Asahi Glass Company, Limited) and afterwards cutting into pieces with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 6 mm (thickness) was used. The configuration and the deposition condition for the second film were the same as the configuration and the deposition condition for the second film in Example 1. Afterwards, by the same process as in the case of Example 31, both glass plates were bonded to each other.

25 According to the above-described processes, the laminated glasses (in the following, referred to as laminated glasses according to Examples 51 to 54) were manufactured. Also in Examples 55 to 58, using the same method, laminated glasses were manufactured. In these examples,

30 the second film formed on the second glass was the same as the second film in Example 1, except that antimony was added to a tin oxide layer instead of fluorine.

(Examples 60 to 66)

First, on one surface of the first glass plate, a first film was formed. For the first glass plate, a transparent float glass (Clear by Asahi Glass Company, Limited) with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 6 mm (thickness) was used.

The configuration of the first film had a seven layer structure as illustrated in FIG. 6. The respective layers were formed continuously by using an inline type sputtering device.

For the first and second dielectric layers (AZO films), aluminum-zinc alloy targets, to which aluminum of 2 wt% was added, were used, and as a discharge gas, carbon dioxide of 100 sccm was introduced. At this time, a deposition pressure was 0.35 Pa.

The third dielectric layer (AZO film, SZO film) was a laminated layer of an AZO film, which was deposited by using an aluminum-zinc alloy target to which aluminum of 2 wt% had been added, and introducing carbon dioxide of 100 sccm as a discharge gas, and of an SZO film, which was deposited by using a tin-zinc alloy target including tin of 50 wt% and introducing as discharge gases argon and oxygen of 30 sccm and 70 sccm, respectively. A deposition pressure of the SZO film was 0.50 Pa.

For the first and second functional layers (AgPd films), silver-palladium alloy targets to which palladium of 1 wt% had been added were used, and as a discharge gas, argon of 50 sccm was introduced. At this time, a deposition pressure was 0.14 Pa.

The first and second barrier layers (Ti films, NiCr films), titanium targets or nickel-chromium alloy targets including nickel of 50 wt% were used, and as a discharge gas, argon of 100 sccm was introduced. At this time, a deposition pressure was 0.25 Pa.

For the second glass plate, a glass plate obtained by forming the second film using an online CVD method on a transparent float glass with a soda lime composition (Clear by Asahi Glass Company, Limited) and afterwards cutting into pieces with a dimension of 70 mm (vertical) × 100 mm (horizontal) × 4 mm (thickness) was used. The configuration and the deposition condition for the second film in Examples 60, 61 and 64 to 66 were the same as the configuration and the deposition condition for the second film in Examples 51 to 54. The configuration and the deposition condition for the second film in Examples 62 and 63 were the same as the configuration and the deposition condition for the second film in Examples 55 to 58.

Afterwards, by the same process as in the case of Examples 51 to 58, both glass plates were bonded to each other. According to the above-described processes, the laminated glasses (in the following, referred to as laminated glasses according to Examples 60 to 66) were manufactured. TABLES 5 and 6, in the following, show the configurations of the laminated glasses according to Examples 51 to 66 as a whole.

[TABLE 5]

Example	first glass plate	first coating film	third coating film	energy transmittance of first glass plate on which first or third coating film was laminated Te (%)	second glass plate	second coating film	emissivity of fourth surface
51	Clear (6 mm)	-	AZO(30nm)+AgPd(12nm)+Ti(3.5nm)+AZO(96nm)+AgPd(16.5nm)+Ti(6.5nm)+AZO(30nm)	21	Clear (6 mm)	SiO _x layer+F doped tin oxide	0.14
52	Clear (6 mm)	-	AZO(30nm)+AgPd(12nm)+Ti(4nm)+AZO(96nm)+AgPd(16.5nm)+Ti(9nm)+	18	Clear (6 mm)	SiO _x layer+F doped	0.14

	mm)		AZO(30nm)		mm)	tin oxide	
53	Clear (6 mm)	-	AZO(30nm)+AgPd(14nm)+Ti(3.5nm)+ AZO(98nm)+AgPd(23nm)+Ti(6.5nm)+ AZO(30nm)	15	Clear (6 mm)	SiO _x layer+ F doped tin oxide	0.14
54	Clear (6 mm)	-	AZO(30nm)+AgPd(12nm)+Ti(2nm)+ AZO(96nm)+AgPd(16nm)+Ti(2nm)+ AZO(30nm)	29	Clear (6 mm)	SiO _x layer+ F doped tin oxide	0.14
55	Clear (6 mm)	-	AZO(30nm)+AgPd(14nm)+Ti(2nm)+ AZO(97nm)+AgPd(16nm)+Ti(4nm)+ AZO(28nm)	24	Clear (6 mm)	SiO _x layer+ Sb doped tin oxide	0.25
56	Clear (6 mm)	-	AZO(30nm)+AgPd(13nm)+Ti(3nm)+ AZO(97nm)+AgPd(16nm)+Ti(6nm)+ AZO(28nm)	22	Clear (6 mm)	SiO _x layer+ Sb doped tin oxide	0.25
57	Clear (6 mm)	-	AZO(30nm)+AgPd(14nm)+Ti(2nm)+ AZO(97nm)+AgPd(24nm)+Ti(4nm)+ AZO(28nm)	17	Clear (6 mm)	SiO _x layer+ Sb doped tin oxide	0.25
58	Clear (6 mm)	-	AZO(30nm)+AgPd(12nm)+Ti(1nm)+ AZO(97nm)+AgPd(15nm)+Ti(1nm)+ AZO(28nm)	32	Clear (6 mm)	SiO _x layer+ Sb doped tin oxide	0.25
59	Clear (6 mm)	-	AZO(45nm)+AgPd(18nm)+Ti(2.5nm)+ AZO(76.5nm)+AgPd(11nm)+Ti(1nm)+ AZO(48nm)+AgPd(15nm)+Ti(1nm)+ AZO(27nm)	17	Clear (6 mm)		0.84

[TABLE 6]

Exa mple	first glass plate	first coating film	third coating film	energy transmittance of first glass plate on which first or third coating film was laminated Te (%)	second glass plate	second coating film	emissivity of fourth surface
60	Clear (3 mm)	-	AZO(25nm)+AgPd(12nm)+ Ti(3.5nm)+AZO(99nm)+ AgPd(14.9nm)+Ti(6.5nm)+ AZO(14nm)+SZO(14nm)	23	Clear (6 mm)	SiO _x layer+ F doped tin oxide	0.14
61	Clear (3 mm)	-	AZO(25nm)+AgPd(12nm)+ Ti(3.5nm)+AZO(99nm)+ AgPd(17.9nm)+Ti(6.5nm)+ AZO(14nm)+SZO(14nm)	20	Clear (6 mm)	SiO _x layer+ F doped tin oxide	0.14
62	Clear (3 mm)	-	AZO(29nm)+AgPd(8.4nm)+ NiCr(3nm)+AZO(91nm)+ AgPd(17nm)+NiCr(5nm)+ AZO(11nm)+SZO(17.5nm)	25	Clear (6 mm)	SiO _x layer+ Sb doped tin oxide	0.25
63	Clear (3 mm)	-	AZO(29nm)+AgPd(8.4nm)+ NiCr(3nm)+AZO(92nm)+ AgPd(17nm)+NiCr(5nm)+ AZO(11nm)+SZO(17.5nm)	25	Clear (6 mm)	SiO _x layer+ Sb doped tin oxide	0.25
64	Clear (6 mm)	-	SZO(20nm)+AgPd(15.8nm)+ Ti(3.4nm)+AZO(5nm)+SZO(71nm)+ AZO(5nm)+AgPd(8.5nm)+Ti(1.5nm)+	21	Clear (4 mm)	SiO _x layer+ F doped tin oxide	0.18

			AZO(6nm)+SZO(10nm)+TiO ₂ (1nm)				
65	Clear (6 mm)	-	SZO(25nm)+AZO(16nm)+ AgPd(6.7nm)+Ti(2.2nm)+AZO(6nm)+ SZO(67nm)+AZO(6nm)+ AgPd(17.6nm)+Ti(3.5nm)+ AZO(10nm)+SZO(11nm)	19	Clear (4 mm)	SiO _x layer+ F doped tin oxide	0.18
66	Clear (6 mm)	-	SZO(25nm)+AZO(18nm)+ AgPd(3.8nm)+Ti(2nm)+AZO(6nm)+ SZO(65nm)+AZO(6nm)+ AgPd(17.5nm)+Ti(3nm)+AZO(6nm)+ SZO(15nm)	20	Clear (4 mm)	SiO _x layer+ F doped tin oxide	0.18

(Evaluation)

Using the respective laminated glasses,
manufactured according to the above-described processes,
5 the following evaluation was performed.

(Evaluation of optical characteristics)

A spectroscopic measurement was performed for
the respective laminated glasses using a spectrophotometer
U4100 by Hitachi, Ltd., and by a method in conformity with
10 ISO 9050:2003, a visible light reflectance R_{vout} (%), an
energy reflectance R_{eout} , a shielding coefficient SC, and a
visible light transmittance T_v (%) were calculated.

Note that the above-described measurements were
performed by emitting light from the first outside of each
15 laminated glass, i.e. from outside of the first glass
plate. Emissivity was measured using Emissometer by
Devices and Services Company, and calculated using a
conversion formula for measurements results that was
previously determined through an infrared spectrometer
20 FT/IR-420 by JASCO Corporation.

TABLE 7, in the following, shows a visible light
reflectance R_{vout} (%), an energy reflectance R_{eout} , a
shielding coefficient SC, and a visible light
transmittance T_v (%), obtained for each laminated glass as
25 a whole.

[TABLE 7]

Example	visible light reflectance $R_{v_{out}}$ (%)	energy reflectance $R_{e_{out}}$ (%)	shielding coefficient SC	visible light transmittance T_v (%)
1	25.7	19.3	0.29	31.9
2	26.3	19.4	0.31	33.9
3	27.1	20.7	0.30	33.4
4	26.1	19.3	0.29	31.0
5	29.1	21.8	0.28	31.7
11	8.1	6.2	0.30	29.0
12	8.0	6.0	0.32	31.7
13	10.0	7.1	0.34	37.8
14	8.8	6.0	0.32	34.0
15	9.7	7.0	0.32	37.3
16	11.9	11.1	0.32	35.2
17	12.1	11.3	0.34	37.5
18	11.8	11.1	0.32	34.3
31	36	27	0.56	56.0
32	35	26	0.37	45.0
33	35	25	0.34	39.0
34	34	25	0.33	36.0
35	34	26	0.36	26.0
36	34	27	0.29	27.0
37	34	27	0.26	21.0
38	9	55	0.55	62.0
39	7	40	0.40	51.0
40	7	39	0.39	44.0
41	5	39	0.39	31.0
42	11.84	10.4	0.53	47.9
43	25.6	18.9	0.49	37.0
51	19.2	31.1	0.28	34.8
52	19.5	31.3	0.26	30.5
53	28.2	37.7	0.22	27.1
54	19.3	31.2	0.34	46.1
55	19.4	33.7	0.29	34.9
56	19.4	32.1	0.28	30.8
57	26.8	39.1	0.23	26.9
58	18.9	30.9	0.34	43.4
59	16.5	40.3	0.30	35.6
60	22.5	35.7	0.29	35.7
61	25.7	37.8	0.26	32.7
62	16.4	26.7	0.30	32.1
63	17.1	26.8	0.30	32.1

64	22.7	35.9	0.29	36.6
65	15	24.4	0.29	30.2
66	18.7	22.9	0.31	30.4

FIG. 7 illustrates a graph in which a relation between the visible light transmittance T_v (%) and the shielding coefficient SC obtained for each laminated glass was plotted. Moreover, FIG. 8 illustrates a graph in which a relation between the visible light transmittance T_v (%) and the visible light reflectance $R_{v_{out}}$ (%) obtained for each laminated glass was plotted. Moreover, FIG. 9 illustrates a graph in which a relation between an energy transmittance T_e (%) of the first glass and the shielding coefficient SC obtained for each laminated glass was plotted. Furthermore, FIG. 10 illustrates a graph in which a relation between the energy reflectance $R_{e_{out}}$ (%) and the shielding coefficient SC obtained for each laminated glass was plotted.

Note that the results of measurement of the laminated glass according to Examples 31 to 32, 37 to 40, and 42 to 43 cannot be found in FIG. 7. This is because the results of measurement for the examples greatly depart from the range of the horizontal axis and the vertical axis illustrated in FIG. 7.

Moreover, the results of measurement of the laminated glass according to Examples 31, 38, 42 and 43 cannot be found in FIGs. 9 and 10. This is because the results of measurement for the examples greatly deviate from the range of the vertical axis illustrated in FIGs. 9 and 10.

From FIG. 7, in the case of the laminated glasses according to Examples 1 to 5, 11 to 18, and 51 to 66, it is found that all plotted points are included within the region "A" expressed by the shielding

coefficient $SC \leq 0.35$. Moreover, from FIG. 8, in the case of the laminated glasses according to Examples 1 to 5, 11 to 18 and 51 to 66, it is found that all plotted points are included within the region "B" expressed by the

5 visible light reflectance $R_{v_{out}} \leq 30\%$.

In each case of the laminated glasses according to Examples 31 to 43, it is found that plotted points are not included in both of the regions "A" and "B".

Accordingly, it is possible to say that the
10 laminated glasses according to Examples 1 to 5, 11 to 18, and 51 to 66 are provided with an excellent heat shielding property and the feature that a reflection from the first side is significantly controlled.

Moreover, it was found that in the laminated
15 glass according to Examples 1 to 5, 11 to 18 and 51 to 66, all plotted points satisfy the relation of visible light transmittance $T_v (\%) > 26\%$, and have sufficient transmittance characteristics.

From FIG. 9, in the case of the laminated
20 glasses according to Examples 1 to 5, 11 to 18 and 51 to 66, it is found that all plotted points are included in the region "C" indicated by the shielding coefficient $SC \leq 0.35$. These plotted points roughly have a tendency such that the shielding coefficient SC increases with the
25 increase of the energy transmittance T_e of the first glass. All of these plotted points are included in the region where the energy transmittance of the first glass $T_e < 50\%$. When the energy transmittance T_e is greater than in this region, the SC value is greater than 0.35. In the case of
30 the laminated glasses according to Examples 31 to 43, plotted points that are not included in the region can be found. The plotted points for Examples 33, 34, 36 and 37 are included in the region where the shielding coefficient

$SC \leq 0.35$, but are distributed in the region where the visible light reflectance $R_{v_{out}} > 30\%$, as illustrated in FIG. 8, and degrade design properties due to a noticeable glare.

5 From FIG. 10, in the case of the laminated glasses according to Examples 1 to 5, 11 to 18 and 51 to 66, it is found that all plotted points are included in the region "D" indicated by the shielding coefficient $SC \leq 0.35$. These plotted points roughly have a tendency that
10 the shielding coefficient SC decreases with the increase of the energy reflectance Re_{out} . All of these plotted points are included in the region where the energy reflectance of the first glass $Re_{out} \geq 4\%$. When the energy reflectance Re_{out} is less than in this region, the SC value
15 can be expected to be greater than 0.35. The plotted points for Examples 33, 34, 36 and 37 are included in the region where the shielding coefficient $SC \leq 0.35$, but are distributed in the region where the visible light reflectance $R_{v_{out}} > 30\%$, as illustrated in FIG. 8, and
20 degrade design properties due to a noticeable glare.

(Evaluation of reflection color)

Next, using the laminated glasses according to Examples 1 to 5, 11 to 18 and 51 to 66, evaluation of reflection color was implemented. Specifically, the
25 evaluation of reflection color was performed for reflected light when visible light is emitted from the first side of the laminated glass (i.e. the first glass plate side). Incident angles were set to be 5° and 55° . The reflected light was quantified by expressing reflected light
30 obtained in conformity with ISO 9050:2003 with CIE1976L*a*b* chromaticity coordinates.

TABLE 8, in the following, shows results of evaluation of reflection color obtained for the laminated glasses

according to Example 1 to 5, 11 to 18 and 60 to 66 as a whole.

[TABLE 8]

5

Example	reflection color incident at 5 degrees			reflection color incident at 55 degrees		
	L*	a*	b*	L*	a*	b*
1	57.8	-2.6	-2.8	58.0	-4.1	-4.9
2	58.3	-2.9	-2.2	58.2	-6.1	-4.4
3	59.1	-0.8	-3.3	58.4	-5.8	-5.7
4	58.1	-2.9	-2.1	58.1	-6.1	-4.4
5	60.9	-3.3	-4.4	58.3	-5.8	-5.7
11	34.2	-3.6	-2.7	40.6	-6.8	0.0
12	34.0	-3.4	-4.3	40.1	-7.8	-1.7
13	37.8	-4.8	-1.2	40.2	-7.8	-1.9
14	35.5	-6.5	-2.0	38.8	-7.7	-1.4
15	37.3	-5.2	-1.1	38.9	-7.7	-1.5
16	41.0	-3.8	-0.9	43.2	-6.1	-1.7
17	41.4	-3.7	-1.3	43.5	-6.4	-2.0
18	40.9	-3.7	-1.1	43.1	-6.4	-1.9
51	52.2	-19.8	-25.0	47.7	-3.3	-32.4
52	52.7	-20.2	-27.7	47.8	-2.0	-34.9
53	61.4	-29.9	-24.5	54.1	-8.3	-36.6
54	52.0	-19.7	-17.9	48.3	-6.6	-26.0
55	52.4	-19.0	-23.3	48.4	-1.9	-30.0
56	52.4	-19.4	-24.5	48.0	-3.2	-31.6
57	60.1	-26.7	-24.9	53.9	-2.6	-34.7
58	51.3	-18.5	-14.8	48.0	-8.8	-22.8
59	48.9	-11.0	-21.7	50.2	16.6	-20.7
60	55.6	-20.1	-20.6	50.7	-7.8	-29.8
61	58.8	-24.5	-20.9	52.6	-10.9	-32.5
62	48.4	-13.3	-20.8	46.0	-3.2	-25.5
63	49.4	-14.1	-19.9	46.6	-4.6	-25.2
64	55.0	-3.4	-7.0	56.0	2.6	-7.3
65	45.5	-4.1	-16.3	46.5	1.0	-15.9
66	51.7	-5.2	-0.9	52.8	-4.4	-4.4

As indicating in TABLE 8, it was found that for all laminated glasses except for Example 59, the reflection color exists in the third quadrant where both a* and b* are negative values. Moreover, absolute values

10

of a^* and b^* were sufficiently small. According to the above-described properties, the reflection colors of these laminated glasses exist in the region of light blue color to light green color.

5 With respect to the reflection color of such an area, because any awkward impression to the viewer would be small, rather tending to be of a preferable quality, it is possible to say that the laminated glasses are provided with an excellent design property.

10 In this way, in the case of the laminated glasses according to Examples 1 to 5, 11 to 18 and 51 to 66, it was confirmed that the possibility of degrading a design property of a laminated glass by reflection color is sufficiently low. Particularly, it was found that the
15 laminated glasses according to Examples 64 to 66 have more excellent color tone compared with other configurations. There is concern that because for the laminated glass according to Example 59 the color coordinate a^* is a positive value in reflection color for incident light at
20 55°, the reflection color may cause an awkward impression.

INDUSTRIAL APPLICABILITY

25 The laminated glass disclosed in the present application can be preferably applied to a window glass of a building or the like.

30 The present application is based on and claims the benefit of priority of Japanese Priority Applications No. 2015-107729 filed on May 27, 2015 and No. 2015-243501 filed on December 14, 2015, the entire contents of which are hereby incorporated by reference.

REFERENCE SIGNS LIST

100 first laminated glass

	101	first outside
	102	second outside
	110	first glass plate
	112	first surface
5	114	second surface
	120	second glass plate
	122	third surface
	124	fourth surface
	130	intermediate film
10	150	first coating film
	152	undercoat layer
	153	conductive oxide layer
	154	high refractive index layer
	170	second coating film
15	172	undercoat layer
	173	conductive oxide layer
	200	second laminated glass
	201	first outside
	202	second outside
20	210	first glass plate
	212	first surface
	214	second surface
	220	second glass plate
	222	third surface
25	224	fourth surface
	230	intermediate film
	270	second coating film
	280,280A	third coating film
	282,282A	first dielectric layer
30	283	functional layer
	283A	first functional layer
	284	second dielectric layer
	284A	first barrier layer

285A second dielectric layer

286A second functional layer

287A second barrier layer

288A third dielectric layer

WHAT IS CLAIMED IS:

[Claim 1] A laminated glass comprising a first glass
5 plate; and a second glass plate that is bonded to the
first glass plate via an intermediate film,
wherein the first glass plate has a first
surface and a second surface opposite to each other, the
second glass plate has a third surface and a fourth
10 surface opposite to each other, the first surface is
arranged farther from the intermediate film than the
second surface, and fourth surface is arranged farther
from the intermediate film than the third surface,
wherein a first coating film is arranged on the
15 first surface or the second surface,
wherein a second coating film is arranged on the
fourth surface,
wherein, from the first glass plate of the
laminated glass side, a visible light reflectance
20 represented as $R_{v_{out}}$ (%) that is measured in conformity
with ISO 9050:2003, a solar radiation heat reception rate
represented as a g-value, a visible light transmittance
represented as T_v (%), and a shielding coefficient
represented as SC that is obtained by formula (1)
25
$$SC = g\text{-value} / 0.88 \quad (\text{formula (1)})$$

satisfy $R_{v_{out}} \leq 30\%$, $T_v > 26\%$, and $SC \leq 0.35$, and
wherein when reflected light obtained, in
conformity with ISO 9050:2003, for light incident with
angles of 5 degrees and 55 degrees from the first glass
30 plate side is quantified by expressing with CIE1976L*a*b*
chromaticity coordinates, values of a^* and b^* are both 3
or less.

[Claim 2] The laminated glass according to claim 1,
wherein the shielding coefficient, SC, satisfies
 $SC \leq 0.33$.

5

[Claim 3] The laminated glass according to claim 1 or
2,

wherein the values of the chromaticity
10 coordinates a^* and b^* satisfy $a^* > -10$ and $b^* > -20$.

[Claim 4] The laminated glass according to any one of
claims 1 to 3,

15 wherein an energy transmittance, T_e , measured in
conformity with ISO 9050:2003 for laminated layers of the
first glass plate and the first coating film is 50% or
less, and the second coating film is a film with an
emissivity of 0.4 or less.

20

[Claim 5] The laminated glass according to any one of
claims 1 to 4,

25 wherein an energy reflectance, Re_{out} , measured in
conformity with ISO 9050:2003 from the first glass plate
of the laminated glass side satisfies $4\% \leq Re_{out}$.

[Claim 6] The laminated glass according to any one of
30 claims 1 to 5,

wherein after a perspiration resistance test in
conformity with ISO 12870 for three days, a number of
defects within a range of $1\text{ mm} \times 1\text{ mm}$ measured by

observing a surface of the second coating film with a microscope of 50 times magnification is 50 or less.

5 [Claim 7] The laminated glass according to any one of claims 1 to 6,
wherein at least any one of the first coating film and the second coating film includes a conductive tin oxide.

10

[Claim 8] The laminated glass according to any one of claims 1 to 7,
wherein at least any one of the first coating
15 film and the second coating film includes a nitride.

[Claim 9] The laminated glass according to any one of claims 1 to 8,
20 wherein at least any one of the first coating film and the second coating film includes silver.

[Claim 10] The laminated glass according to claim 7,
25 wherein the conductive tin oxide includes tin oxide doped with antimony (Sb).

[Claim 11] The laminated glass according to claim 7,
30 wherein the conductive tin oxide includes tin oxide doped with fluorine (F).

[Claim 12] The laminated glass according to any one of claims 7, 10 and 11,

5 wherein an undercoat is arranged between the conductive tin oxide and the first glass plate or between the conductive tin oxide and the second glass plate.

[Claim 13] The laminated glass according to claim 12, wherein the undercoat is a multi-layered film.

10

[Claim 14] A laminated glass comprising a first glass plate; and a second glass plate that is bonded to the first glass plate via an intermediate film,

15 wherein the first glass plate has a first surface and a second surface opposite to each other, the second glass plate has a third surface and a fourth surface opposite to each other, the first surface is arranged farther from the intermediate film than the second surface, and the fourth surface is arranged farther from the intermediate film than the third surface,

20

wherein a first coating film is arranged on the second surface,

25 wherein a second coating film is arranged on the fourth surface,

wherein the first coating film includes two layers mainly including silver or a silver alloy, and

30 wherein the layer of the two layers that is closer to the second surface is thicker than the other layer.

[Claim 15] The laminated glass according to claim 14,

wherein a ratio of a thickness of the other layer to the thickness of the layer closer to the second surface falls within a range of 0.4 to 0.8.

5

[Claim 16] A laminated glass comprising a first glass plate; and a second glass plate that is bonded to the first glass plate via an intermediate film,

10 wherein the first glass plate has a first surface and a second surface opposite to each other, the second glass plate has a third surface and a fourth surface opposite to each other, the first surface is arranged farther from the intermediate film than the second surface, and the fourth surface is arranged farther
15 from the intermediate film than the third surface,

wherein a first coating film is arranged on the second surface,

wherein a second coating film is arranged on the fourth surface,

20 wherein the first coating film includes two layers mainly including silver or a silver alloy, and

wherein a thickness of the layer of the two layers closer to the second surface is less than 10 nm, and a ratio of a thickness of the other layer to the
25 thickness of the layer closer to the second surface is 2.5 or more.