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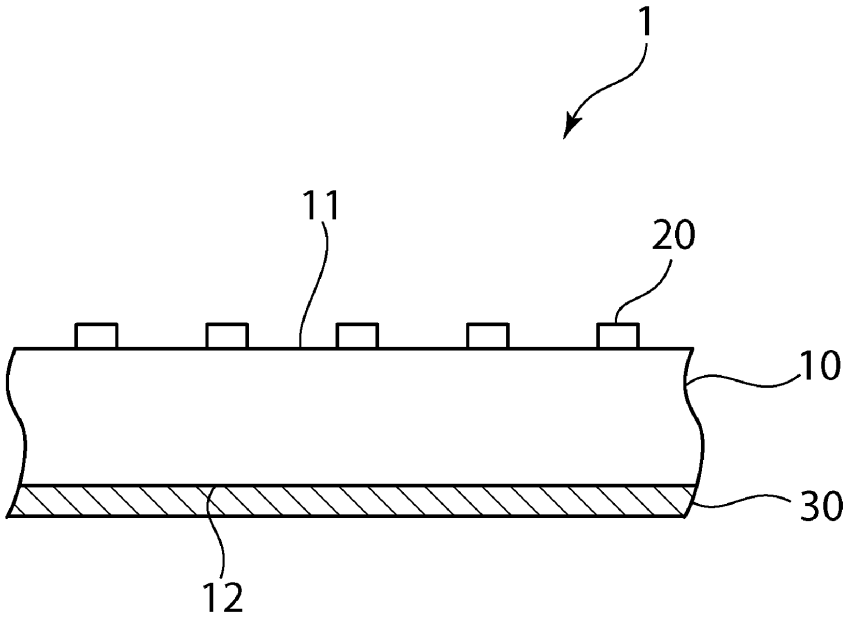
(54) TOP PLATE FOR COOKING DEVICE

(57) Provided is a top plate for a cooking device capable of preventing cooking water or the like from seeping into the coating film, having an excellent design, and capable of reducing the slip of cooking utensils. A top plate 1 for a cooking device includes: a glass substrate 10 that has a cooking surface 11 on which a cooking utensil is to be placed and a back surface 12 located on a side opposite to the cooking surface 11; and a first coating film 20 provided on the cooking surface 11 and having a pattern, the first coating film 20 being made only of glass.

[FIG. 1.]



EP 3 220 059 A1

Description

[Technical Field]

[0001] The present invention relates to top plates for cooking devices.

[Background Art]

[0002] A low-expansion crystallized glass plate has been conventionally used as a top plate for a cooking device, such as an electromagnetic cooking device, a radiant heater cooking device or a gas cooking device. Furthermore, a coating film is provided on a surface of the glass plate located on a cooking surface side for the purpose of preventing slip of cooking utensils thereon and preventing scrapes on the glass plate due to friction of cooking utensils thereagainst.

[0003] For example, the following Patent Literatures 1 to 3 disclose top plates for cooking devices in which a coating film, such as a printed layer or a decorated layer, is provided on a cooking surface of a plate formed of a low-expansion crystallized glass substrate. In Patent Literatures 1 to 3, the coating film is described as being made of glass and inorganic pigment. In addition, in Patent Literature 1, the coating film is described as being formed on the whole or part of the cooking surface of the top plate.

[Citation List]

[Patent Literature]

[0004]

[PTL 1]
JP-A-2003-168548
[PTL 2]
JP-A-2007-005318
[PTL 3]
JP-A-2014-037926

[Summary of Invention]

[Technical Problem]

[0005] However, the coating films disclosed in Patent Literatures 1 to 3 have a problem that, because of their low denseness, if cooking water or the like boils over, the cooking water or the like may seep into the coating films, so that the coating films get dirty. Furthermore, the coating films also have a problem that because the resistance at the friction of cooking utensils thereagainst is likely to become large, the coating films may suffer scrapes or may be peeled, resulting in impairment of the design of the top plate and failure to sufficiently reduce the slip of cooking utensils.

[0006] An object of the present invention is to provide a top plate for a cooking device capable of preventing cooking water or the like from seeping into the coating film, having an excellent design, and capable of reducing the slip of cooking utensils.

[Solution to Problem]

[0007] A top plate for a cooking device according to the present invention includes: a glass substrate that has a cooking surface on which a cooking utensil is to be placed and a back surface located on a side opposite to the cooking surface; and a first coating film provided on the cooking surface and having a pattern, the first coating film being made only of glass.

[0008] In the present invention, the pattern is a pattern having a portion where a film is formed and a portion where no film is formed. Examples of the pattern include, for example, dotted patterns, lattice patterns, geometric patterns, patchy patterns, irregular patterns, and linear patterns.

[0009] In the top plate for a cooking device according to the present invention, the glass substrate may be transparent. In this case, the top plate preferably further includes a second coating film provided on the back surface of the glass substrate.

[0010] In the top plate for a cooking device according to the present invention, the glass substrate may be a deeply colored crystallized glass plate.

[Advantageous Effects of Invention]

[0011] According to the present invention, a top plate for a cooking device can be provided which can prevent cooking water or the like from seeping into the coating film, has an excellent design, and can reduce the slip of cooking utensils.

[Brief Description of Drawings]

[0012]

[Fig. 1]
Fig. 1 is a schematic cross-sectional view showing a top plate for a cooking device according to one embodiment of the present invention.
[Fig. 2]
Fig. 2 is a schematic plan view showing a first coating film in the top plate for a cooking device according to the one embodiment of the present invention when viewed from a direction perpendicular to a cooking surface.
[Fig. 3]
Fig. 3 is a graph showing results of evaluation on smoothness of a first coating film of a top plate for a cooking device obtained in Example 1.
[Fig. 4]
Fig. 4 is a graph showing results of evaluation on smoothness of a first coating film of a top plate for a

cooking device obtained in Comparative Example 1.

[Description of Embodiments]

[0013] Hereinafter, a description will be given of a preferred embodiment. However, the following embodiment is merely illustrative and the present invention is not limited to the following embodiment. Throughout the drawings, members having substantially the same functions may be referred to by the same reference characters.

[0014] Fig. 1 is a schematic cross-sectional view showing a top plate for a cooking device according to one embodiment of the present invention. A top plate 1 for a cooking device includes a glass substrate 10. The glass substrate 10 has a cooking surface 11 and a back surface 12. The cooking surface 11 is a surface on which a cooking utensil, such as a pot or a frying pan, is to be placed. On the other hand, the back surface 12 is a surface located toward the inside of the cooking device.

[0015] Heating and cooling are repeatedly applied to the top plate 1 for a cooking device. Therefore, the glass substrate 10 preferably has excellent thermal resistance and a low coefficient of thermal expansion. Specifically, the softening point of the glass substrate 10 is preferably 700°C or more and more preferably 750°C or more. Furthermore, the average coefficient of linear thermal expansion of the glass substrate 10 at 30°C to 750°C is preferably within the range of -10×10^{-7}/°C to $+30\times10^{-7}$/°C and more preferably -10×10^{-7}/°C to $+20\times10^{-7}$/°C. Therefore, the glass substrate 10 is preferably a glass, a crystallized glass or a tempered glass that have a high glass transition temperature and a low coefficient of thermal expansion.

[0016] In this embodiment, the glass substrate 10 is made of a low-expansion crystallized glass. Specific examples of the low-expansion crystallized glass include a crystallized glass N-0 manufactured by Nippon Electric Glass Co., Ltd., for example. Although in this embodiment a transparent glass capable of transmitting light in the visible wavelength range is used as the glass substrate 10, the glass substrate 10 may be a low-expansion crystallized glass having a low light transmittance in the visible wavelength range as will be described later and examples thereof include crystallized glasses GC-190 and N-11 manufactured by Nippon Electric Glass Co., Ltd., for example.

[0017] A first coating film 20 is provided on the cooking surface 11 of the glass substrate 10. The first coating film 20 is a printed layer of a pattern having discrete portions. The first coating film 20 is a patterned layer for giving a design using a pattern. The provision of the first coating film 20 enables prevention of scrapes on the cooking surface 11 and reduction of the slip of cooking utensils thereon.

[0018] Fig. 2 is a schematic plan view showing the first coating film 20 in the top plate for a cooking device according to the one embodiment of the present invention when viewed from a direction perpendicular to the cooking surface. As shown in Fig. 2, in this embodiment, a dotted pattern is provided as the first coating film 20. However, in the present invention, any pattern other than dotted patterns may be used as the pattern. Examples of the patterns other than dotted patterns that can be used include, for example, lattice patterns, geometric patterns, patchy patterns, irregular patterns, and linear patterns.

[0019] When the shape of the first coating film 20 is approximately circular as viewed from the cooking surface 11 side, the size of the pattern of the first coating film 20 preferably has a diameter in the range of 0.5 to 5 mm. When the shape of the first coating film 20 is rectangular, each side of the coating film 20 preferably has a length in the range of 0.2 to 4 mm. Furthermore, when the shape of the first coating film 20 is a latticed shape or a linear shape, the lines constituting the lattice or the lines of the linear pattern preferably have a width in the range of 0.2 to 5.0 mm. For the other shapes, it is sufficient that they have an appropriate size to provide the same effects as the above shapes.

[0020] The first coating film 20 is made only of glass. The phrase "made only of glass" in the present invention means that it is made substantially only of glass. In other words, the first coating film 20 is substantially free of any inorganic pigment. Therefore, the first coating film 20 may contain any components other than any inorganic pigment so far as it can exert the effects of the present invention. Furthermore, it may contain a trace of inorganic pigment so far as it can exert the effects of the present invention.

[0021] As thus far described, since in this embodiment the first coating film 20 is made of glass powder and contains no inorganic pigment, the first coating film 20 is clear and colorless. Therefore, even if the first coating film 20 suffers scrapes, the scrapes are unnoticeable, so that the design is less likely to be impaired. Hence, the top plate 1 for a cooking device has an excellent design.

[0022] Furthermore, when the first coating film 20 is made only of glass, it becomes a dense film as compared with when an inorganic pigment is added thereto. Therefore, it is less likely that the top plate 1 for a cooking device gets dirty due to seeping of cooking water or the like thereinto.

[0023] Moreover, because the surface of the first coating film 20 is smooth as compared with the case where an inorganic pigment is added thereto, it can be prevented that the resistance becomes too large when a cooking utensil scrapes against the first coating film 20, thus preventing peeling of the coating film.

[0024] From the viewpoint of more effectively reducing dirt due to cooking water or the like, the arithmetic mean roughness (Ra) of the first coating film 20 is preferably not more than 1.0 μm and more preferably not more than 0.4 μm. Furthermore, the thickness of the first coating film 20 is preferably not more than 10 μm and more preferably not more than 6 μm.

[0025] On the other hand, from the viewpoint of more effectively reducing the slip of cooking utensils, the arith-

metic mean roughness (Ra) of the first coating film 20 is preferably not less than 0.07 μm and more preferably not less than 0.1 μm. Furthermore, the thickness of the first coating film 20 is preferably not less than 1 μm and more preferably not less than 1.5 μm.

[0026] Moreover, since the first coating film 20 is made only of glass, it has excellent adhesion to the glass substrate 10. Therefore, the first coating film 20 is less likely to be peeled due to friction of cooking utensils, such as pots. Hence, the provision of the first coating film 20 made only of glass enables effective reduction of slip of cooking utensils without impairing the design.

[0027] No particular limitation is placed on the type of the glass constituting the first coating film 20 but examples include borosilicate glasses, silicate glasses containing at least one of an alkali metal component and an alkaline earth metal component, and phosphate glasses containing zinc and aluminum.

[0028] The first coating film 20 can be formed, for example, by printing a paste containing glass powder, a vehicle (a solvent medium made of a binder, a solvent, and so on), and so on by various printing methods, such as screen printing or ink-jet printing. More specifically, the first coating film 20 is formed by firing a printed paste layer. The firing temperature is, but not necessarily limited to, preferably not less than 600°C and more preferably not less than 700°C. Furthermore, the firing temperature is preferably not more than 900°C and more preferably not more than 850°C.

[0029] In the present invention, the area of the first coating film 20 when viewed from the direction perpendicular to the cooking surface 11 is preferably within the range of 0.5 to 70%, more preferably 1 to 60%, and particularly preferably 1.5 to 50% of the entire area of the cooking surface. If the area of the first coating film 20 is too small, the slip of cooking utensils may not be able to be sufficiently reduced. If the area of the first coating film 20 is too large, a vitreous texture thereof may be likely to be impaired.

[0030] A second coating film 30 is provided on the back surface 12 of the glass substrate 10. The second coating film 30 is a light shielding film closely coated on the entire surface except for a region where a display is formed. Therefore, the provision of the second coating film 30 enables hiding of internal devices, such as a heater, located inside of the cooking device.

[0031] The second coating film 30 preferably contains a glass component and a pigment. The content of the glass component in the second coating film 30 is preferably 20 to 99% by mass and more preferably 30 to 95% by mass. Examples of the glass component that can be preferably used include borosilicate glasses, silicate glasses containing at least one of an alkali metal component and an alkaline earth metal component, and phosphate glasses containing zinc and aluminum.

[0032] The content of the pigment in the second coating film 30 is preferably 1 to 80% by mass and more preferably 5 to 70% by mass. An inorganic pigment is preferably used as the pigment. Examples of the inorganic pigment that can be used include white pigments, such as TiO_2, ZrO_2, and $ZrSiO_4$, Co-Al-Zn-based, Co-Al-Si-based, and Co-Al-Ti-based blue pigments, Co-Al-Cr-based and Co-Ni-Ti-Zn-based green pigments, Ti-Sb-Cr-based and Ti-Ni-based yellow pigments, Co-Si-based red pigments, Ti-Fe-Zn-based, Fe-Zn-based, Fe-Ni-Cr-based, and Zn-Fe-Cr-Al-based brown pigments, and Cu-Cr-based, Cu-Cr-Fe-based, and Cu-Cr-Mn-based black pigments.

[0033] The second coating film 30 can be formed, for example, by printing a paste containing glass powder, pigment powder, a vehicle, and so on by various printing methods, such as screen printing or ink-jet printing. More specifically, the second coating film 30 is formed by firing a printed paste layer. The firing temperature is, but not necessarily limited to, preferably not less than 600°C and more preferably not less than 700°C. Furthermore, the firing temperature is preferably not more than 900°C and more preferably not more than 850°C.

[0034] In the present invention, a metal film formed by sputtering or other processes may be provided as the second coating film, i.e., the light shielding film.

[0035] Note that in the present invention the second coating film, i.e., the light shielding film, may not be provided. In this case, it is preferred to use, as the glass substrate, a V_2O_5-containing Li_2O-Al_2O_3-SiO_2-based, deeply colored, crystallized glass plate or a β-spodumene-precipitated Li_2O-Al_2O_3-SiO_2-based crystallized glass plate. Thus, internal devices and so on located inside of the cooking device can be hidden even without providing any light shielding film.

[0036] As thus far described, since the top plate for a cooking device according to the present invention includes the first coating film made of glass, it has an excellent design and can reduce the slip of cooking utensils, such as pots. Therefore, the top plate can be suitably used for gas cooking devices, IH cooking devices, radiant heater-equipped cooking devices, and so on. In the case of gas cooking devices, a trivet or the like on which a cooking utensil is to be placed may be disposed on the top plate. According to the present invention, scrapes on and peeling of the coating film caused by friction of such a trivet or the like against the top plate can also be reduced.

[0037] Hereinafter, the present invention will be demonstrated by offering specific examples of the present invention. However, the present invention is not limited to the following examples.

(Example 1)

[0038] A paste prepared by uniformly mixing a B_2O_3-SiO_2-based glass frit and a vehicle to reach a mass ratio (glass frit to vehicle) of 57:43 was printed on a cooking surface of a glass substrate using screen printing and then fired at 830°C, thus producing a top plate for a cooking device in which a dot-patterned first coating film was

formed on the cooking surface of the glass substrate. The thickness of the first coating film was 3.5 μm.

(Comparative Example 1)

[0039] A paste prepared by uniformly mixing a TiO_2 pigment as a white pigment, a B_2O_3-SiO_2-based glass frit, and a vehicle to reach a mass ratio (TiO_2 pigment to glass frit to vehicle) of 17:40:43 was printed on a cooking surface of a glass substrate using screen printing and then fired at 830°C, thus producing a top plate for a cooking device in which a dot-patterned first coating film was formed on the cooking surface of the glass substrate. The thickness of the first coating film was 3.5 μm.

(Evaluation)

Evaluation on Denseness:

[0040] The denseness of the first coating films of the top plates for cooking devices obtained in Example 1 and Comparative Example 1 was evaluated by applying a water-based red ink on the surface of each coating film, allowing the ink to stand for five minutes, then wiping off the ink with a cloth, and visually observing whether or not the ink seeped into the coating film.

[0041] Whereas no seeping was observed on the coating film of Example 1 made only of glass, seeping was observed on the coating film of Comparative Example 1 made of glass and inorganic pigment. The coating film of Example 1 made only of glass was confirmed to be a dense film.

Evaluation on Smoothness:

[0042] The smoothness of the first coating films of the top plates for cooking devices obtained in Example 1 and Comparative Example 1 was evaluated using a stylus surface roughness measuring instrument (manufactured by Mitutoyo Corporation, product name: SJ-400).

[0043] Fig. 3 is a graph showing results of evaluation on smoothness of the first coating film of the top plate for a cooking device obtained in Example 1 and Fig. 4 is a graph showing results of evaluation on smoothness of the first coating film of the top plate for a cooking device obtained in Comparative Example 1. In Figs. 3 and 4, the ordinate axis represents the displacement (μm) of the first coating film along the thickness direction thereof and the abscissa axis represents the displacement (μm) of the first coating film along the surface direction thereof.

[0044] It was confirmed from Figs. 3 and 4 that the first coating film of Example 1 made only of glass had a smooth surface as compared with the first coating film of Comparative Example 1 made of glass and inorganic pigment.

Evaluation on Adhesion and Noticeability of Scrapes:

[0045] The first coating films of the top plates for cooking devices obtained in Example 1 and Comparative Example 1 were subjected to an abrasion resistance test. The abrasion resistance test was performed by applying 200-grit abrasive paper on a 1.3 kg weight and reciprocating the weight on the surface of each first coating film 1000 times. The adhesion between the first coating film and the glass substrate and the noticeability of scrapes made on the first coating film were evaluated by visually observing, after the abrasion resistance test, whether or not the first coating film was peeled and whether or not the surface of the first coating film was clouded.

[0046] The coating film of Example 1 made only of glass caused neither peeling nor clouding of the surface and had excellent adhesion and scrapes made thereon were unnoticeable. In contrast, peeling and surface clouding were observed on the coating film of Comparative Example 1 made of glass and inorganic pigment, the adhesion thereof was low as compared with the coating film of Example 1 made only of glass, and scrapes made thereon were noticeable.

[Reference Signs List]

[0047]

1... top plate for cooking device
10...glass substrate
11...cooking surface
12...back surface
20...first coating film
30...second coating film

Claims

1. A top plate for a cooking device comprising:

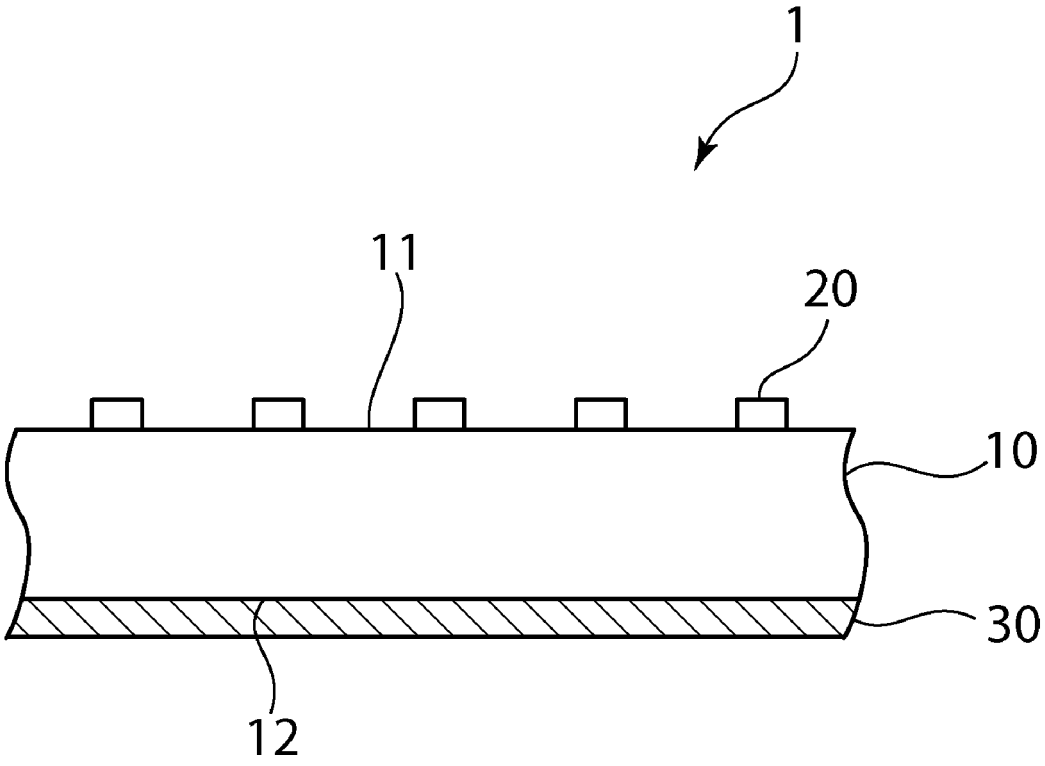
a glass substrate that has a cooking surface on which a cooking utensil is to be placed and a back surface located on a side opposite to the cooking surface; and
a first coating film provided on the cooking surface and having a pattern, the first coating film being made only of glass.

2. The top plate for a cooking device according to claim 1, wherein the pattern is a dotted, lattice or linear pattern.

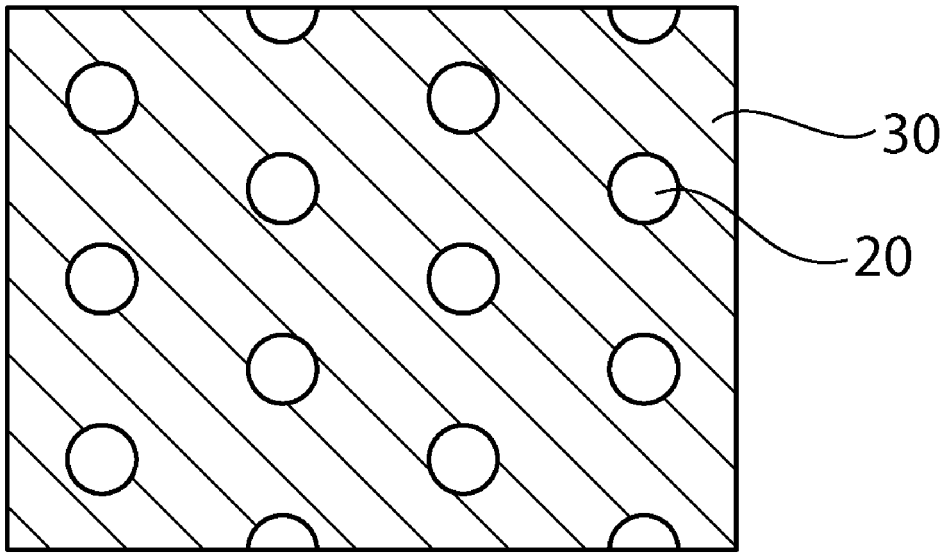
3. The top plate for a cooking device according to claim 1 or 2, wherein
the glass substrate is transparent, and
the top plate further comprises a second coating film provided on the back surface of the glass substrate.

4. The top plate for a cooking device according to claim 1 or 2, wherein the glass substrate is a deeply colored crystallized glass plate.

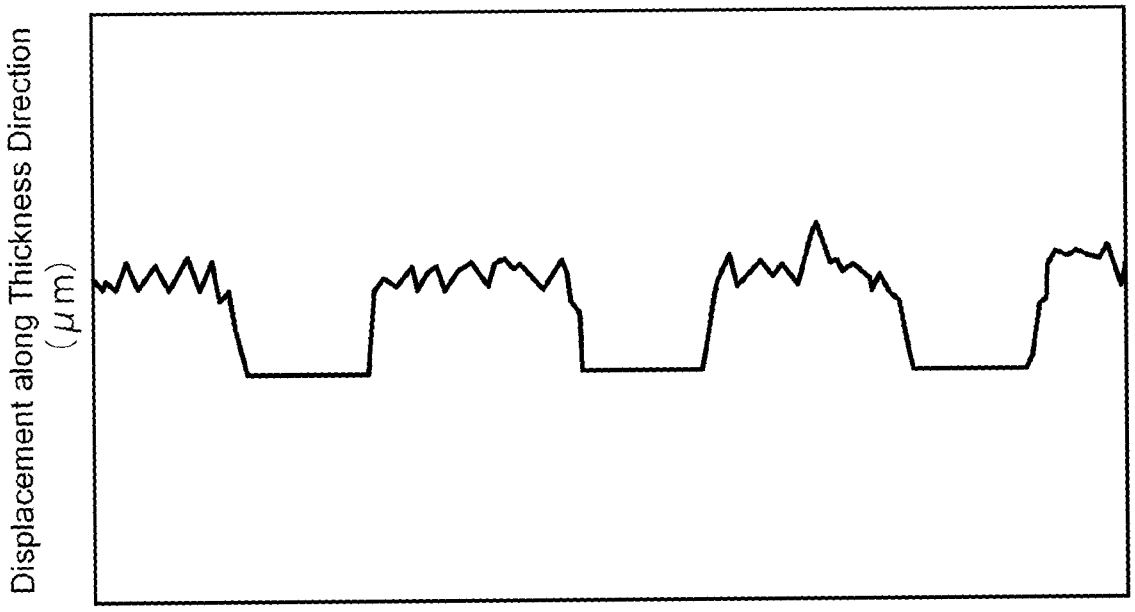
[FIG. 1.]



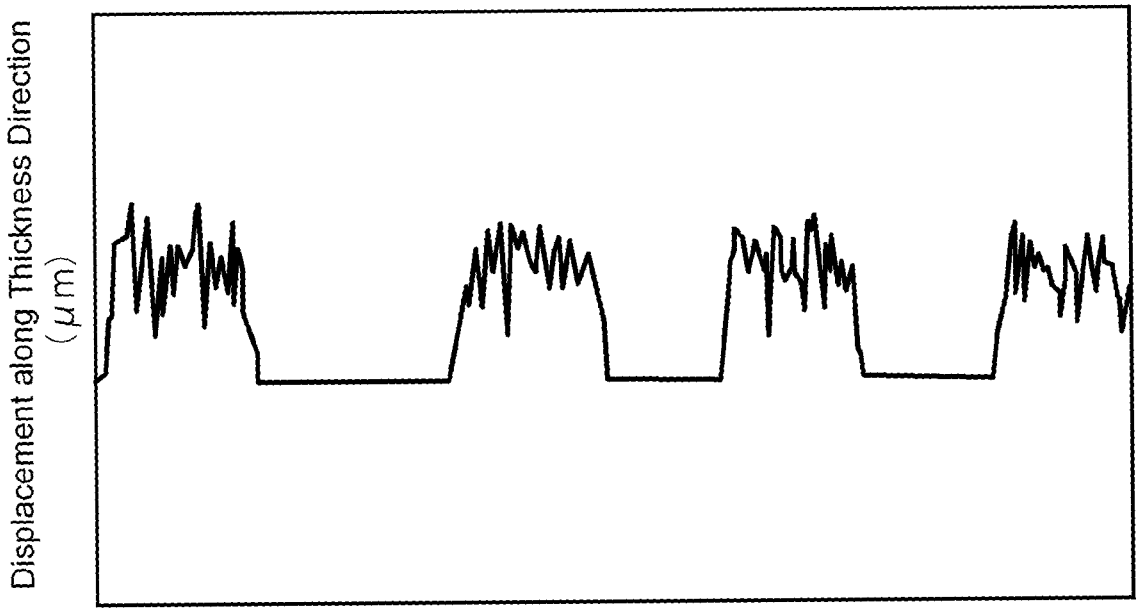
[FIG. 2.]



[FIG. 3.]


Displacement along Thickness Direction (μm)
Displacement along Surface Direction (μm)

[FIG. 4.]


Displacement along Thickness Direction (μm)
Displacement along Surface Direction (μm)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/072763

A. CLASSIFICATION OF SUBJECT MATTER
F24C15/10(2006.01)i, *H05B6/12*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24C15/10, H05B6/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2010-71515 A (Narumi China Corp.), 02 April 2010 (02.04.2010), entire text; all drawings (Family: none)	1-2 3-4
X Y	JP 2014-37926 A (Nippon Electric Glass Co., Ltd.), 27 February 2014 (27.02.2014), paragraphs [0019] to [0021]; fig. 1 to 2 (Family: none)	1-2 3-4
Y	JP 2005-276584 A (Sanka Kogyo Co., Ltd.), 06 October 2005 (06.10.2005), paragraphs [0022] to [0029]; fig. 3 (Family: none)	3

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 October 2015 (20.10.15)	02 November 2015 (02.11.15)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/072763

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2011-216457 A (Nippon Electric Glass Co., Ltd.), 27 October 2011 (27.10.2011), paragraphs [0003] to [0006] (Family: none)	4

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003168548 A **[0004]**
- JP 2007005318 A **[0004]**
- JP 2014037926 A **[0004]**