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(71) Applicant: **Nitto Boseki Co., Ltd.**

**Fukushima-shi  
Fukushima 960-8161 (JP)**

(72) Inventor: **NAKASHIMA Taichi**

**Fukushima-shi, Fukushima 960-8161 (JP)**

(74) Representative: **Schön, Christoph**

**Dr. Schön, Neymeyr & Partner mbB  
Bavariaring 26  
80336 München (DE)**

(54) **RESIN-COATED INORGANIC MULTIFILAMENT FIBER FABRIC AND WINDOW SHADE USING SAME**

(57) Provided are a resin-coated inorganic multifilament fiber fabric that enables to achieve an excellent heat insulation property and excellent view from indoors, while having sufficient hardness and high dimensional stability, and a window shade using the same. The resin-coated inorganic multifilament fiber fabric includes a first resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 80.0 to 100.0 as a warp, and a second resin-coated inorganic multifilament fiber yarn coated with a resin composition

having an L\* value of 10.0 to 40.0 as a weft, while being provided with a first surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 83.0 to 96.0%, and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 17.0 to 4.0%, and a second surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 4.0 to 17.0% and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 96.0 to 83.0%.

**EP 3 933 081 A1**

**Description**

## Technical Field

5 **[0001]** The present invention relates to a resin-coated inorganic multifilament fiber fabric and a window shade using the same.

## Background Art

10 **[0002]** Conventionally, it is known to use resin-coated inorganic multifilament fiber fabrics obtained by plain weaving yarns in which inorganic multifilament fibers (for example, glass fibers) are coated with resin compositions, as window shades (for example, see Patent Literature 1). For example, Patent Literature 1 describes the resin-coated inorganic multifilament fiber fabric enhancing a heat insulation property (in particular solar radiation reflectance) by comprising titanium dioxide particles in the resin composition, with which the inorganic multifilament fiber is coated.

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## Citation List

## Patent Literature

20 **[0003]** Patent Literature 1: Japanese Patent No. 5339015

## Summary of Invention

## Technical Problem

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**[0004]** On the other hand, especially in the summer, the window shade is required for a high solar radiation reflectance in order to prevent an indoor temperature from rising. Normally, when the solar radiation reflectance is high, the visible light reflectance also becomes high, and therefore, when a window shade having a high solar radiation reflectance is used, there may arise a problem of a view being impaired due to the influence of the high visible light reflectance when trying to see outside through the window shade from room.

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**[0005]** Furthermore, window shades comprising resin-coated inorganic multifilament fiber fabrics may be used as window shades for large-size windows by utilizing the high thermal stability of resin-coated inorganic multifilament fiber fabrics. In this case, the window shades are required to have sufficient hardness so that the window shades do not turn over even if a large amount of wind hits the large area thereof when opening the window. Moreover, although a large-size window shade becomes heavy, it is required for high dimensional stability in the vertical direction thereof so as not to be affected due to the large weight of the window shade itself.

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**[0006]** In view of the above circumstances, an object of the present invention is to provide a resin-coated inorganic multifilament fiber fabric that enables to achieve a window shade having an excellent heat insulation property and excellent view from indoors, while having sufficient hardness and high dimensional stability, and to provide the window shade having an excellent heat insulation property and excellent view from indoors, while having sufficient hardness and high dimensional stability.

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## Solution to Problem

45 **[0007]** In order to attain the above object, the present invention is characterized by a resin-coated inorganic multifilament fiber fabric, the resin-coated inorganic multifilament fiber fabric comprising a first resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 80.0 to 100.0 as a warp (weft), and a second resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 10.0 to 40.0 as a weft (warp), while being provided with a first surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 83.0 to 96.0%, and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 17.0 to 4.0%, and a second surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 4.0 to 17.0% and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 96.0 to 83.0%.

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55 **[0008]** The resin-coated inorganic multifilament fiber fabric of the present invention comprises a first resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 80.0 to 100.0 as a warp (weft), and a second resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 10.0 to 40.0 as a weft (warp). Here, the L\* value is brightness in the CIE1976 (L\*, a\*, b\*) color space, and means that the larger the L\* value is, the brighter it is, and the smaller the L\* value is, the darker it is.

5 [0009] Therefore, in the resin-coated inorganic multifilament fiber fabric of the present invention, a first surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 80.0 to 100.0, which is 83.0 to 96.0%, and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 10.0 to 40.0, which is 17.0 to 4.0%, is brighter than a second surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 4.0 to 17.0% and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 96.0 to 83.0%.

[0010] As a result, the resin-coated inorganic multifilament fiber fabric of the present invention can exhibit different brightness on both sides thereof and can be excellent in both the heat insulation property and the view from indoors.

10 [0011] Further, in the resin-coated inorganic multifilament fiber fabric of the present invention, at least either of the resin composition in the first resin-coated inorganic multifilament fiber yarn or the resin composition in the second resin-coated inorganic multifilament fiber yarn preferably comprises metal oxide particles having a volume-average particle diameter of 0.4 to 15.0  $\mu\text{m}$ . The resin-coated inorganic multifilament fiber fabric of the present invention can be provided with higher hardness and higher dimensional stability when at least one of the resin compositions comprises the metal oxide particles.

15 [0012] The window shade of the present invention, on the other hand, is characterized by comprising the resin-coated inorganic multifilament fiber fabric of the present invention.

[0013] In the window shade of the present invention, the first resin-coated inorganic multifilament fiber yarn or the second resin-coated inorganic multifilament fiber yarn, in which the resin composition comprises the metal oxide particles, is preferably arranged in a vertical direction of the window shade.

20 [0014] In the window shade of the present invention, when the first resin-coated inorganic multifilament fiber yarn or the second resin-coated inorganic multifilament fiber yarn, in which the resin composition comprises the metal oxide particles, is arranged in a vertical direction of the window shade, the window shade can exhibit higher hardness and higher dimensional stability in the vertical direction of thereof.

25 [0015] Moreover, the first surface of the window shade of the present invention is preferably arranged on the window side and the second surface thereof is preferably arranged on the indoor side.

30 [0016] The resin-coated inorganic multifilament fiber fabric of the present invention has the brighter first surface than the second surface as described above. Therefore, the window shade of the present invention comprising the resin-coated inorganic multifilament fiber fabric of the present invention can exhibit the excellent heat insulation property by increasing the solar radiation reflectance when the aforementioned brighter first surface side is arranged on the window side and achieve the excellent view by reducing the visible light reflectance when the darker second surface side is arranged on the indoor side.

#### Description of Embodiments

35 [0017] Next the embodiments of the present invention will be described in more detail below.

[0018] The resin-coated inorganic multifilament fiber fabric of the present embodiment comprises a first resin-coated inorganic multifilament fiber yarn coated with the resin composition having an L\* value of 80.0 to 100.0 as a warp (weft), and the second resin-coated inorganic multifilament fiber yarn coated with the resin composition having an L\* value of 10.0 to 40.0 as a weft (warp), while being provided with the first surface having the area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 83.0 to 96.0%, and the area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 17.0 to 4.0%, and a second surface having the area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 4.0 to 17.0% and the area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 96.0 to 83.0%.

40 [0019] The area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn or the second resin-coated inorganic multifilament fiber yarn can be approximately estimated from the weave structure diagram in which the ups and downs of the warp and weft are formed.

45 [0020] The inorganic multifilament fiber constituting the resin-coated inorganic multifilament fiber yarn includes a glass fiber, a carbon fiber, a silica fiber, an alumina fiber, etc., and the glass fiber is preferred. The glass composition of the glass fiber includes an E glass composition, a high strength and high elastic modulus glass composition, and a high elastic modulus and easily producible glass composition.

50 [0021] The E glass composition is a composition comprising  $\text{SiO}_2$  in the range of 52.0 to 56.0% by mass,  $\text{Al}_2\text{O}_3$  in the range of 12.0 to 16.0% by mass, MgO and CaO in the range of 20.0 to 25.0% by mass in total, and  $\text{B}_2\text{O}_3$  in the range of 5.0 to 10.0% by mass, in terms of oxide with respect to the total amount of glass fibers. Further, the high strength and high elastic modulus glass composition is a composition comprising  $\text{SiO}_2$  in the range of 64.0 to 66.0% by mass,  $\text{Al}_2\text{O}_3$  in the range 24.0 to 26.0 %by mass, and MgO in the range of 9.0 to 11.0% by mass, in terms of oxide with respect to the total amount of glass fibers. Further, the highly elastic and easily producible glass composition is a composition comprising  $\text{SiO}_2$  in the range of 57.0 to 60.0% by mass,  $\text{Al}_2\text{O}_3$  in the range of 17.5 to 20.0% by mass, MgO in the range of 8.5 to 12.0% by mass, CaO in the range of 10.0 to 13.0% by mass, and  $\text{B}_2\text{O}_3$  in the range of 0.5 to 1.5% by mass,

in terms of oxide with respect to the total amount of glass fibers, and a total amount of SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, MgO and CaO of the composition is 98.0% by mass or more.

**[0022]** The fiber diameter of the glass fiber (the average diameter of a filament, a plurality of which are bundled and constitute a glass fiber) is, for example, 3 to 15 μm, preferably 6 to 12 μm, and more preferably 7 to 9 μm. Moreover, the number of filaments bundled to form the glass fiber is, for example, 100 to 1,000, preferably 150 to 800, more preferably 200 to 500, and the yarn weight is, for example, 15 to 120 tex (g/km), preferably 20 to 90 tex, and more preferably 30 to 75 tex.

**[0023]** The inorganic multifilament fiber occupies, for example, 20.0 to 65.0% by mass, preferably 25.0 to 60.0% by mass, and more preferably 30.0 to 55.0% by mass of the total amount of the resin-coated inorganic multifilament fiber yarn.

**[0024]** The resin, with which the inorganic multifilament fiber is coated, includes polyvinyl chloride and acrylic-based resins (polyacrylic acid, polyacrylic acid ester, polymethacrylic acid, polymethacrylic acid ester, a copolymer comprising acrylic acid (ester) or methacrylic acid (ester)), non-halogenated vinyl polymers, polyurethanes, polyamides, thermoplastic polyolefins, thermoplastic olefin (TOP) elastomers, styrenebutadiene-based copolymers, styrene-ethylene-butylene-styrene-based styrene copolymers, polyesters, silicones, etc., with the polyvinyl chloride, acrylic-based resins, and thermoplastic polyolefin being preferred.

**[0025]** The resin composition may comprise a pigment or dye in the resin in order to adjust the L\* value. The pigment or dye (light color pigment or dye) that increases the L\* value of the resin composition includes titanium oxide, zinc oxide, and lithopone, etc., and the pigment or dye that lowers the L\* value (dark color pigment or dye) includes carbon black, titanium black, perylene black, etc.

**[0026]** In order to improve the processability and weather resistance of the resin composition, the resin composition can comprise, as additives, a plasticizer, a viscosity modifier, an ultraviolet absorber, a flame retardant, a lubricant, a heat stabilizer, a surfactant, a filler, etc.

**[0027]** For example, a resin composition having an L\* value of 80.0 to 100.0, includes, compositions of 20 to 50% of the resin, 1 to 30% of the light color pigment or dye, 45 to 75% of the resin composition composed of the additive, with respect to the total amount of the resin composition, and a resin composition having an L\* value of 10.0 to 40.0 includes compositions of 20 to 50% of the resin, 1 to 30% of the light color pigment or dye and 45 to 75% of the resin composition composed of the additive, with respect to the total amount of the resin composition.

**[0028]** The L\* value of the resin composition can be measured by the method described below using a resin composition solution, and the resin composition solution can be prepared by mixing the aforementioned resin, light color pigment or dye or dark color pigment or dye, the additive, and a solvent (for example, acetone, tetrahydrofuran, cyclohexane), if necessary, and it can also be prepared by immersing the resin-coated inorganic multifilament fiber yarn in a solvent (for example, acetone, tetrahydrofuran, cyclohexane) to elute a resin composition layer in the solvent.

**[0029]** The first (second) resin-coated inorganic multifilament fiber yarn may be provided with other coating layer between the inorganic multifilament fiber and the resin composition layer having an L\* value of 80.0 to 100.0 (10.0 to 40.0). The other coating layer includes a resin layer and a metal layer. The resin layer includes, for example, a vinyl chloride resin layer, a vinyl acetate resin layer, a vinyl chloride-vinyl acetate copolymer resin layer, etc. The metal layer includes, for example, an aluminum layer formed by vapor deposition. From the viewpoint of enhancing the bondability between the inorganic multifilament fiber and the resin composition layer having an L\* value of 80.0 to 100.0 (10.0 to 40.0), the other coating layer is preferably a resin layer, and more preferably a vinyl chloride-vinyl acetate copolymer resin layer.

**[0030]** Further, the ratio of the L\* value of the second resin-coated inorganic multifilament fiber yarn to the L\* value of the first resin-coated inorganic multifilament fiber yarn (L\* value of the second resin-coated inorganic multifilament fiber yarn/L\* value of the first resin-coated inorganic multifilament fiber yarn) is, for example, in the range of 0.15 to 0.40, preferably 0.18 to 0.35, and more preferably 0.20 to 0.30.

**[0031]** The resin-coated inorganic multifilament fiber fabric is woven by, for example, satin weave, and the warp weave density is, for example, 12 to 56 threads/25 mm, and the weft weave density is, for example, 12 to 56 threads/25 mm.

**[0032]** When the resin-coated inorganic multifilament fiber fabric is used as a window shade, and a passerby, etc., try to look at the room through the window shade from an oblique direction on the window side, the first resin-coated inorganic multifilament fiber yarn is preferably used as the warp, the direction of which corresponds to the vertical direction of the window shade because the light is efficiently reflected and blocked to contribute to improvement for protection of privacy.

**[0033]** The resin-coated inorganic multifilament fiber fabric has the area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of preferably 88.0 to 95.0% on the first surface, and the area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of preferably 12.0 to 5.0%. Further, the resin-coated inorganic multifilament fiber fabric has the area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of preferably 5.0 to 12.0% on the second surface, and the area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of preferably 95.0 to 88.0%. Each of the first surface or the second surface of the resin-coated inorganic multifilament fiber fabric was binarized by using an image analysis apparatus, and the area occupancy ratio can be determined by calculating the proportion of the area corresponding to the first resin-coated inorganic multifilament

fiber yarn with respect to the entire area of the yarns.

**[0034]** Further, in the resin-coated inorganic multifilament fiber fabric, at least either of the resin composition in the first resin-coated inorganic multifilament fiber yarn or the resin composition in the second resin-coated inorganic multifilament fiber yarn, comprises metal oxide particles having a volume-average particle diameter of 0.4 to 15.0  $\mu\text{m}$ . The metal oxide includes titanium dioxide, aluminum hydroxide, calcium carbonate, etc. The resin composition may comprise the metal oxide particles in an amount of, for example, 1.0 to 35.0% by mass, preferably 2.0 to 30.0% by mass, and more preferably 2.5 to 25.0% by mass, relative to the total amount.

**[0035]** When the resin-coated inorganic multifilament fiber fabric is used as a window shade, it can obtain higher hardness and higher dimensional stability in the vertical direction, and therefore, the resin composition in the resin-coated inorganic multifilament fiber yarn used as a warp, the direction of which corresponds to the vertical direction of the window shade, preferably comprises the metal oxide, among the first resin-coated inorganic multifilament fiber yarn or the second resin-coated inorganic multifilament fiber yarn.

**[0036]** The resin-coated inorganic multifilament fiber fabric of the present embodiment is preferably provided with a solar radiation reflectance of 50.0% or more on the first surface, a visible light reflectance of 30.0% or less on the second surface, 600.0 mN or more of a Gurley stiffness and softness, and an elongation of 4.0% or less. Further, the resin-coated inorganic multifilament fiber fabric is more preferably provided with a solar radiation reflectance of 51.0% or more on the first surface, a visible light reflectance of 25.0% or less on the second surface, 650.0 mN or more of a Gurley stiffness and softness, and an elongation of 3.7% or less. Further, the resin-coated inorganic multifilament fiber fabric is still more preferably provided with a solar radiation reflectance of 52.0% or more on the first surface, a visible light reflectance of 22.5% or less on the second surface, 700.0 mN or more of a Gurley stiffness and softness, and an elongation of 3.6% or less. Further, the resin-coated inorganic multifilament fiber fabric is most preferably provided with a solar radiation reflectance of 60.0% or more on the first surface, a visible light reflectance of 20.0% or less on the second surface, 720.0 mN or more of a Gurley stiffness and softness, and an elongation of 3.5% or less.

**[0037]** The window shade of the present embodiment comprises the resin-coated inorganic multifilament fiber fabric, and is provided with a size of, for example, 5 to 30 m in the vertical direction and 1 to 5 m in the horizontal direction. For the window shade, warp direction of the resin-coated inorganic multifilament fiber fabric is typically taken as the vertical direction.

**[0038]** In the window shade, the first resin-coated inorganic multifilament fiber yarn or the second resin-coated inorganic multifilament fiber yarn in which the resin composition comprises the metal oxide particles is arranged in the vertical direction of the window shade. Further, the first surface of the window shade is arranged on the window side and the second surface is arranged on the indoor side.

**[0039]** Next, Examples and Comparative Examples of the present invention will be described below.

#### Examples

##### [Example 1]

**[0040]** In the present Example, first, 400 glass filaments having an E glass composition with diameter of 7  $\mu\text{m}$  were bundled as an inorganic multifilament fiber yarn to prepare a glass fiber yarn having a mass of 45.0 tex. Next, the glass fiber yarn was continuously passed through a tank comprising a resin solution for pre-coating while being transported at a speed of 250 m/min to impregnate the glass fiber yarn with the resin solution for pre-coating. Here, the resin solution for pre-coating is a mixture of 160 parts by mass of acetone as a solvent and 45.7 parts by mass of a vinyl chloride-vinyl acetate copolymer resin (manufactured by Yamaichi Chemical Industry Co., Ltd., trade name: NTD40).

**[0041]** Next, the glass fiber yarn impregnated with the resin solution for pre-coating was passed through a die to squeeze liquid, and then heated at 300°C for 3 seconds to obtain a glass fiber yarn coated with a pre-coating layer.

**[0042]** Next, the glass fiber yarn coated with the pre-coating layer was continuously passed through the tank comprising a first resin composition solution, while being transported at a speed of 250 m/min, then passed through a die to squeeze the liquid followed by heated so that the mass was 129 tex to obtain a first resin-coated glass fiber yarn (corresponding to the first resin-coated inorganic multifilament fiber yarn) coated with the first resin composition on the pre-coating layer.

**[0043]** Here, as the first resin composition solution, a first resin composition ( $L^*$  value of 95.4) composed of 87.7% by mass of a vinyl chloride resin composition comprising a vinyl chloride resin (manufactured by Shin-Daiichi Vinyl Corporation, trade name: ZEST P21), a plasticizer, a surfactant, and a white pigment (manufactured by Nikko Bics Co., Ltd., trade name: 1005 white) and 12.3% by mass of titanium dioxide particles having a volume-average particle diameter of 1.0  $\mu\text{m}$  as metal oxide particles (manufactured by Tayca Corporation, trade name: JR-1000), was used. The white pigment contained metal oxide particles having a volume-average particle diameter of less than 0.4  $\mu\text{m}$ .

**[0044]** Next, the glass fiber yarn coated with the pre-coating layer was continuously passed through the tank comprising a second resin composition solution, while being transported at a speed of 250 m/min, then passed through a die to squeeze the liquid followed by heated so that the mass was 129 tex to obtain a second resin-coated glass fiber yarn

(corresponding to the second resin-coated inorganic multifilament fiber yarn) coated with the second resin composition on the precoating layer.

5 **[0045]** Here, as the second resin composition solution, a second resin composition ( $L^*$  value of 22.3) that is a vinyl chloride resin composition comprising a vinyl chloride resin (manufactured by Shin-Daiichi Vinyl Corporation, trade name: ZEST P21), a plasticizer, a surfactant, and a black pigment (manufactured by Nikko Bics Co., Ltd., trade name: 1075 Black). The black pigment contained metal oxide particles having a volume-average particle diameter of less than 0.4  $\mu\text{m}$ .

10 **[0046]** Next, with the first resin-coated glass fiber yarn used as a warp, the second resin-coated glass fiber yarn used as a weft, and the warp weave density of 56 threads/25 mm and the weft weave density of 42 threads/25 mm, weaving was carried out so that the area occupancy ratio of the first resin-coated glass fiber yarn and the area occupancy ratio of the second resin-coated glass fiber yarn were those shown in Table 1 to obtain the resin-coated glass fiber fabric of Example 1 (corresponding to the resin-coated inorganic multifilament fiber fabric).

**[0047]** It is noted that in the present Example, the  $L^*$  value of the resin composition and the area occupancy ratio of the resin-coated inorganic multifilament fiber yarn were measured as follows.

15 [Measurement method of  $L^*$  value of resin composition]

20 **[0048]** First, the resin composition solution was spread between spacers having a thickness of 0.7 mm, excess liquid was removed, and then it was heated at 180°C for 10 minutes to obtain a resin formed product having a film thickness of 0.7 mm. The obtained resin formed product was evaluated for the  $L^*$  value in the  $L^*a^*b^*$  color space by using a spectrophotometer SE6000 manufactured by Nippon Denshoku Industries Co., Ltd., which was used as the  $L^*$  value of the resin composition.

[Measurement method of area occupancy ratio of resin-coated inorganic multifilament fiber yarn]

25 **[0049]** First, one observation portion in one surface of the resin-coated inorganic multifilament fiber fabric was observed at 20 times magnification with a microscope (VHX-2000 manufactured by KEYENCE CORPORATION) while irradiating light from the back side of the surface and was treated with binarization processing to determine the area of the void portion as the area of the white portion. Next, the same portion was similarly observed while irradiating light from the front surface of the one surface, and binarization processing was carried out to determine the area of the first resin-coated inorganic multifilament fiber yarn as the area of the white portion. Next, the area of the second resin-coated inorganic multifilament fiber yarn was calculated from the area of the observation portion, the area of the void portion, and the area of the first resin-coated inorganic multifilament fiber yarn. Next, from the area of the first resin-coated inorganic multifilament fiber yarn and the area of the second resin-coated inorganic multifilament fiber yarn, an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn, in one observation portion were calculated.

30 **[0050]** For at least three observation portions per one surface of the resin-coated inorganic multifilament fiber fabric, area occupancy ratios of the first resin-coated inorganic multifilament fiber yarn and area occupancy ratios of the second resin-coated inorganic multifilament fiber yarn were calculated and then averaged to determine an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn on one surface of the resin-coated inorganic multifilament fiber fabric.

[Example 2]

45 **[0051]** In the present Example, a resin-coated glass fiber yarn fabric was obtained exactly in the same manner as in Example 1 except that a first resin composition ( $L^*$  value of 91.8) that was a vinyl chloride resin composition comprising a vinyl chloride resin (manufactured by Shin-Daiichi Vinyl Corporation, trade name: ZEST P21), a plasticizer, a surfactant, and a white pigment (manufactured by Nikko Bics Co., Ltd., trade name: 1005 white), was used as the first resin composition solution.

50 [Comparative Example 1]

55 **[0052]** In the present Comparative Example, a resin-coated glass fiber yarn fabric was obtained in exactly the same manner as in Example 2 except that weaving was carried out by a variation of twill weave so that the area occupancy ratio of the first resin-coated glass fiber yarn and the area occupancy ratio of the second resin-coated glass fiber yarn were those shown in Table 1.

[Comparative Example 2]

**[0053]** In the present Comparative Example, a resin-coated glass fiber yarn fabric was obtained in exactly the same manner as in Example 1 except that weaving was carried out by a variation of plain weave so that the warp weave density was 56 threads/25 mm and the weft weave density was 40 threads/25 mm, and the area occupancy ratio of the first resin-coated glass fiber yarn and the area occupancy ratio of the second resin-coated glass fiber yarn were those shown in Table 1.

[Comparative Example 3]

**[0054]** In the present Comparative Example, a resin-coated glass fiber yarn fabric was obtained exactly in the same manner as in Example 1 except that a second resin composition ( $L^*$  value of 66.1) that was a vinyl chloride resin composition comprising a vinyl chloride resin (manufactured by Shin-Daiichi Vinyl Corporation, trade name: ZEST P21), a plasticizer, a surfactant, and a grey pigment (manufactured by Nikko Bics Co., Ltd., trade name: TW-158 grey), was used as the second resin composition solution. The grey pigment contained metal oxide particles having a volume-average particle diameter of less than 0.4  $\mu\text{m}$ .

**[0055]** The infrared reflectance, visible light reflectance, Gurley stiffness and softness, and elongation were each measured for the resin-coated glass fiber yarn fabrics of Examples 1 and 2 and Comparative Examples 1 to 3 in the following manner. The results are shown in Table 1.

[Measurement method of infrared reflectance]

**[0056]** The surface of the resin-coated inorganic multifilament fiber fabric having the area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn that was higher than the area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn, was subjected to infrared reflectance measurement with a spectrophotometer (V-670 manufactured by JASCO Corporation) according to JIS-K-5602.

[Measurement method of visible light reflectance]

**[0057]** The surface of the resin-coated inorganic multifilament fiber fabric having the area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn that was higher than the area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn was subjected to visible light reflectance measurement with a spectrophotometer (V-670 manufactured by JASCO Corporation) according to JIS-R-3106.

[Measurement method of Gurley stiffness and softness]

**[0058]** A sample test piece of 25 mm  $\times$  38 mm was collected from the resin-coated inorganic multifilament fiber fabric so that the warp could be passed in the long side direction. Next, the Gurley stiffness and softness of the sample test piece was measured by using a Gurley stiffness tester (manufactured by Toyo Seiki Seisakusho Co., Ltd.) according to JIS L1096.

[Measurement method of elongation]

**[0059]** The elongation of the warp of the resin-coated inorganic multifilament fiber fabric was measured with a tensile tester (AG-50K manufactured by Shimadzu Corporation) according to JIS L 1096.

[Table 1]

		Examples		Comparative Examples		
		1	2	1	2	3
First resin-coated glass fiber yarn (warp)	$L^*$ value of resin composition 1 (LI)	95.4	91.8	91.8	95.4	95.4
	Presence or absence of metal oxide particle in resin composition 1	Presence	Absence	Absence	Presence	Presence

EP 3 933 081 A1

(continued)

		Examples		Comparative Examples			
		1	2	1	2	3	
5	Second resin-coated glass fiber yarn (weft)	L* value of resin composition 2 (L2)	22.3	22.3	22.3	22.3	66.1
10		Presence or absence of metal oxide particle in resin composition 2	Absence	Absence	Absence	Absence	Absence
L2/L1		0.23	0.24	0.24	0.23	0.69	
15	First surface	Area occupancy ratio of first resin-coated glass fiber yarn (%)	91.5	91.5	67.0	50.0	91.5
		Area occupancy ratio of second resin-coated glass fiber yarn (%)	8.5	8.5	33.0	50.0	8.5
20	Second surface	Area occupancy ratio of first resin-coated glass fiber yarn (%)	8.5	8.5	33.0	50.0	8.5
		Area occupancy ratio of second resin-coated glass fiber yarn (%)	91.5	91.5	67.0	50.0	91.5
25	Solar radiation reflectance (%)		63.7	52.8	42.9	51.3	75.3
Visible light reflectance (%)		18.5	16.7	30.4	54.3	39.0	
30	Gurley stiffness and softness (mN)		735.0	702.0	589.3	281.7	1053.5
Elongation (%)		3.4	3.4	4.3	5.4	3.4	

[0060] It is clear that the resin-coated glass fiber yarn fabrics of Examples 1 and 2 shown in Table 1 have the larger solar radiation reflectance than the resin-coated glass fiber yarn fabrics of Comparative Examples 1 to 3, while having the smaller visible light reflectance, excellent heat insulation property and excellent view from indoors, and further that the resin-coated glass fiber yarn fabrics of Examples 1 and 2 have the larger Gurley stiffness and softness than the resin-coated glass fiber yarn fabrics of Comparative Examples 1 to 3, while having the smaller elongation, more sufficient hardness and high dimensional stability.

**Claims**

1. A resin-coated inorganic multifilament fiber fabric, comprising a first resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 80.0 to 100.0 as a warp (weft), and a second resin-coated inorganic multifilament fiber yarn coated with a resin composition having an L\* value of 10.0 to 40.0 as a weft (warp), while being provided with a first surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 83.0 to 96.0%, and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 17.0 to 4.0%, and a second surface having an area occupancy ratio of the first resin-coated inorganic multifilament fiber yarn of 4.0 to 17.0% and an area occupancy ratio of the second resin-coated inorganic multifilament fiber yarn of 96.0 to 83.0%.
2. The resin-coated inorganic multifilament fiber fabric according to claim 1, wherein at least either a resin composition in the first resin-coated inorganic multifilament fiber yarn or a resin composition in the second resin-coated inorganic multifilament fiber yarn comprises metal oxide particles having a volume-average particle diameter of 0.4 to 15.0 μm.
3. A window shade comprising the resin-coated inorganic multifilament fiber fabric according to claim 1 or 2.

**EP 3 933 081 A1**

4. The window shade according to claim 3, wherein the first resin-coated inorganic multifilament fiber yarn or the second resin-coated inorganic multifilament fiber yarn, in which the resin composition comprises the metal oxide particles, is arranged in a vertical direction of the window shade.

5 5. The window shade according to claim 3 or 4, wherein the first surface is arranged on a window side and the second surface is arranged on an indoor side.

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/022825

A. CLASSIFICATION OF SUBJECT MATTER D03D 15/00 (2006.01) i; D03D 15/12 (2006.01) i; E06B 9/24 (2006.01) i FI: D03D15/00 102Z; D03D15/00 E; D03D15/12 A; E06B9/24 A		
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) D03D1/00-27/18; E06B9/24-9/50; A47H1/00-99/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Published examined utility model applications of Japan	1922-1996	
Published unexamined utility model applications of Japan	1971-2020	
Registered utility model specifications of Japan	1996-2020	
Published registered utility model applications of Japan	1994-2020	
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.
A	JP 2018-21272 A (UNIVERS CO., LTD.) 08.02.2018 (2018-02-08) claims	1-5
A	JP 47-29274 Y1 (TORAY INDUSTRIES, INC.) 01.09.1972 (1972-09-01) claims, examples	1-5
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<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
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"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 11 August 2020 (11.08.2020)	Date of mailing of the international search report 18 August 2020 (18.08.2020)	
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer  Telephone No.	

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No. PCT/JP2020/022825
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**REFERENCES CITED IN THE DESCRIPTION**

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