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(54) Title: COATED GLASS PANE

(57) Abstract: The invention relates to a coated glass pane with a solar control coating comprising in sequence at least the following transparent layers: a lower dielectric layer, a functional layer comprising at least one metal or metal compound, and an upper dielectric layer, the functional layer comprising at least one of tungsten, molybdenum, a tungsten-based alloy, a molybdenum-based alloy, their nitrides, carbides and/or borides.

Coated glass pane

The invention relates to coated glass panes with a solar control coating and more specifically to heat treatable coated glass panes with a solar control coating.

Solar control coatings typically comprise a functional layer consisting of at least one metal or metal compound, the thickness and material of it being chosen to impart to the coated glass pane a reduced visible light and solar energy transmittance, such reduction taking place partially by absorption and partially by reflection. Typical materials for functional layers of solar control coatings are metals like Ni, Cr, Ti, Zr, Ta, Hf, Nb and their alloys, e.g. stainless steel or NiCr, furthermore certain compounds of these, e.g. their nitrides, borides and/or carbides. The total solar energy transmittance (usually given as TSHT or g value and comprising both the energy transfer by direct transmission and by re-radiation) of such solar control coated glass panes is typically slightly higher than, equal to or slightly lower than their light transmittance T_L .

The functional layers of such solar control coatings are usually embedded between a lower dielectric layer, arranged close to the glass surface, and an upper dielectric layer above the functional layer, one or both providing one or more of the functions:

- anti-reflection of the functional layer by optical interference;
- influencing the growth of the functional layer;
- mechanical and chemical protection to improve, e.g., the corrosion and scratch resistance of the coating;
- barrier against diffusion of gases like oxygen or nitrogen, of components of the glass substrate and/or of components of the coating layers;
- stabilisation of the functional layer during heat treatments, etc.

Such dielectric layers are often comprised only of a single layer but may alternatively comprise several partial layers and/or mixtures of mainly dielectric materials which may however be supplemented by low amounts and/or thin layers of other materials including metals.

Heat treated glass panes which are toughened to impart safety properties and/or are bent are required for a large number of areas of application, for example for architectural or motor vehicle glazings. It is known that for thermally toughening and/or bending glass panes it is

necessary to process the glass panes by a heat treatment at temperatures near or above the softening point of the glass used and then either to toughen them by rapid cooling or to bend them with the aid of bending means. The relevant temperature range is for standard float glass of the soda lime silica type typically about 590 – 690 °C, the glass panes being kept in this
5 temperature range for several minutes before initiating the actual toughening and/or bending process.

“Heat treatment”, “heat treated” and “heat treatable” in the following description and in the claims refers to thermal bending and/or toughening processes such as mentioned before.

Difficulties can arise if these glass panes are to be provided with coatings, particularly with
10 coatings comprising at least one metal-based or oxidizable metal compound functional layer, e.g. to impart solar control properties. Such coatings are usually not heat treatable per se, which means that their functional layers tend to oxidize, thereby losing at least partially their solar control function, or are even locally or fully destroyed. Although it would be possible to apply the coatings to the glass pane after the heat treatment has taken place, it would be
15 preferable if coatings able to withstand such heat treatments could be made available.

When solar control coated glass panes are intended to be heat treatable, the dielectric layers embedding the functional layer need to be well selected to protect it against oxidation during the heat treatment and to stabilize it against diffusion effects. Layers consisting essentially of silicon nitride, silicon oxinitride, aluminium nitride, aluminium oxinitride or their mixtures
20 are well known and have been repeatedly proposed in the art as dielectric layers in heat treatable solar control coatings.

Solar control coatings such as described before are disclosed for example in JP-A 05-124 839, EP 0 386 993 B1, EP 0 501 632 B1, EP 0 536 607 B1, EP 0 546 302 B1, EP 0 747 329 B1, EP 1 218 307 A1, EP 1 448 491 A1, US 6,689,475 B1, WO 2004-046 058 A1, WO 2004-063
25 111 A1 and WO 2004-070 072 A2.

While certain of the known solar control coated glass panes have been shown to be of practical value and have been made available to the flat glass products market there is still a need for improvement and for the provision of alternative coatings allowing to further optimize the optical, mechanical and chemical properties of solar control coated glass panes.

30 The invention aims therefore generally to provide coated glass panes of the kind described hereinbefore providing the glass panes with solar control properties.

The invention aims more specifically to provide solar control coatings which withstand ordinary environmental influences during storage, transport and use of the coated glass panes and survive the mechanical and chemical conditions acting on the coated glass panes during usual handling and processing steps without a significant quality loss.

- 5 Even more specifically these coated glass panes shall be heat treatable and preserve their properties mentioned before also after a heat treatment. In this context the invention aims to keep the haze value of the coated glass panes low during a heat treatment.

A further aim is to minimize changes of the optical properties of the coated glass pane due to a heat treatment such that heat treated and non heat treated coated glass panes may be used
10 side by side without appearing substantially different.

The invention aims particularly at achieving medium and high values of light and solar energy transmittance, e.g. light transmittance values of above 30 %.

The invention is defined in claim 1. Preferred embodiments of the invention are set out in the subclaims. A glazing comprising at least one inventive coated glass pane is subject of claim
15 14. A process for the manufacture of a heat treated solar control glass pane is subject of claim 15.

A coated glass pane according to the invention is provided with a solar control coating comprising in sequence, starting from the glass surface, at least the following transparent layers: a lower dielectric layer, a functional layer comprising at least one metal or metal compound,
20 and an upper dielectric layer, wherein the functional layer comprises at least one of tungsten, molybdenum, a tungsten-based alloy, a molybdenum-based alloy, their nitrides, carbides and/or borides.

Tungsten- or molybdenum-based alloys are to be understood as alloys with a predominant content of the base material the relevant properties of which are still dominated by the base
25 material. While the acceptable range of the content of the alloying partner(s) depends on the alloy partner(s) such alloys will typically comprise at least about 50 at.%, preferably at least about 75 at.% or most often at least about 90 at.% of the base material. Alloys containing about 10 – 30 at.% titanium and/or chromium and 90 – 70 at.% tungsten may be mentioned as examples for tungsten-based alloys.

Specifically, but not only, if the coated glass pane shall be heat treatable it is preferred that the functional layer comprises pure tungsten or a tungsten-based alloy, or even more preferred a nitride of tungsten or of a tungsten-based alloy with an atomic ratio of tungsten or tungsten-based alloy : nitrogen between about 10 : 1 and 1 : 2, even more preferred between about 3 : 1 and 1.01 : 1. It has been observed that tungsten atoms diffuse substantially less through the coating than other materials known for solar control purposes such as NiCr when subjected to a heat treatment which means that a functional layer comprising tungsten, a tungsten-based alloy or their nitride is less prone to degradation by heat treatment. Trials of the inventors indicate that if a tungsten nitride is provided with a tungsten to nitrogen atomic ratio slightly above 1 : 1 (slightly substoichiometric tungsten nitride) further optimized product properties and processability can be achieved.

The thickness of the transparent functional layer is primarily chosen according to the light and solar energy transmittance the coated glass pane is intended to have. For the most purposes a thickness in the range of about 2 to 40 nm will be appropriate, a thickness range of 2 – 15 nm being particularly preferred for high and medium values of the light and solar energy transmittance.

The functional layer may be composed of a single layer or may comprise several partial layers and/or a material mixture as long as the predominant part of the functional layer is composed of the materials listed before such that the solar control function is predominantly provided by the materials specified according to the invention. As predominant part shall be understood a content of at least about 50 %, usually at least about 75 % and most specifically at least about 90 %, each in atomic percent of the whole functional layer. The functional layer does specifically not comprise any substantial amount of silver or other noble metals. It does furthermore not contain any substantial amount of oxygen.

The technical purpose of the lower and upper dielectric layers, which may, as mentioned above, be single layers or may be composed of several partial layers, is primarily to anti-reflect the functional layer. In addition hereto - specifically in case the coated glass shall be heat treatable - the materials of these dielectric layers are preferably chosen such that a barrier function against diffusion of oxygen and other atoms through the coating during a heat treatment is provided.

For the lower and upper dielectric layers mainly serving as anti-reflection layers a number of materials well known to the person skilled in the art for such purpose may be chosen. If the coated glass pane shall be heat treatable the upper and/or the lower dielectric layer preferably each comprise at least one layer of a nitride or oxinitride of silicon and/or aluminium.

5 Specifically preferred are layers of the silicon aluminium oxinitride type with an atomic ratio Al : Si in the order of about 2 – 10 % and an atomic ratio O : N in the order of about 3 – 30 %.

To achieve the desired anti-reflection property and to function properly as a diffusion barrier the upper dielectric layer shall preferably have a geometrical thickness between about 20 and 60 nm for the materials mentioned before which have a refractive index at 550 nm of about 2.

10 For the lower dielectric layer having the same refractive index a thickness between about 5 and 30 nm is preferred. These thicknesses would need to be adapted, as is well known in the art, if materials having different refractive indices were used.

A preferred solar control coating according to the invention consists of a lower dielectric layer comprising a layer of aluminium-doped silicon nitride or oxinitride, of a functional layer
15 comprising a nitride of tungsten or of a tungsten-based alloy and of an upper dielectric layer comprising a layer of aluminium-doped silicon nitride or oxinitride, most preferably without any substantial further layer.

The thicknesses of the individual transparent layers of the solar control coating may be widely varied according to the specific properties aimed at. It is generally preferred if the thicknesses
20 of the individual layers of the coating are set such that, if deposited on a clear glass pane having a light transmittance T_L without the coating of 90 %, the light transmittance T_L of the coated glass pane is in the range of about 10 - 70 %, preferably in the range of about 20 - 65 % and even more preferred in the range of more than 30 % up to 60 %. The total solar energy transmittance will at the same time be in the order of about 10 % to about 75 % (about 20 –
25 70 %, pref. more than about 30 % up to about 65 %).

At the same time or alternatively the thicknesses of the individual layers of the coating are set such that the light reflection R_L of the coated glass pane is in the range of about 10 – 35 %, preferably in the range of about 15 – 25 %.

The inventive coated glass allows achieving a comparably neutral appearance both in
30 transmission and reflection. By setting the individual layer thicknesses appropriately colour characteristics can be achieved where the transmission colour values are in the range of $0 \geq$

$a_T^* \geq -3$ and $0 \geq b_T^* \geq -7$ and the glass side reflection colour values are in the range of $2 \geq a_G^* \geq -4$ and $2 \geq b_G^* \geq -10$. The coated glass panes will therefore appear very neutral or most often slightly bluish, blue/green or blue/violet both in transmission and glass side reflection.

5 T_L and g are used in accordance with their general meaning as a measure of the flux transmitted through the coated glass pane as a percentage of the incident flux of luminous solar radiation (T_L) and as a ratio of the incident flux of total solar radiation (g).

Preferably the materials and thicknesses of the individual layers and specifically of the dielectric layers of the solar control coating are chosen such that the coated glass pane is heat treatable. While dielectric layers of the silicon and/or aluminium (oxi)nitride type are preferred, other well-known diffusion barrier materials like zinc-tin oxide, other silicon
10 compounds or the like materials may alternatively be chosen.

While heat treatability in its broadest meaning encompasses any coated glass whose quality (including specifically its optical properties and the number of visible faults) is not significantly impaired during a heat treatment, it is preferred to choose the materials and thicknesses
15 of the individual layers of the solar control coating such that $\Delta E^* \leq 3$, preferably ≤ 2.5 and most preferably ≤ 2 for each of glass side reflection (ΔE_G^*), film or coated side reflection (ΔE_F^*) and transmission (ΔE_T^*) after such heat treatment, ΔE_i^* being defined as $\Delta E_i^* = ((\Delta a_i^*)^2 + (\Delta b_i^*)^2 + (\Delta L_i^*)^2)^{1/2}$, wherein ΔL_i^* , Δa_i^* and Δb_i^* are the differences of the colour values L_i^* , a_i^* , b_i^* of the coated glass pane each before and after a heat treatment.

20 The invention is furthermore directed to heat treated coated glass panes such as described hereinbefore which even after the heat treatment display a haze value of at most 0.5, preferably of at most 0.4. "Haze" designates the percentage of transmitted light which in passing through the coated glass pane deviates from the incident beam by forward scattering (measured in accordance with ASTM D 1003-61). A haze value which remains low during
25 heat treatment is a good indicator for heat treatability.

The invention is finally directed to a process for the manufacture of a heat treated solar control glass pane wherein a solar control coated glass pane such as claimed in the product claims is heat treated for up to 10 minutes at a temperature of 590 - 690 °C in an oxygen-containing atmosphere such that its haze value remains below 0.5.

30 While the inventive solar control coating will most often consist only of the three essential layers described hereinbefore it is within the scope of the invention to add further auxiliary

layers generally known in the art like primer layers, outer protective layers, barrier layers, colour modification layers, etc., to the coating to modify its properties as long as these additional layers do not impair the basic properties of the coated glass aimed at by the invention.

- 5 It is furthermore within the scope of the invention to add minor amounts of additives (dopants) to the materials of the individual layers, e.g., if their deposition efficiency can be enhanced thereby, as long as the properties of the modified materials are not significantly impaired as compared to the materials without such additives (dopants).

The invention is not limited to a certain production process for the solar control coating.
10 However, it is particularly preferred if at least one of the layers and preferably all layers is/are applied by magnetron cathode sputtering, either in the DC mode or in the medium frequency mode, wherein metallic or semiconducting targets are sputtered non-reactively or reactively in a suitable sputtering atmosphere. Depending of the materials to be sputtered planar or rotating targets may be used.

- 15 Solar control coated glass panes according to the invention may be used, e.g., as monolithic glass panes, as part of multiple glazings with at least one gas-filled interspace, as part of laminated glazings, for technical, architectural, automotive or other applications. Solar control glazings comprising an inventive coated glass pane are preferably installed such that the solar control coating is arranged on the second surface counted from the outside of the glazing.
20 Counted surfaces in this respect are only surfaces facing the atmosphere or a gas-filled interspace of the glazing.

The glass panes used as a substrate for the solar control coating according to the invention usually consist of soda lime silica glass produced by the float glass process and may be clear or tinted. Other glass compositions are generally not excluded. The thicknesses of the glass
25 panes depend upon their intended application and are usually but without limitation between about 2 and 12 mm.

The invention is hereinafter explained in some more detail with the aid of two examples without the intention to limit the scope of the invention thereby.

Example 1

A 4 mm thick clear float glass pane having a light transmittance T_L of about 90 % before being coated was placed in a laboratory sputtering device in which an Al-doped silicon target containing about 10 wt.% aluminium and 90 wt.% silicon and a tungsten target were arranged and the sputtering chamber was evacuated.

In a first coating step the lower dielectric layer of an inventive solar control coating was deposited on the glass pane. For this purpose a sputtering gas mixture comprising Ar and N_2 in a ratio of 12 : 5 was introduced into the sputtering chamber. The Al-doped silicon target was activated by applying a sputtering power of 900 W using a pulsed power supply. The glass pane was moved past the Al-doped silicon target until an Al-doped silicon oxinitride layer with a thickness of about 15 nm was deposited. The compound layer contained mainly nitrogen, but also a low amount of oxygen stemming from residual oxygen in the sputtering atmosphere.

In a second coating step the functional layer of the solar control coating was deposited on the lower dielectric layer. For this purpose a sputtering gas comprising only Ar was introduced into the sputtering chamber. The tungsten target was activated by applying a sputtering power of 300 W using a DC power supply. The glass pane was moved past the tungsten target until a pure tungsten layer with a thickness of about 5 nm was deposited.

In a third coating step the upper dielectric layer of the solar control coating was deposited on the functional layer. For this purpose a sputtering gas mixture comprising Ar and N_2 in a ratio of 12 : 5 was again introduced into the sputtering chamber. The Al-doped silicon target was activated again by applying a sputtering power of 900 W using a pulsed power supply. The glass pane was moved past the Al-doped silicon target until a further Al-doped silicon oxinitride layer with a thickness of about 35 nm was deposited.

The coated glass pane was thereafter heat treated for 5 minutes at 650 °C.

The main optical properties of the solar control coated glass pane according to Example 1 are listed in Table 1. The first line contains the optical values immediately after deposition of the coating. The second line contains the optical values after the heat treatment of the coated glass pane.

The values for the visible light transmittance T_L and the reflectance R_L were measured and calculated according to conventional methods, e.g. by using a Perkin Elmer Lambda 900 Spectrophotometer or a HunterLab Ultrascan XE (light type D65, angle of incidence 10°) to obtain spectral curves of transmission and reflection. All transmittance and reflectance values including the total solar energy transmittance (expressed as g value) were calculated according to EN 410.

The colour characteristics were measured and reported using the well established CIE LAB L_1^* , a_1^* , b_1^* coordinates (see e.g. [0030] and [0031] in WO 2004-063 111 A1).

Table 1

	T_L [%]	R_L [%] glass side	R_L [%] film side	g	Transmission properties (D65 at 10°)			Glass Side Reflection properties (D65 at 10°)			Film Side Reflection properties (D65 at 10°)		
					L_T^*	a_T^*	b_T^*	L_G^*	a_G^*	b_G^*	L_F^*	a_F^*	b_F^*
As deposited	45	22.3	18.6	0.53	72.9	-0.8	-0.7	54.6	-2.8	-6.5	50.1	-0.2	6.8
Heat treated	47.1	21.3	17.7	0.55	74.3	-0.7	-0.1	53.5	-2.9	-6.7	49	-0.3	5.1

10

The colour variation values which were caused by the heat treatment were calculated to:

$\Delta E_T^* = 1.53$ (Transmission), $\Delta E_G^* = 1.12$ (Glass side reflection) and $\Delta E_F^* = 2.03$ (Film side reflection).

All these values are well below 3 indicating only a slight change in the appearance of the coated glass pane both in transmission and in reflection.

The haze value was 0.15 before and 0.35 after the heat treatment which is well below the upper limit of about 0.5 which is usually applied to define heat treatable coatings.

It can be seen from Table 1 that with a solar control coating according to Example 1 light transmittance values of slightly below 50 % are achieved, the g value being at the same time slightly more than 0.5 (corresponding to a solar energy transmittance of more than 50 %). The transmission colour is very neutral, the glass side reflected colour, which is the relevant colour in most solar control window applications, is slightly bluish, whereas the less important film glass side colour is slightly yellowish. These values change only slightly during the heat treatment.

20

Solar control coated glass panes according to Example 1 passed a number of ageing and durability tests.

One way of testing the chemical durability of a coated glass pane is to boil the coated glass sample in about 0.5 l of 5 % HCl for 1 hour.

- 5 Mechanical durability may be tested by applying the Taber test. A conventional Taber abrader is used to subject the 10 * 10 cm² coated glass sample to 300 revolutions of two C.S. 10 F abrasion wheels each having attached a 500 g weight. If no substantial scratches appear when viewed with the naked eye under visible light, the test is passed and the coated glass pane is said to be mechanically durable.
- 10 Both tests were passed by a coated sample according to Example 1.

Example 2

A 4 mm thick clear float glass pane having a light transmittance T_L of about 90 % before being coated was placed in a laboratory sputtering device in which an Al-doped silicon target containing about 10 wt.% aluminium and 90 wt.% silicon and a tungsten target were arranged and the sputtering chamber was evacuated.

In a first coating step the lower dielectric layer of an inventive solar control coating was deposited on the glass pane. For this purpose a sputtering gas mixture comprising Ar and N₂ in a ratio of 12 : 5 was introduced into the sputtering chamber. The Al-doped silicon target was activated by applying a sputtering power of 900 W using a pulsed power supply. The glass pane was moved past the Al-doped silicon target until an Al-doped silicon oxinitride layer with a thickness of about 15 nm was deposited. The compound layer contained mainly nitrogen, but also a low amount of oxygen stemming from residual oxygen in the sputtering atmosphere.

25 In a second coating step the functional layer of the solar control coating was deposited on the lower dielectric layer. For this purpose a sputtering gas mixture comprising Ar and N₂ in a ratio of 3 : 4 was introduced into the sputtering chamber. The tungsten target was activated by applying a sputtering power of 300 W using a DC power supply. The glass pane was moved past the tungsten target until a tungsten nitride layer with a thickness of about 5 nm was deposited. The nitrogen content of the sputter atmosphere was set such that the tungsten

30

nitride layer was essentially stoichiometric. Slightly substoichiometric tungsten nitride with a somewhat lower nitrogen content than 1 : 1 (atomic ratio nitrogen : tungsten) might have been used to optimize the coating further.

In a third coating step the upper dielectric layer of the solar control coating was deposited on the functional layer. For this purpose a sputtering gas mixture comprising Ar and N₂ in a ratio of 12 : 5 was again introduced into the sputtering chamber. The Al-doped silicon target was activated again by applying a sputtering power of 900 W using a pulsed power supply. The glass pane was moved past the Al-doped silicon target until a further Al-doped silicon oxinitride layer with a thickness of about 35 nm was deposited.

10 The coated glass pane was thereafter heat treated for 5 minutes at 650 °C.

The main optical properties of the solar control coated glass pane according to Example 2 are listed in Table 2. The first line contains the optical values immediately after deposition of the coating. The second line contains the optical values after the heat treatment of the coated glass pane.

15 All values in Table 2 were determined according to the methods described in the context of Example 1.

Table 2

	T _L [%]	R _L [%] glass side	R _L [%] film side	g	Transmission properties (D65 at 10°)			Glass Side Reflection properties (D65 at 10°)			Film Side Reflection properties (D65 at 10°)		
					L _T [*]	a _T [*]	b _T [*]	L _G [*]	a _G [*]	b _G [*]	L _F [*]	a _F [*]	b _F [*]
As deposited	55	22.3	20.6	0.61	79	-0.5	0.8	54.5	-2.8	-5.5	52.5	-0.9	2.3
Heat treated	56	22.4	20.5	0.62	79.6	-0.4	1	54.6	-2.7	-4.7	52.3	-0.9	2.5

20 The colour variation values which were caused by the heat treatment were calculated to:

$\Delta E_T^* = 0.64$ (Transmission), $\Delta E_G^* = 0.81$ (Glass side reflection) and $\Delta E_F^* = 0.28$ (Film side reflection).

All these values are well below 1 indicating a practically invisible change in the appearance of the coated glass pane both in transmission and in reflection.

The haze value was 0.15 before and 0.31 after the heat treatment which is well below the upper limit of 0.5 which is usually applied to define heat treatable coatings.

- 5 It can be seen from Table 2 that with a solar control coating according to Example 2 light transmittance values of about 55 % and g values of about 0.6 can be achieved. The transmission colour is extremely neutral, the glass side reflected colour is slightly bluish, whereas the coated glass side colour is neutral to very slightly yellowish. These values remain nearly unchanged during the heat treatment.
- 10 Solar control coated glass panes according to Example 2 passed a number of ageing tests among which were the HCl test and the Taber test mentioned in Example 1.

- 15 While the invention has been specifically described with reference to tungsten-based functional layers, molybdenum-based functional layers will lead to similar results and properties. If no heat treatability is aimed at other dielectric materials well known for anti-reflection purposes, e.g. SnO₂, ZnO, TiO₂ or the like, may replace the silicon aluminium oxinitride in the dielectric layers.

Patent Claims

1. Coated glass pane with a solar control coating comprising in sequence at least the following transparent layers:
 - a lower dielectric layer,
 - a functional layer comprising at least one metal or metal compound, and
 - an upper dielectric layer,**characterized in that**
 - the functional layer comprises at least one of tungsten, molybdenum, a tungsten-based alloy, a molybdenum-based alloy, their nitrides, carbides and/or borides.
2. Coated glass pane according to claim 1, characterised in that the functional layer comprises pure tungsten or a tungsten-based alloy.
3. Coated glass pane according to claim 1, characterised in that the functional layer comprises a nitride of tungsten or of a tungsten-based alloy with an atomic ratio of tungsten or tungsten-based alloy : nitrogen between 10 : 1 and 1 : 2.
4. Coated glass pane according to claim 3, characterised in that the functional layer comprises a nitride of tungsten or of a tungsten-based alloy with an atomic ratio of tungsten or tungsten-based alloy : nitrogen between 3 : 1 and 1.01 : 1.
5. Coated glass pane according to any of the foregoing claims, characterised in that the upper dielectric layer comprises a layer of a nitride or oxinitride of silicon and/or aluminium.
6. Coated glass pane according to any of the foregoing claims, characterised in that the lower dielectric layer comprises a layer of a nitride or oxinitride of silicon and/or aluminium.
7. Coated glass pane according to any of the foregoing claims, characterised in that the lower dielectric layer comprises a layer of aluminium-doped silicon nitride or oxinitride, the functional layer comprises a nitride of tungsten or of a tungsten-based alloy and the upper dielectric layer comprises a layer of aluminium-doped silicon nitride or oxinitride.
8. Coated glass pane according to any of the foregoing claims, characterised in that the thicknesses of the individual layers of the coating are set such that, if deposited on a clear glass pane having a light transmittance T_L without the coating of 90 %, the light

transmittance T_L of the coated glass pane is in the range of 10 - 70 %, preferably in the range of 20 - 65 %, most preferred in the range of more than 30 % to 60 %.

9. Coated glass pane according to any of the foregoing claims, characterised in that the thicknesses of the individual layers of the coating are set such that the light reflection R_L is in the range of 10 - 35 %, preferably in the range of 15 - 25 %.
10. Coated glass pane according to any of the foregoing claims, characterised in that the thicknesses of the individual layers of the coating are set such that the transmission colour values are in the range of $0 \geq a_T^* \geq -3$ and $0 \geq b_T^* \geq -7$ and the glass side reflection colour values are in the range of $2 \geq a_g^* \geq -4$ and $2 \geq b_g^* \geq -10$.
11. Coated glass pane according to any of the foregoing claims, characterised in that it is heat treatable.
12. Coated glass pane according to claim 11, characterised in that $\Delta E^* \leq 3$, preferably less than 2.5 and most preferred less than 2, for each of glass side reflection, coating side reflection and transmission after a heat treatment.
13. Heat treated coated glass pane according to any of the foregoing claims, characterised in that its haze value after the heat treatment is at most 0.5, preferably at most 0.4.
14. Solar control glazing comprising a coated glass pane according to any of the foregoing claims, the solar control coating being arranged on the second surface counted from the outside of the glazing.
15. Process for the manufacture of a heat treated solar control glass pane wherein a solar control coated glass pane according to any of claims 1 to 12 is heat treated for up to 10 minutes at a temperature of 590 - 690 °C in an oxygen-containing atmosphere such that its haze value remains below 0.5.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/002132

A. CLASSIFICATION OF SUBJECT MATTER
INV. C03C17/34 C03C17/36

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)
C03C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 674 (C-1140), 10 December 1993 (1993-12-10) & JP 05 221691 A (ASAHI GLASS CO LTD), 31 August 1993 (1993-08-31) abstract	1-15
A	WO 97/39481 A (NORTHEASTERN UNIVERSITY) 23 October 1997 (1997-10-23) claim 20	1-15
A	US 4 650 698 A (MORIYA ET AL) 17 March 1987 (1987-03-17) column 3, line 61 - column 4, line 2	1-15
A	GB 1 265 831 A (EASTMAN KODAK COMPANY) 8 March 1972 (1972-03-08) claims 1-4	1-16
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* 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
- *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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- *Z* document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

29 September 2006

06/10/2006

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/002132

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 939 201 A (BOIRE ET AL) 17 August 1999 (1999-08-17) column 9, line 1 - line 6; claim 3 -----	1-16
A	EP 0 934 913 A (NIPPON SHEET GLASS CO., LTD) 11 August 1999 (1999-08-11) paragraph [0019] - paragraph [0022] -----	1-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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