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(54) Title: METHOD OF MAKING A HEAT-TREATED COATED GLASS ARTICLE USING A POLYMER DISPERSION

(57) Abstract: A temporary protective coating is provided over a coated glass substrate. The temporary protective coating is applied in an aqueous dispersion then solidified on the substrate. The temporary protective coating is then removed by treatment with a basic solution. In certain example embodiments, the temporary protective coating is applied after heat treatment before the coated substrate is coupled to another substrate to form a window unit such as an IG window unit or a laminated vehicle windshield.

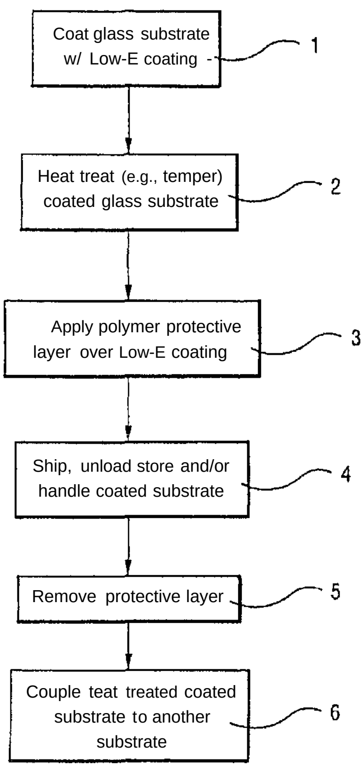

Fig. 2

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TITLE OF THE INVENTION

METHOD OF MAKING A HEAT-TREATED COATED GLASS ARTICLE USING A POLYMER DISPERSION

[0001] This application claims the benefit of priority to U.S. Patent Application No. 60/935,404 filed August 10, 2007, which is incorporated by reference in its entirety.

[0002] This invention in certain example instances relates to a method of making a heat-treated coated glass article having functional coatings. In certain example instances, a temporary protective polymer based layer is formed on a coated glass following heat treatment thereof (e.g., thermal tempering of the coated article), in order to enhance the mechanical and environmental durability of the heat treated thin film coating following the heat treatment process (e.g., during shipping, unloading, robotic handling and/or human handling of the heat treated coated article). The protective polymer based layer may be removed prior to, for example, the coated article being loaded into the insulating and/or laminating washer at a fabricator (e.g., IG window unit fabricator). The temporary protective layer may be easily removed by using a basic solution.

BACKGROUND OF THE INVENTION

[0003] It is known in the art to use coated articles in the context of window units such as insulating glass (IG) window units. For example, see U.S. Patent No. 6,632,491 to Thomsen, the disclosure of which is hereby incorporated herein by reference. In the '491 patent for example, a solar management coating (e.g., low-E coating) is provided on the inner surface of one of the glass substrates of an IG window unit so as to protect a building interior against infrared (IR) radiation and the heat generated thereby. Coated glass substrates of IG units often have to be heat treated (e.g., tempered), prior to IG unit assembly for example, to meet certain code requirements.

[0004] Large pieces of glass (whether heat treated or not) may have certain size-related problems related to handling. Large sheets of glass, for example, may be placed through operations relating to cutting, seaming, and/or edge deletion. In one or more of these operations, the surface of the glass may benefit from protection.

[0005] Following heat treatment (e.g., thermal tempering and/or heat bending), the heat treated coated glass substrate is often subjected to shipping, unloading, storage on a pallet or the like, robotic handling and/or human handling. One or more of these often tends to damage the heat treated coated glass substrate (e.g., via scratching, corrosion, and/or the like) before it can be coupled to another substrate to form an IG window unit, laminated window, or the like. Yields are reduced due to such damage which often occurs between heat treatment and coupling to another substrate.

[0006] For example, coated sheets are often scratched due to (a) rubbing up against other sheets or the like during shipment, unloading and/or storage; (b) pliers used by glass handlers; (c) abrasion caused by gloves worn by glass handlers; and/or (d) other types of rubbing/abrasion. Additionally, corrosion can be a significant cause of damage and is often caused by high humidity conditions, acid rain, and/or other materials which tend to collect on the coated articles during transport, storage and/or handling.

[0007] In view of the above, it can be seen that there exists a need in the art to better protect heat treated coated glass sheets in the processing stages following heat treatment and before coupling to another substrate. In particular, increased protection against mechanical abrasion and environmental damage is needed. Over the years, numerous attempts have been made in this regard.

[0008] The dusting of coated sheets with Lucor powder separator is often carried out in an attempt to better protect coated glass sheets in processing stages prior to heat treatment. Unfortunately, Lucor powder provides no protection against corrosion damage, and also is not particularly effective in protecting against scratch damage due to the use of pliers, brushes, gloves and the like.

[0009] Encapsulating of racks during shipment has also been tried. However, encapsulating racks is labor intensive and has proven only partially effective during shipment.

[0010] U.S. Patent No. 6,682,773 to Medwick discloses a technique to protect coated glass prior to heat treatment where a water-soluble temporary protective layer is applied to a coated glass sheet via a liquid solution. In particular, the protective layer is formed from an aqueous coating solution containing a polyvinyl alcohol polymer which is then dried and may thereafter be removed by washing in water. The technique of the '773 patent may be undesirable in that the coating is typically water soluble. Thus, the protective coating may have the tendency to absorb moisture in hot and/or humid conditions which may result in adhesive bonding of stacked glass substrates. Thus, it can be seen that the technique of the '773 patent may be undesirable.

[0011] U.S. Patent No. 6,849,328 to Medwick discloses a technique where a water-soluble temporary protective layer is applied to a coated glass sheet via a liquid solution or where a carbon coating is sputtered onto the glass sheet. However, these coatings are removed and thus provide no protection during the period after heat treatment.

[0012] U.S. Patent No. 4,710,426 to Stephens discloses a protective polymeric layer on a coated sheet. However, the isocyanate used in the '426 system prevents the protective polymeric layer from being practically removed in a reasonable manner.

[0013] EP 1 380 553 also discloses a temporary protective coating on a coated article. However, like the '773 Patent, the protective coating of EP 1 380 553 burns off during heat treatment and thus provides no protection during the period after heat treatment when the coated article is subjected to damage/corrosion.

[0014] U.S. Patent App. Pub. No. 2006/0065350 to Richardson discloses a protective layer including polyethylene and an optional adhesive layer including acrylic. But these protective layers are limited in size and may not be applied on large sheets of glass, e.g., sheets larger than 100 inches.

[0015] Temporary protective coatings may be formed from solutions or dispersions of polymeric materials or waxes. Whereas laminated protective films are removed by hand peeling, different removal techniques to remove temporary coatings may also include the use of organic solvents, water, steam, alkaline inorganic solvents, etc., and thermal decomposition by combustion at furnace temperatures.

[0016] In view of the above, it can be seen that there exists a need in the art to better protect coated glass sheets in the processing stages following heat treatment (e.g., thermal tempering and/or heat bending), in particular between heat treatment and coupling of the coated article to another substrate. The protective layer(s) can be easily removed in a processing step prior to coupling the heat treated coated substrate to another substrate. In particular, increased protection against mechanical abrasion and environmental damage is needed between heat treatment and coupling to another substrate in order to improve yields and reduce the likelihood of damage.

BRIEF SUMMARY OF EXAMPLE EMBODIMENTS OF THE INVENTION

[0017] In certain embodiments of this invention, a temporary protective film is provided on a glass substrate that is coated with a multi-layer low-E coating. The temporary protective film includes one or more layers and is located on the glass substrate over at least the low-E coating.

[0018] In certain example embodiments, the temporary protective film is designed such that it can be applied over a low-E coating in an efficient manner without the need for any sort of lengthy curing procedure. In this regard, the temporary protective film is preferably applied (e.g., sprayed) in liquid form and cooled/evaporated relatively quickly. Moreover, in certain example embodiments of this invention, the temporary protective film is designed such that it can be applied following heat treatment and be easily removed by treatment using an alkaline solution and washed prior coupling the coated substrate to another substrate to form an IG window unit, laminated window, or the like. In certain example embodiments, the temporary protective film is designed such that it is not water soluble so that it remains on and protects the low-E coated glass substrate even upon exposure to water and other environmental elements involving humidity.

[0019] In certain example embodiments of this invention, there is provided a method of making an insulating glass (IG) window unit, the method comprising: sputtering a multi-layered low-E coating onto a glass substrate, wherein the low-E coating comprises at least one infrared (IR) reflecting layer comprising silver sandwiched between at least first and second dielectric layers; thermally tempering the glass substrate with the low-E coating thereon; after said tempering, applying a polymer dispersion in liquid form to a top surface of the low-E coating and evaporating the liquid to form a protective polymer sheet so as to create a protected coated article;

removing the protective sheet off the low-E coating by treating at least a portion of the protective polymer sheet with a basic solution to form an unprotected coated article; and after removing the protective sheet or film off the low-E coating, coupling the tempered coated article including the glass substrate and low-E coating to another substrate to form an IG window unit.

[0020] In certain example embodiments of this invention, there is provided a method of making a protected coated substrate, the method comprising applying an aqueous polymer dispersion comprising acrylic polymer in liquid form to a top surface of a heat-treated substrate and drying the polymer dispersion to form a protective film so as to create a protected coated article, wherein the substrate comprises monolithic glass, and wherein the protective film may be partially removed via alkaline treatment.

[0021] In other example embodiments of this invention, there is provided a method of making a window unit, the method comprising: forming a multi-layer coating on a glass substrate; heat treating the glass substrate with the coating thereon; after said tempering, applying a polymer dispersion in liquid form to a top surface of the multi-layer coating and evaporating the liquid to form a protective polymer sheet so as to create a protected coated article; removing the protective sheet off the multi-layer coating by treating at least a portion of the protective polymer sheet with a basic solution to form an unprotected coated article; and after removing the protective sheet or film off the multi-layer coating, coupling the heat treated coated article including the glass substrate and coating to another substrate to form a window unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIGURE 1 is a cross sectional view of a coated article according to an example embodiment of this invention.

[0023] FIGURE 2 is a flowchart illustrating certain example steps performed in an example embodiment of this invention.

[0024] FIGURE 3 is a cross section view of an IG window unit coated article according to an example embodiment of this invention.

[0025] FIGURE 4 is a cross sectional view of a coated article according to an example embodiment of this invention.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

[0026] A temporary protective film, having one or more layers, is provided on a glass substrate that is coated with a multi-layer low-E coating in certain embodiments of this invention. The temporary protective film is typically provided on the substrate over a multi-layer low-E coating, where the low-E coating typically includes at least one infrared (IR) reflecting layer of a material comprising silver or the like. In certain example instances, the IR reflecting layer(s) may be sandwiched between at least a pair of dielectric layers.

[0027] A temporary coating may be formed from an aqueous dispersion and removed by using a basic solution. Furthermore, mechanical removal, such as with a cloth or brush, may be used to aid the removal of the temporary protection coating. The liquid dispersion may be applied via any conventional liquid application technique, including, for example, spraying, roller coating, dipping, meniscus, and/or curtain coating processes.

[0028] Although described in connection with a multi-layer low-E coating, a protective layer in accordance with certain embodiments of this invention may be useful in a variety of applications, including, for example, surface protection of sensitive surfaces of coated glass used in concentrated solar power mirrors, energy efficient windows, etc. In certain embodiments, the substrate may be monolithic glass, such as those having UV-blocking properties and/or low-E or low-emissivity properties. UV-blocking properties refer to the capability of blocking at least a portion of the ultraviolet spectrum.

[0029] In certain example embodiments of this invention, the temporary protective coating is applied following heat treatment (e.g., thermal tempering and/or heat bending), and remains on the heat treated coated article until it is removed before the heat treated coated article is coupled to another substrate to form an IG window unit, laminated windshield, or the like. Thus, certain example embodiments of this invention allow fabricators to more aggressively handle and/or process coated glass sheets after heat treatment and before coupling to another substrate without running a significant risk of damage. This permits yields to be increased, and costs cut.

[0030] In certain example embodiments, the temporary protective coating is not water soluble so that it remains on and protects the low-E coated glass substrate during post-HT shipping, storage, unloading, handling, and/or handling, before the heat treated coated article is coupled to another substrate. Thus, the coated sheet is not as susceptible to damage (e.g., scratching and/or corrosion) during such times.

[0031] Fig. 1 is a cross sectional view of an intermediate-stage coated article, following heat treatment, according to an example embodiment of this invention. The coated article of Fig. 1 is referred to as an "intermediate-stage" coated article because it typically exists during only a particular stage of the manufacturing process after heat treatment but before the heat treated coated article is coupled to another glass substrate to form an IG unit, laminated window, or the like. As shown in Fig. 1, the coated article includes a glass substrate 21 which supports a low-E coating 23. Provided on the substrate 21 over the low-E coating is a protective layer(s) 27 that is optionally adhered to the low-E coating via adhesive layer 25.

[0032] Low-E coating 23 may be any suitable type of low-E coating in different embodiments of this invention. For example, and without limitation, any of the coatings in any of the following U.S. Patents may be used as the coating 23: 6,461,731; 6,447,891; 6,602,608; 6,576,349; 6,514,620; 6,524,714; 5,688,585; 5,563,734; 5,229,194; 4,413,877 and 3,682,528, all of which are hereby incorporated herein by reference. In certain example embodiments, the top layer of the low-E coating is of or comprises silicon nitride which may or may not be doped with a metal such as Al and/or stainless steel.

[0033] Protective layer 27 may comprise an acrylic polymer, such as one formed from an aqueous acrylic polymer dispersion. A suitable aqueous acrylic polymer dispersion may, for example, include EC-44 available from Eco Coat Glass Protection Inc. Protective films formed from this dispersion may be removed from a coated glass surface by treatment with an alkaline liquid and mechanical means using physical contact, e.g., via conventional brush washers. Other polymer dispersions, such as those including polymers or copolymers of vinylacetate, acrylic, acrylic esters, styrene, butadiene, rubber, and/or urethane, may be suitable in accordance with various embodiments. Adjuvents (e.g., foaming agents, such as surfactants) may be present in certain example embodiments of this invention.

[0034] The thickness of protective layer 27 maybe 1-50 microns - or more preferably 5-25 microns in thickness - so as to facilitate removal via disintegration of the polymer in a basic solution. Foaming agents such as air and/or inert gas may also be mixed with the uncured precursor material prior to application in a liquid form. Suitable foaming agents may include, for example, sodium lauryl ether sulfate, sodium dodecyl sulfate, alkylaryl sulfonates, polyethoxyalkanols, and/or other well-known surfactants. Suitable inert gasses are those that do not react with the polymer dispersion and may include, for example, ambient air, nitrogen, argon, etc. The addition of gas and/or foam may reduce the density of the resultant protective layer 27.

[0035] In certain example embodiments of this invention, protective layer 27 has a visible transmission of less than 70% (measured regarding all visible wavelengths of light), more preferably less than 60%, and most preferably less than 50% (thus, the optics of the coated article are typically undesirable when the protective layer 27 is thereon). In certain example instances, the protective layer 27 may be blue or otherwise colored. The blue or blue/green coloration of layer 27 is advantageous in that it allows edges of the layer 27 to be clearly seen by operators and also permits handlers to be able to easily determine whether or not the protective layer 27 is still on the coated substrate. This is helpful in preventing coated articles with a layer 27 thereon from being coupled to another glass substrate to form a final product such as an IG unit or the like before layer 27 has been removed by disintegration or the like.

[0036] Fig. 2 is a flowchart illustrating certain steps carried out according to an example embodiment of this invention during the manufacture of an IG window unit. With reference to Figs. 1-2, first, a glass substrate 21 is coated with a low-E coating 23 (step 1). Example low-E coatings 23 which may be used are discussed above. The low-E coating is typically a multi-layer coating 23 which includes at least one IR reflecting layer of a material such as silver that is sandwiched between at least a pair of dielectric layers. The coating 23 is typically applied via sputtering or the like. After the coating 23 is applied to the glass substrate 21, the coated glass substrate is heat treated (e.g., thermally tempered and/or heat bent) (step 2). Thermal tempering (an example of heat treatment) typically involves heat treatment of a coated glass substrate using furnace temperature(s) of at least 58O^{0}C, more preferably of at least about 600^{0}C and still more preferably of at least 62O^{0}C. An example heat treating furnace temperature is from 600 to 700^{0}C. This heat treatment (e.g., tempering and/or bending) can take place for a period of at least 4 minutes, at least 5 minutes, or more in different situations.

[0037] Then, following the heat treatment, protective layer 27 is applied to the top of the low-E coating 23 via spraying and cooling/evaporation (step 3) to form the coated sheet shown in Fig. 1. After the protective layer 27 has been applied over the low-E coating 23, the coated article may be subjected to one or more of shipping to a fabricator, unloading from a shipment crate or pallet at the fabricator location, storage, and/or handling by an operator and/or robot (step 4). Optionally, in certain example embodiments of this invention, it is possible to coat or dust the coated articles with Lucor™ powder for purposes of protection even after the protective layer 27 has been applied. The Lucor spacer powder may help separate the coated sheets from one another during shipment to an IG unit fabricator and/or during storage with other coated articles.

[0038] In certain example embodiments, the protective layer(s) 27 remains on the heat treated coated article from the exit of the furnace line unloading until the coated glass substrate is loaded into the insulating and/or laminating washer at the fabricator (note: the furnace may be located at the glass manufacturer or at the fabricator). The protective layer 27 is at least partially removed by disintegrating the polymer just before this washer and thus just before being coupled to another glass or plastic substrate to form an IG window unit, laminated windshield, or the like (step 5). The heat treated coated article composed of substrate 21 and low-E coating 23 in monolithic form, may in certain example embodiments have a visible transmission of at least 40%, more preferably of at least 70%, after removal of the layers 25, 27. After the protective layer 27 has been removed, the coated sheet composed of glass substrate 21 and low-E coating 23 is coupled to another glass or plastic sheet via at least one spacer and/or sealant to form an IG window unit (step 6).

[0039] Typically, an IG window unit may include two spaced apart substrates 21, 24 as shown in Fig. 3. Example IG window units are illustrated and described, for example, in U.S. Patent Nos. 5,770,321, 5,800,933, 6,524,714, 6,541,084 and 6,936,347. Fig. 3 illustrates that an example IG window unit may include the coated glass substrate including glass substrate 21 and coating 23 coupled to another glass substrate 24 via a spacer(s) (not shown), sealant(s) (not shown) or the like with a gap 28 being defined therebetween. This gap 28 between the substrates in IG unit embodiments may in certain instances be filled with a gas such as argon (Ar), or alternatively may be filled with air. An example IG unit may comprise a pair of spaced apart clear glass substrates each about 4 mm thick, one of which is coated with a coating 23 herein in certain example instances, where the gap between the substrates may be from about 5 to 30 mm, more preferably from about 10 to 20 mm, and most preferably about 16 mm. In certain example IG unit embodiments of this invention, the coating is designed such that the resulting IG unit (e.g., with, for reference purposes, a pair of 4 mm clear glass substrates spaced apart by 16 mm with Argon gas in the gap) has a U-value of no greater than 1.25 W/(m^2K), more preferably no greater than 1.20 W/(m^2K), even more preferably no greater than 1.15 W/(m^2K), and most preferably no greater than 1.10 W/(m^2K). The IG window unit may have a visible transmission of from 50-80% in certain example embodiments of this invention, more preferably from 60-75%.

[0040] In view of the above, it can be seen that the protective layer 27 serves to protect the coated sheet from damage (e.g., scratching, corrosion and the like) during shipping, unloading, cutting, edge seaming and grinding, robotic handling and human handling. An example benefit is significantly higher fabrication yields for the product.

[0041] Fig. 4 illustrates protective layer 27 provided on a low-E coating 23 according to an example non-limiting embodiment of this invention. While any type of coating 23 may be used, the coating shown in Fig. 4 is provided for purposes of example, and includes first and second IR reflecting layers of silver with a number of dielectric layers provided therebetween. Other types of coatings (e.g., other low-E coatings, solar control coatings, mirror coatings, etc.) may instead be used between glass substrate 21 and temporary protective layer 27.

[0042] As noted above, in certain embodiments, protective layer 27 may be removed by mechanical methods (e.g., scrubbing, brushing, etc.), chemical methods (e.g., dissolution in an alkaline solution, such as ammonium hydroxide, sodium hydroxide, etc.), or a combination of the two. For example, the protective layer comprising an acrylic polymer may be first washed with a basic solution, then rubbed clean and dried with a cloth.

[0043] Several illustrative, non-limiting examples were made in accordance with certain exemplary embodiments.

[0044] Example 1

[0045] A coating formulation obtained from Eco Coat Glass Protection Systems Inc., British Columbia, Canada, was used in this example to provide surface protection to Guardian's commercial product RLE-HT. Coating formulation EC-44 containing an aqueous acrylic polymer dispersion was applied to a tempered Low-E surface while the glass was maintained at a surface temperature of about 100^{0}C. The conveyor speed was maintained at about 20 meter/min and airless hydraulic spray nozzles were placed at about 20 cm above the glass surface. Due to rapid evaporation of water and solvent the resultant coatings were frosty in appearance and the coating thickness varied from about 15-25μm. Tempered Low-E glass protected with EC-44 was subjected to 50^{0}C and 95% relative humidity (RH). The protective coating was removed by applying GS-40 coating converter liquid obtained from Eco Coat. Converter liquid was applied by spray process and after about 15 sec of dwell time the substrate was rinsed under running tap water followed by gentle mechanical abrasion using a soft cloth. It was found that tempered low-E surface remained unaffected due to exposure to humidity and no surface defects due to silver corrosion were noticed.

[0046] Example 2

[0047] A coating formulation obtained from Eco Coat was used in this example to provide surface protection to Guardian's commercial product RLE-HT. Coating formulation EC-44 containing an aqueous acrylic polymer dispersion was applied to a tempered low-E surface while the glass was maintained at a surface temperature of about 38^{0}C. The conveyor speed was maintained at about 20 meter/min and airless hydraulic spray nozzles were placed at about 20 cm above the glass surface. Due to slower evaporation of water and solvent the polymer particles were able coalesce to form a clear and transparent coating. The coating thickness varied from about 6-10μm. Tempered low-E glass protected with EC-44 was subjected to ASTM salt-fog test. Protected low-E glass was also tested for mechanical protection by Taber abrasion test. Two circular rotating Calibrase CS-I OF abrasive wheels with an applied overall load of 500gm were used for Taber abrasion test. The protective coating was removed after tests by applying GS-40 coating converter liquid obtained from Eco Coat. Converter liquid was applied by spray process and after about 15 sec of dwell time the substrate was rinsed under running tap water followed by gentle mechanical abrasion using a mechanical glass washer equipped with soft drum brushes approved for low-E surface. It was found that the tempered low-E surface remained unaffected due to exposure to highly corrosive salt-fog atmosphere and no surface defects due to silver corrosion were noticed. It was also found that low-E surface protected with EC-44 coating remained unaffected after about 50 Taber rotations while an unprotected low-E surface was completely marred after only about 5 rotations.

[0048] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. Furthermore, all numerical values and ranges are approximate and include some variation and/or deviation therefrom.

CLAIMS

1. A method of making an insulating glass (IG) window unit, the method comprising:

sputtering a multi-layered low-E coating onto a glass substrate, wherein the low-E coating comprises at least one infrared (IR) reflecting layer comprising silver sandwiched between at least first and second dielectric layers;

thermally tempering the glass substrate with the low-E coating thereon;

after said tempering, applying a polymer dispersion in liquid form to a top surface of the low-E coating and evaporating the liquid to form a protective polymer sheet so as to create a protected coated article;

removing the protective sheet off the low-E coating by treating at least a portion of the protective polymer sheet with a basic solution to form an unprotected coated article; and

after removing the protective sheet off the low-E coating, coupling the tempered coated article including the glass substrate and low-E coating to another substrate to form an IG window unit.

2. The method of claim 1, wherein an uppermost layer of the low-E coating comprises silicon nitride.

3. The method of claim 1, wherein the polymer dispersion comprises an aqueous polymer dispersion.

4. The method of claim 1, wherein the polymer dispersion comprises an aqueous polymer dispersion comprising an acrylic polymer.

5. The method of claim 1, wherein the protective sheet has a visible transmission of less than 70%.

6. The method of claim 1, wherein the IG window unit has a visible transmission of from 50 to 75%.

7. The method of claim 1, wherein the protective sheet is blue and/or green colored.

8. The method of claim 1, wherein the protective sheet is not water soluble.

9. The method of claim 1, wherein the step of removing the protective sheet to form an unprotected coated article further comprises mechanically washing the low-E coating using physical contact.

10. A method of making a window unit, the method comprising:

forming a multi-layer coating on a glass substrate;

heat treating the glass substrate with the coating thereon;

after said tempering, applying a polymer dispersion in liquid form to a top surface of the multi-layer coating and evaporating the liquid to form a protective polymer sheet so as to create a protected coated article;

removing the protective sheet off the multi-layer coating by treating at least a portion of the protective polymer sheet with a basic solution to form an unprotected coated article; and

after removing the protective sheet off the coating, coupling the heat treated coated article including the glass substrate and coating to another substrate to form a window unit.

11. The method of claim 10, wherein an uppermost layer of the low-E coating comprises silicon nitride.

12. The method of claim 10, wherein the polymer dispersion comprises an aqueous polymer dispersion.

13. The method of claim 10, wherein the polymer dispersion comprises an aqueous polymer dispersion comprising an acrylic polymer.

14. The method of claim 10, wherein the protective sheet has a visible transmission of less than 70%.

15. The method of claim 10, wherein the IG window unit has a visible transmission of from 50 to 75%.

16. The method of claim 10, wherein the protective sheet is blue and/or green colored.

17. The method of claim 10, wherein the protective sheet is not water soluble.

18. The method of claim 10, wherein the step of removing the protective sheet further comprises mechanically washing the multi-layer coating using physical contact.

19. A method of making a protected coated substrate, the method comprising applying an aqueous polymer dispersion comprising acrylic polymer in liquid form to a top surface of a heat-treated substrate and drying the polymer dispersion to form a protective film so as to create a protected coated article, wherein the substrate comprises monolithic glass, and wherein the protective film may be partially removed via alkaline treatment.

20. The method of claim 19, wherein the substrate comprises glass having UV-blocking properties, low-E and/or low emissivity properties

21. The method of claim 19, wherein the substrate comprises a portion of a solar power mirror or an energy efficient window.

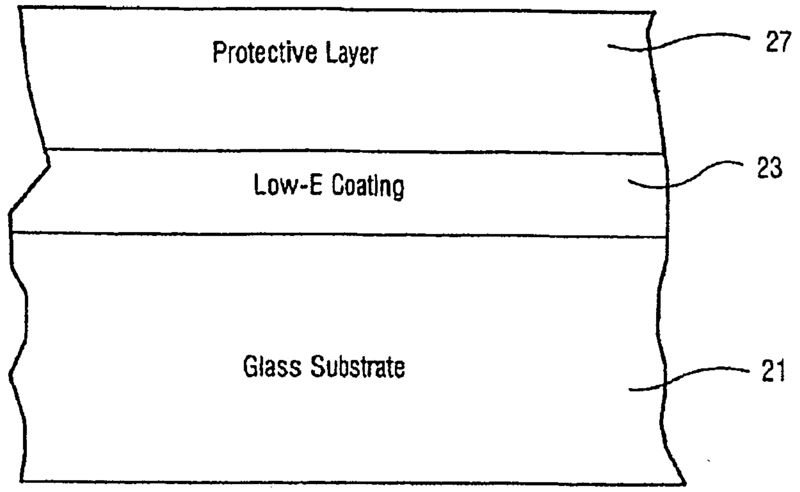
Protective Layer
27
Low-E Coating
23
Glass Substrate
21

Fig. 1

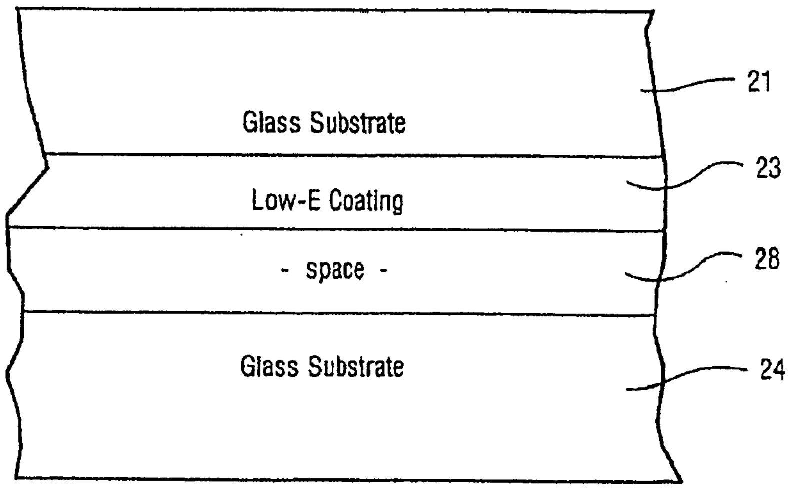
21
Glass Substrate
23
Low-E Coating
- space -
28
Glass Substrate
24

Fig. 3

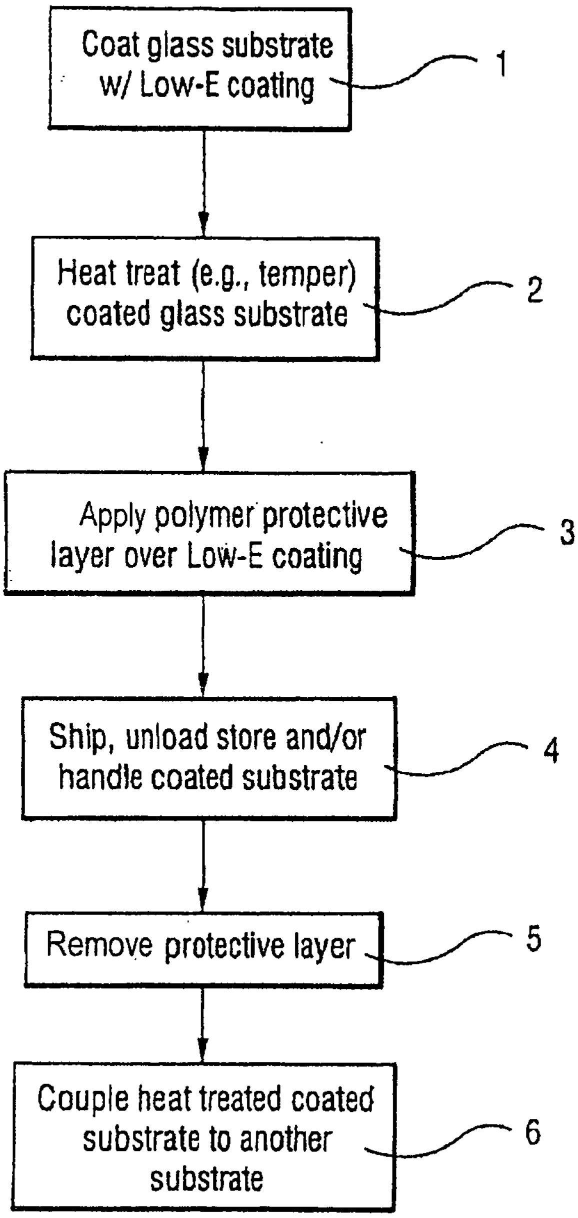
Coat glass substrate w/ Low-E coating
1
Heat treat (e.g., temper) coated glass substrate
2
Apply polymer protective layer over Low-E coating
3
Ship, unload store and/or handle coated substrate
4
Remove protective layer
5
Couple heat treated coated substrate to another substrate
6

Fig. 2

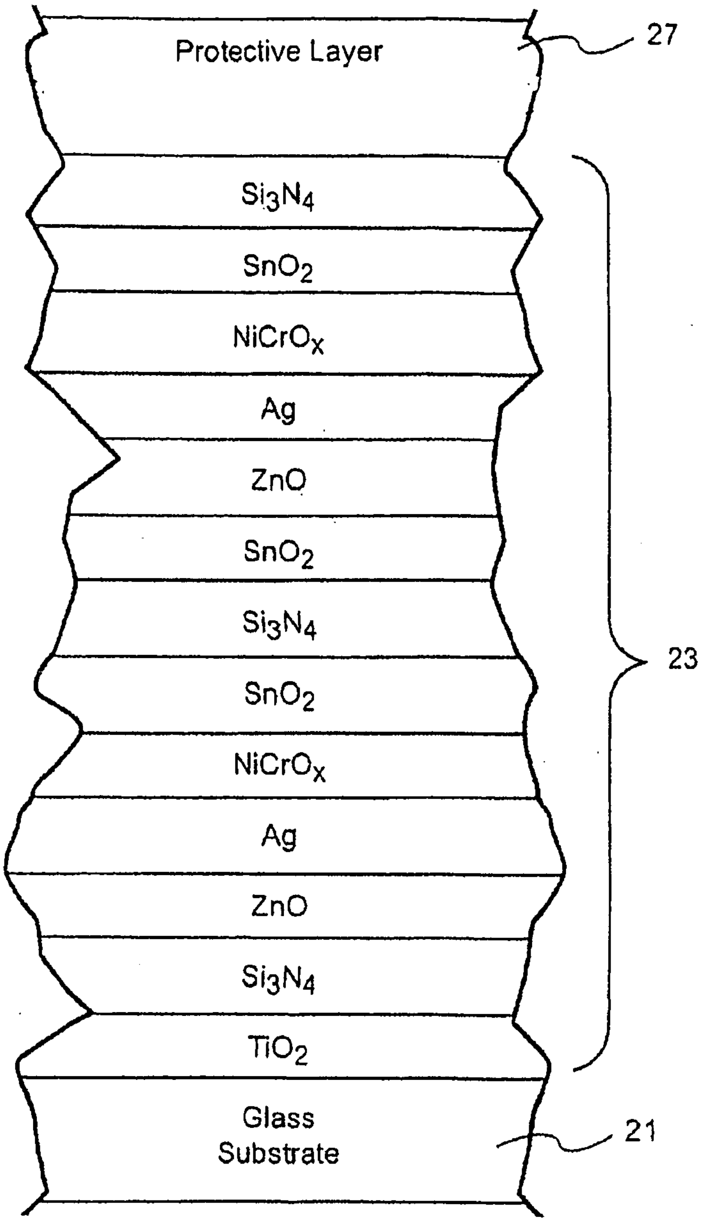
Protective Layer
27
Si3N4
SnO2
NiCrOx
Ag
ZnO
SnO2
Si3N4
SnO2
NiCrOx
Ag
ZnO
Si3N4
TiO2
23
Glass
Substrate
21

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/009564

A. CLASSIFICATION OF SUBJECT MATTER
INV. C03C17/42 C09D5/00

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

B. RELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C03C C09D

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/176988 Al (MEDWICK PAUL A [US] ET AL) 28 November 2002 (2002-11-28) cited in the application abstract paragraph [0011] - paragraph [0012] paragraph [0025] paragraph [0032] paragraph [0041] claims 8,32	1-21
A	EP 1 380 553 A (GLAVERBEL [BE]) 14 January 2004 (2004-01-14) cited in the application abstract paragraph [0006] - paragraph [0007] paragraph [0018]	1-21

-/--

[X] Further documents are listed in the continuation of Box C

[X] 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

'E' earlier document but published on or after the international filing date

'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

'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 dale 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 abne

'Y' document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 November 2008	28/11/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P B 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax (+31-70) 340-3016	Picard, Sybille

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/009564

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 2006/065350 A1 (RICHARDSON CORY [US] ET AL) 30 March 2006 (2006-03-30) cited in the application abstract figures 1,2 paragraph [0026] - paragraph [0027] examples -----	1-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/009564

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			US	2005181219	Al	18-08-2005
US 2006065350	Al	30-03-2006	CA	2569245	Al	06-04-2006
			EP	1793993	Al	13-06-2007
			WO	2006036605	Al	06-04-2006