

REMOVABLE WINDOW FILM FOR MOTOR VEHICLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a removable window film for motor vehicles that can be adhered to a glass window of motor vehicles having a smooth surface, sufficiently held on the glass window after adhering and easily peeled from the glass window of motor vehicles without damaging of the window film or staining of the glass window of motor vehicles, and can reduce transmittance of ultraviolet light or visible light as required.

2. Description of Related Art

In recent years, as window films that are adhered to a glass window of motor vehicles, films which comprise a base film according to purposes, such as, fashion property, design property and privacy protection, the same pressure sensitive adhesive as used in films for building materials that can prevent glass-splashing, the pressure sensitive adhesive being applied on the base film, and a silicone type polyester release film that is adhered to the pressure sensitive adhesive layer, have been used.

The window films for motor vehicles, however, are difficult to perform adhesion to the window, because strong pressure sensitive adhesives are used in the window films for motor vehicles, so that there are many failings attributed to adhesion of each surfaces of the pressure sensitive adhesive layers with each other in adhesion process to the window. Also, there is a defect that in peeling of the window films after adhering window films for motor vehicles to the window once, damaging of the window film and/or residues of the



adhesives on the window are caused and it is impossible to remove and adhere the window films for motor vehicles easily, because the window films are adhered with the strong pressure sensitive adhesives. Further, thinners or solvents have been used to remove the residues of the pressure sensitive adhesives left on the window, so that there are dangers of damaging polyurethane leathers or polyvinyl chloride leathers used as interior materials for the motor vehicles.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a removable window film for motor vehicles that can be peeled even if surfaces of the pressure sensitive adhesive layers are adhered with each other in adhesion process to the motor vehicle windows, can be easily adhered to the motor vehicle windows, can maintain sufficient adhesion to the windows in practical use after adhering, and can be easily peeled from the glass windows without damaging of the window film or staining of the glass windows.

Another object of the present invention is to provide an adhering method that can adhere easily a window film to motor vehicle windows.

Extensive investigations undertaken by the present inventors directed to the object described above have led to the discovery that such objects can be achieved by the formation of an adhesive layer comprising a low adhesive strength type adhesive on one surface of the base film.

The present invention thus provides a removable window film for motor vehicles which comprises a base film and an adhesive layer having removability and low adhesive strength and comprising

a low adhesive strength type adhesive, wherein the adhesive layer is formed on one surface of the base film.

In another aspect, the present invention provides the removable window film for motor vehicles as described above, wherein a metal vapor deposited layer is provided between the base film and the adhesive layer.

In still another aspect, the present invention provides the removable window film for motor vehicles as described above, wherein a colorant is incorporated in the low adhesive strength type adhesive.

In yet another aspect, the present invention provides the removable window film for motor vehicles as described above, wherein an ultraviolet absorbent is incorporated in the low adhesive strength type adhesive.

Further, the present invention provides an adhering method which comprises adhering the removable window film for motor vehicles as described above to a motor vehicle window.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a sectional view of an embodiment of a removable window film for motor vehicles according to the present invention ;

Figure 2 shows a sectional view of another embodiment of a removable window film for motor vehicles according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The adhesive layer of the removable window film for motor vehicle of the present invention comprises a low adhesive strength type adhesive.

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The low adhesive strength type adhesive includes, for example, a polyurethane low adhesive strength type adhesive. The polyurethane low adhesive strength type adhesive includes, for example, a polyurethane elastomer. The polyurethane elastomer is comprised of a soft segment containing a long chain polyol as a main component and a hard segment containing a diisocyanate compound and a chain extension agent. As the long chain polyol includes, polyester polyols or polyether polyols are mainly used. The diisocyanate compound includes tolylene diisocyanate (TDI), diphenylmethane diisocyanate (pure MDI), hexamethylene diisocyanate (HDI), and the like. The chain extension agent includes a low molecular weight polyol, an aromatic diamine, and the like.

The types of the polyurethane elastomer include :

a one component type, in which a thermoplastic polyurethane elastomer produced by polymerizing a long chain polyol and a diisocyanate, such as, TDI, MDI, and the like is diluted with an organic solvent ;

a two component type, in which a curing reaction is carried out by adding a crosslinking agent, such as, a polyisocyanate to a polyurethane elastomer or a prepolymer of the polyurethane elastomer.

Preferable polyisocyanate used as the crosslinking agent is an aliphatic or alicyclic polyisocyanate in view of weathering resistance. Also, the two component type is preferably added with a crosslinking accelerator.

Further, the polyurethane elastomer includes : a moisture curing type, in which an isocyanate is reacted with moisture in air ; and a hot melt type of thermomelting extrusion type.

In addition, the other polyurethane low adhesive strength

type adhesives include, for example, a polyurethane produced by reacting an end isocyanate group-containing prepolymer, which is produced by reacting a mixture of one or more polyols having an average functional group number of 2 to 2.6 with an excess organic diisocyanate, with a mixture of one or more polyols having an average functional group number of 2 or more in equivalent ratio of NCO to OH of about 0.65 to about 1.15, wherein the total of the average functional group number of the polyol mixture and the average functional group number of the polyol mixture as the prepolymer component is more than 4 and less than 5. In the polyurethane, the polyols of the polyol mixture include: propylene glycol, ethylene glycol, polymers produced by additional polymerizing propylene oxide, ethylene oxide or the both oxides to propylene glycol or ethylene glycol; polyether diols, such as, polytetramethylene ether glycol; polyester glycols produced by dehydration condensation of low molecular weight glycols, such as, ethylene glycol, propylene glycol and 1, 4-butane diol, and organic acids, such as, adipic acid and phthalic acid; glycerol, trimethylol propane, pentaerythritol, arabitol, sorbitol and polymers produced by additional polymerizing propylene oxide, ethylene oxide or the both oxides to one or more of them as an initial agent. It is also possible to use polymer polyols produced by polymerizing vinyl monomers, such as, acrylonitrile and styrene in the polyols described above. The organic diisocyanates include: aromatic diisocyanates, such as, 2, 4-tolylenediisocyanate, 2, 6-tolylenediisocyanate, a mixture thereof, crude tolylenediisocyanate, 4, 4'-diphenylmethanediisocyanate, 2, 4'-diphenylmethanediisocyanate, polymethylenepolyphenyl polyisocyanate and 1, 5-naphthylenediisocyanate; aliphatic or alicyclic diisocyanates, such as, hexamethylenediisocyanate, lysinediisocyanate,

isophoronediiisocyanate , 4 , 4 ' - dicyclohexylmethanediisocyanate , isopropylidene bis (cyclohexylisocyanate) and xylidenediisocyanate ; and dimmers, trimmers and carbodiimide modified compounds thereof. Among the organic diisocyanates, the aliphatic or alicyclic diisocyanate is preferred in view of weathering resistance.

Further, the other polyurethane low adhesive strength type adhesives include a polyurethane composed of essentially a polyisocyanate compound and a low molecular weight olefin type polyol which has no polar groups in the molecular skeleton, and has end hydroxyl groups, a number average molecular weight of from about 500 to about 5000, and a number of hydroxyl groups per molecule of from about 1.5 to about 8. The polyisocyanate compounds that can be used include the same as the polyisocyanate compounds described above.

The polyurethane low adhesive strength type adhesives can be used as sole or in a combination of two or more of the polyurethane low adhesive strength type adhesives.

The low adhesive strength type adhesive can be used singly or in a combination of two or more members.

In the present invention, the low adhesive strength means a peel strength of preferably from 1 g/25mm to 50 g/25mm.

A colorant can be incorporated in the above mentioned low adhesive strength type adhesives.

The colorant includes conventional colorants, such as, dyes and pigments. Examples of the colorant include : organic pigments or dyes, such as, phthlocyanine type, azo type, condensed azo type, azo lake type, Hansa type, benzimidazolone type, anthraquinone tpye, diallylide type, perylene type, perynone type, indigo type, thioindigo type, isoindolinone type, azomethineazo type, dioxazine type,

quinacridone type, aniline black type, triphenylmethane type, carbon black type, methine type, quinophthalone type and anthrapyridone type pigments or dyes; and inorganic pigments, such as, oxides, sulfides or sulfates of zinc, lead, titanium, antimony, cadmium, iron, arsenic, magnesium, aluminum, cobalt or chromium, and metal powders. Examples of the inorganic pigments are titanium oxide type, iron oxide type, iron hydroxide type, chromium oxide type, spinel baked type, chromic acid type, chromium vermilion type, Prussian blue type, aluminum powder type and bronze powder type pigments.

When vivid color tone or high transparency is specifically required, dyes or pigments, such as, anthraquinone type, indigo type and diazo type are used. When weathering resistance is required, oxides, sulfides or sulfates of zinc, lead, titanium, antimony, cadmium, iron, arsenic, magnesium, aluminum, cobalt or chromium, or the like are used.

The colorants that can transmit only arbitrary color are preferred, and the colorants that can transmit only blue, brown or gold are specifically preferred.

The amount of the colorant can be selected suitably as coloration degree required.

An ultraviolet absorbing agent can be incorporated in the above mentioned low adhesive strength type adhesives.

The ultraviolet absorbing agents include: for example, benzophenone ultraviolet absorbing agents, such as, 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-octoxybenzophenone, 2, 2'-dihydroxy-4-methoxybenzophenone, 2, 4-dihydroxybenzophenone, 2-hydroxy-4-dodecyloxybenzophenone, 2, 2'-dihydroxy-4, 4'-dimethoxybenzophenone, 2-hydroxy-4-methoxy-5-sulfobenzophenone,

and bis (2-methoxy-4-hydroxy-5-benzoylphenyl) methane; salicylic acid ultraviolet absorbing agents, such as, phenylsalicylate, p-tert-butylphenylsalicylate, and p-octylphenylsalicylate; benzotriazole ultraviolet absorbing agents, such as, 2-(2'-hydroxy-5'-methylphenyl) benzotriazole, 2-(2'-hydroxy-5'-tert-butylphenyl) benzotriazole, 2-(2'-hydroxy-3', 5'-di-tert-butylphenyl) benzotriazole, 2-(2'-hydroxy-3-tert-butyl-5'-methylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3', 5'-di-tert-butylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3', 5'-di-tert-amylphenyl) benzotriazole, 2-{2'-hydroxy-3'-(3", 4", 5", 6"-tetrahydrophthalimidomethyl)-5'-methylphenyl} benzotriazole, and 2,2-methylenebis {4-(1, 1, 3, 3-tetramethylbutyl)-6-(2H-benzotriazole-2-yl)phenol}; cyanoacrylate ultraviolet absorbing agents, such as, 2-ethylhexyl-2-cyano-3, 3'-diphenylacrylate, and ethyl-2-cyano-3, 3'-diphenylacrylate.

The amount of the ultraviolet absorbing agent is preferably in a range between about 0.2 and about 5 parts by weight based on 100 parts by weight of the low adhesive strength type adhesive.

The thickness of the adhesive layer is not limited, but normally in a range between about 5 and about 100 micrometers, preferably in a range between about 10 and about 50 micrometers.

In the removable window film for motor vehicles of the present invention, a metal vapor deposited layer can be provided between the base film and the adhesive layer. The examples of metals used in the metal vapor deposited layers include aluminum, gold, silver, copper, nickel, cobalt, chromium, tin and indium, of which aluminum, gold, silver, and tin are more preferred and aluminum is most preferred.

The thickness of the metal vapor deposited layer is preferably in a range between about 50 and about 300 angstroms.

The base film of the present invention is preferably transparent.

Examples of the base films include films or laminated film of various resins including polyolefin resins, such as, polyethylene and polypropylene, vinyl chloride resins, styrene resins, acrylonitrile-butadiene-styrene resins, polyvinyl alcohol resins, acrylic resins, acrylonitrile - styrene resins, vinylidene chloride resins, acrylonitrile acrylic styrene resins, acrylonitrile ethylen-propylen-terpolymer styrene resins, polyurethane resins, polyvinyl butyral resins, poly - 4 - methylpentene - 1 resins, polybutene - 1 resins, poly (vinylidene fluoride) resins, poly vinyl fluoride resins, fluorin-contained resins, polycarbonate resins , polyamide resins , polyacetal resins , polyphenylene oxide resins, polyester resins, such as, polybutylene terephthalate and polyethylene terephthalate, polyphenylene sulfide resins, polyimide resins, polysulfone resins, polyether sulfone resins, aromatic polyester resins and polyallylate resins. Among these films, polyester resin films, vinyl chloride resin films and polyolefin resin films are preferred and polyester resin films are most preferred. The base films can be oriented in uniaxial or biaxial.

The thickness of the base film can be selected suitably, and normally is in a range between about 5 and about 200 micrometers, preferably in a range between about 10 and about 100 micrometers.

In the removable window film for motor vehicles of the present invention, a release film layer can be provided with for protecting the surface of the adhesive layer. The release film is preferably transparent.

The release film layer is preferably a non-silicone type polyester release film.

The adhesive layer can be provided by various methods,

including, for example, a method in which the above low adhesive strength type adhesive dissolved in a suitable solvent is applied to the base film, a method in which the low adhesive strength type adhesive is applied to the base film by heat melt extrusion method, a method in which the low adhesive strength type adhesive dispersed or emulsified in a suitable medium is applied to the base film, a method in which the low adhesive strength type adhesive without using solvent is applied to the base film, a method in which the low adhesive strength type adhesive is applied by a casting method or with calendar rolls or knives, a method in which an adhesive layer formed on release liner is transferred, and a method in which a double-sided adhesive tape applied with a normal adhesive and the low adhesive strength type adhesive on each sides is overlaid on the base film to contact the normal adhesive and the base film.

If anchoring force between the base film and the adhesive layer is insufficient, the surface of the base film to be coated with the adhesive can be treated with corona discharge or can be preferably provided with a primer layer by applying a primer mainly composed of a polyester resin, a urethane resin, or a chlorinated polyolefin resin and containing a filler, as required. Various fillers can be used for this purpose, including silica, calcium carbonate, magnesium carbonate, kaolin, sintered clay, bentonite, zeolite, talc, and diatomaceous earth.

Since the low adhesive strength type adhesive having removability is used in the removable window film for motor vehicles of the present invention, the removable window film for motor vehicles can be adhered to a glass window having a smooth surface, sufficiently held on the glass window after adhering and easily peeled from the glass window without damaging of the

window film or staining of the glass window in a case of peeling the removable window film for motor vehicles. Further, when the colorant or the ultraviolet absorbing agent is incorporated in the low adhesive strength type adhesive, the removable window film for motor vehicles can efficiently reduce transmittance of ultraviolet light or visible light, as required. Furthermore, when the metal vapor deposited layer is provided between the base film and the adhesive layer in the removable window film for motor vehicles, the removable window film for motor vehicles can reflect ultraviolet light and reduce visible light.

The present invention also provides an adhering method which comprises adhering the removable window films for motor vehicles of the present invention to a glass window of motor vehicles. The preferable embodiments of the adhering method of the present invention can reduce transmittance of ultraviolet light or visible light.

Example 1

Figure 1 shows a sectional view of an embodiment of the removable window film for motor vehicles according to the present invention.

On one surface of a transparent base film 1 (a polyester resin film, having a thickness of 25 micrometers), a homogeneous mixture of 100 parts by weight of a polyether type polyurethane elastomer (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON NT-165EL, concentration: 65 percent by weight), 20 parts by weight of an aliphatic diisocyanate crosslinking agent (a product of DAINIPPON INK & CHEMICALS, INC., trade name: BARNOCK DN-950, concentration: 75 percent by weight) and 3

parts by weight of a crosslinking accelerator (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON AccelT) was applied by a casting method and heat at 100 °C for 12 minutes to form an adhesive layer 2 comprising the polyurethane elastomer and having a thickness of 20 micrometers. And then, a transparent nonsilicone type polyester release film 3 (thickness: 25 micrometer) was provided on the surface of the adhesive layer 2 to obtain a removable window film for motor vehicles.

Example 2

A removable window film for motor vehicles was obtained by the same method as in Example 1 except that a homogeneous mixture of 100 parts by weight of a polyester type polyurethane elastomer (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON 5150S, concentration: 50 percent by weight), 4 parts by weight of an aromatic diisocyanate crosslinking agent (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON NX, concentration: 75 percent by weight) and 3 parts by weight of a crosslinking accelerator (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON Accel HM) was used instead of the homogeneous mixture of Example 1.

Example 3

A removable window film for motor vehicles was obtained by the same method as in Example 1 except that 10 parts by weight of a blue dye (a product of CHUO GOSEI CHEMICAL CO., trade name: Neo Super Liquid Blue C531-L, 1:2 type metal complex dye) based on 100 parts by weight of the polyurethane elastomer was mixed into the polyurethane elastomer of Example 1.

Example 4

A removable window film for motor vehicles was obtained

by the same method as in Example 2 except that 10 parts by weight of a blue dye (a product of Nippon Ciba-Geigy Co., trade name : MICROLITH Blue KP, anthraquinone dye) based on 100 parts by weight of the polyurethane elastomer was mixed into the polyurethane elastomer of Example 2.

Example 5

A removable window film for motor vehicles was obtained by the same method as in Example 1 except that 1.5 parts by weight of a benzophenone type ultraviolet absorbing agent, "2, 4-dihydroxybenzophenone", (a product of KYODO CHEMICALS CO., trade name : BIOSORB 100) based on 100 parts by weight of the polyurethane elastomer was mixed into the polyurethane elastomer of Example 1.

Example 6

A removable window film for motor vehicles was obtained by the same method as in Example 2 except that 1.5 parts by weight of a benzophenone type ultraviolet absorbing agent, "2, 4-dihydroxybenzophenone", (a product of KYODO CHEMICALS CO., trade name : BIOSORB 100) based on 100 parts by weight of the polyurethane elastomer was mixed into the polyurethane elastomer of Example 2.

Example 7

As shown in Figure 2, a metal vapor deposited layer 4 (a thickness of the aluminum vapor deposited layer : 100 angstroms) was formed by the vapor deposition of aluminum on one surface of a transparent base film 1 (a polyester resin film, having a thickness of 25 micrometers). A polyurethane elastomer (a product of DAINIPPON INK & CHEMICALS, INC., trade name : CRISVON 5516S, concentration : 30 percent by weight) was applied on a surface of

the metal vapor deposited layer 4 by a casting method and heat at 100 °C for 12 minutes to form an adhesive layer 2 comprising the polyurethane elastomer and having a thickness of 20 micrometers. And then, a transparent nonsilicone type polyester release film 3 (thickness : 25 micrometer) was provided on the surface of the adhesive layer 2 to obtain a removable window film for motor vehicles.

Example 8

A removable window film for motor vehicles was obtained by the same method as in Example 7 except that a homogeneous mixture of 100 parts by weight of a polyester type polyurethane elastomer (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON 5150S, concentration: 50 percent by weight), 4 parts by weight of an aromatic diisocyanate crosslinking agent (a product of DAINIPPON INK & CHEMICALS, INC., trade name: CRISVON NX, concentration : 75 percent by weight) and 3 parts by weight of a crosslinking accelerator (a product of DAINIPPON INK & CHEMICALS, INC., trade name : CRISVON Accel HM) was used instead of the polyurethane elastomer of Example 7.

The removable window films for motor vehicles obtained in Examples 1 through 8 were adhered to a transparent glass window of a motor vehicle. The removable window films for motor vehicles were sufficiently held on the transparent glass window of a motor vehicle after adhering. And then, the removable window films for motor vehicles were peeled from the transparent glass window of the motor vehicle. The removable window films for motor vehicles were easily peeled without damaging. The glass window was not damaged

and did not have a residue of the low adhesive strength type adhesive.

Test pieces prepared with the removable window films for motor vehicles obtained in Examples 1 through 8 were adhered to a transparent glass plate having a smooth surface and peel strength and holding power of the test pieces were measured. Also, ball tack of the test pieces were measured. The results were shown in Table 1.

Table 1

Example	peel strength (g/25mm)		ball tack	holding power (falling time)
	after 30 minutes of adhesion	after one day		
1	4	4	less than 3	more than 7000 sec.
2	25	28	less than 3	more than 7000 sec.
3	6	7	less than 3	more than 7000 sec.
4	19	19	less than 3	more than 7000 sec.
5	7	8	less than 3	more than 7000 sec.
6	17	25	less than 3	more than 7000 sec.
7	6	8	less than 3	more than 7000 sec.
8	21	24	less than 3	more than 7000 sec.

In measuring the holding power of Table 1, no dislocation of the test pieces of Examples 1 through 8 was observed.

The peel strength, the holding power and the ball tack were measured by the following methods.

(1) peel strength

The peel strength was measured according to a peeling method at 180 degrees, which was provided in Japanese Industrial

Standard Z 0237 (1991) 8.3.1.

(2) ball tack

The ball tack was measured by using a inclined plate having an inclination of 30 degrees according to a incline ball tack test method at 180 degrees, which was provided in Japanese Industrial Standard Z 0237 (1991) 12.

(3) holding power

The holding power was measured according to a holding power test method, which was provided in Japanese Industrial Standard Z 0237 (1991) 11.

The holding power relates to cohesive power or shear resistance. The longer the falling time is, the larger shear resistance is.



What is claimed is :

1. A removable window film for motor vehicles which comprises a base film and an adhesive layer having removability and low adhesive strength and comprising a low adhesive strength type adhesive, wherein the adhesive layer is formed on one surface of the base film.
2. The removable window film for motor vehicles as claimed inclaim 1, wherein a metal vapor deposited layer is provided between the base film and the adhesive layer.
3. The removable window film for motor vehicles as claimed in claims 1 or 2, wherein a colorant is incorporated in the low adhesive strength type adhesive.
4. The removable window film for motor vehicles as claimed in any one of claims 1 through 3, wherein an ultraviolet absorbent is incorporated in the low adhesive strength type adhesive.
5. The removable window film for motor vehicles as claimed in any one of claims 1 through 4, wherein a transparent release film is adhered on a surface of the adhesive layer.
6. An adhering method which comprises adhering the removable window film for motor vehicles as claimed in any one of claims 1 through 5 to a motor vehicle window.

This Sheet Has Been Replaced

