

Description

Title of Invention: SURFACE PROTECTIVE FILM

Technical Field

[0001]

The present invention relates to a surface protective film.

Background Art

[0002]

In a production process for an optical member or an electronic member, a surface protective film is generally bonded to an exposed surface for preventing the surface of any such member from flawing at the time of its processing, assembly, inspection, transportation, or the like. Such surface protective film is peeled from the optical member or the electronic member when the need for surface protection is eliminated (Patent Literature 1).

[0003]

When an attempt is made to peel such surface protective film as described above in the optical member or the electronic member having bonded thereto the surface protective film, it is important that the surface protective film can be smoothly peeled only at its interface with the optical member or the electronic member.

[0004]

However, in the case where the optical member or the electronic member includes a member that is liable to break, such as thin glass or a barrier film, when an attempt is made to peel the bonded surface protective film, even though a related-art surface protective film having light peelability is used, the member that is liable to break may be broken by a peel strength.

[0005]

Accordingly, a surface protective film having peelability lighter than that of the related-art surface protective film having light peelability, that is, ultralight peelability is required.

[0006]

Here, when a large amount of a conventional peeling agent is incorporated into the pressure-sensitive adhesive layer of a surface protective film for reducing a peel strength, some degree of ultralight peelability can be expressed in some cases. However, according to such method, after the peeling of the surface protective film, the surface of an adherend is contaminated by the peeling agent to a large extent. Accordingly, when an attempt is made to bond the surface protective film again, there is a problem in that it becomes difficult to bond the surface protective film owing to the contamination of the surface of the adherend.

[0007]

In addition, the surface protective film bonded to the exposed surface for preventing the surface from flawing at the time of the processing, the assembly, the inspection, the transportation, or the like in the production process for the optical member or the electronic member is often stored while being bonded thereto. In this case, when a related-art surface protective film is stored while being bonded thereto, there is a problem in that its adhesion increases with time to make its peelability heavier.

[0008]

As described above, the surface protective film bonded to the exposed surface for preventing the surface from flawing at the time of the processing, the assembly, the inspection, the transportation, or the like in the production process for the optical member or the electronic member has several points to be improved, that is, such points to be improved as described below: the impartment of ultralight peelability; the achievement of an ability to reduce the property by which the surface of an adherend is contaminated; and the achievement of an ability to suppress the peelability of the film from becoming heavier with time.

Citation List

Patent Literature

[0009]

[PTL 1] 2016-17109 A

Summary of Invention

Technical Problem

[0010]

An object of the present invention is to provide a surface protective film having imparted thereto ultralight peelability, to provide a surface protective film that can reduce the property by which the surface of an adherend is contaminated, and to provide a surface protective film that can suppress its peelability from becoming heavier with time.

Solution to Problem

[0011]

According to one aspect of the present invention, there is provided a surface protective film, including a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.08 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 6,000 mm/min.

[0012]

In one embodiment, the surface protective film has a peel strength of 0.02 N/25 mm or less when a polyethylene terephthalate

film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 300 mm/min.

[0013]

According to one aspect of the present invention, there is provided a surface protective film, including a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.35 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 6,000 mm/min.

[0014]

In one embodiment, the surface protective film has a peel strength of 0.07 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 300 mm/min.

[0015]

According to one aspect of the present invention, there is

provided a surface protective film, including a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.135 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 6,000 mm/min.

[0016]

In one embodiment, the surface protective film has a peel strength of 0.023 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 300 mm/min.

[0017]

According to one aspect of the present invention, there is provided a surface protective film, including a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.35 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 6,000 mm/min.

[0018]

In one embodiment, the surface protective film has a peel strength of 0.05 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 300 mm/min.

[0019]

In one embodiment, the surface protective film of the present invention has a residual adhesion ratio of 50% or more.

[0020]

In one embodiment, a pressure-sensitive adhesive forming the pressure-sensitive adhesive layer is formed of a pressure-sensitive adhesive composition, and the pressure-sensitive adhesive composition contains a base polymer and a silicone-based additive and/or a fluorine-based additive.

[0021]

In one embodiment, the silicone-based additive includes at least one kind selected from a siloxane bond-containing compound, a hydroxyl group-containing silicone-based compound, and a cross-linkable functional group-containing silicone-based

compound.

[0022]

In one embodiment, the fluorine-based additive includes at least one kind selected from a fluorine-containing compound, a hydroxyl group-containing fluorine-based compound, and a cross-linkable functional group-containing fluorine-based compound.

[0023]

In one embodiment, the base polymer includes at least one kind selected from a urethane-based resin, an acrylic resin, a rubber-based resin, and a silicone-based resin.

[0024]

In one embodiment, the urethane-based resin includes a urethane-based resin formed of a composition containing a polyol (A) and a polyfunctional isocyanate compound (B).

[0025]

In one embodiment, the urethane-based resin includes a urethane-based resin formed of a composition containing a urethane prepolymer (C) and a polyfunctional isocyanate compound (B).

[0026]

In one embodiment, the pressure-sensitive adhesive composition contains a fatty acid ester.

[0027]

An optical member of the present invention includes the surface protective film of the present invention bonded thereto.

[0028]

An electronic member of the present invention includes the surface protective film of the present invention bonded thereto.

Advantageous Effects of Invention

[0029]

According to the present invention, the surface protective film that has ultralight peelability, that has a low property by which the surface of an adherend is contaminated and that can suppress its peelability from becoming heavier with time can be provided.

Brief Description of Drawings

[0030]

FIG. 1 is a schematic sectional view of a surface protective film according to one embodiment of the present invention.

Description of Embodiments

[0031]

<<<<Surface Protective Film>>>>

A surface protective film of the present invention includes a pressure-sensitive adhesive layer. The surface protective film of the present invention may include any appropriate other member to the extent that the effects of the present invention are not impaired as long as the film includes the pressure-sensitive adhesive layer. The surface protective film of the present invention typically includes a base material layer and the pressure-sensitive adhesive layer.

[0032]

FIG. **1** is a schematic sectional view of the surface protective film according to one embodiment of the present invention. In FIG. **1**, a surface protective film **10** includes a base material layer **1** and a pressure-sensitive adhesive layer **2**. In FIG. **1**, the base material layer **1** and the pressure-sensitive adhesive layer **2** are directly laminated.

[0033]

In FIG. **1**, any appropriate release liner (not shown) may be arranged on the surface of the pressure-sensitive adhesive layer **2** opposite to the base material layer **1** for, for example, protecting the film until the film is used. Examples of the release liner include: a release liner obtained by subjecting the surface of a base material (liner base material), such as paper or a plastic

film, to a silicone treatment; and a release liner obtained by laminating a polyolefin-based resin on the surface of a base material (liner base material), such as paper or a plastic film. Examples of the plastic film serving as the liner base material include a polyethylene film, a polypropylene film, a polybutene film, a polybutadiene film, a polymethylpentene film, a polyvinyl chloride film, a vinyl chloride copolymer film, a polyethylene terephthalate film, a polybutylene terephthalate film, a polyurethane film, and an ethylene-vinyl acetate copolymer film. The plastic film serving as the liner base material is preferably a polyethylene film.

[0034]

The thickness of the release liner is preferably from 1 μm to 500 μm , more preferably from 3 μm to 450 μm , still more preferably from 5 μm to 400 μm , particularly preferably from 10 μm to 300 μm .

[0035]

The thickness of the surface protective film is preferably from 5 μm to 500 μm , more preferably from 10 μm to 450 μm , still more preferably from 15 μm to 400 μm , particularly preferably from 20 μm to 300 μm .

[0036]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.08 N/25

mm or less, more preferably 0.075 N/25 mm or less, still more preferably 0.07 N/25 mm or less, still more preferably 0.065 N/25 mm or less, particularly preferably 0.06 N/25 mm or less, most preferably 0.055 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μ m is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 6,000 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength at a peel rate of 6,000 mm/min, which is an extremely high peel rate, falls within the range, the surface protective film of the present invention can express extremely excellent ultralight peelability. Details about the measurement of the peel strength are described later.

[0037]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.02 N/25 mm or less, more preferably 0.018 N/25 mm or less, still more preferably 0.015 N/25 mm or less, particularly preferably 0.012 N/25 mm or less, most preferably 0.01 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μ m is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel

rate of 300 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength falls within the range, the surface protective film of the present invention can express ultralight peelability. Details about the measurement of the peel strength are described later.

[0038]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.35 N/25 mm or less, more preferably 0.33 N/25 mm or less, still more preferably 0.3 N/25 mm or less, still more preferably 0.27 N/25 mm or less, particularly preferably 0.25 N/25 mm or less, most preferably 0.23 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 6,000 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength after the standing at 80°C for 7 days falls within the range, the peelability of the surface protective film of the present invention can be sufficiently suppressed from becoming heavier with time. Details about the measurement of the peel strength are described later.

[0039]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.07 N/25 mm or less, more preferably 0.06 N/25 mm or less, still more preferably 0.05 N/25 mm or less, particularly preferably 0.045 N/25 mm or less, most preferably 0.04 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 300 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength falls within the range, the peelability of the surface protective film of the present invention can be suppressed from becoming heavier with time. Details about the measurement of the peel strength are described later.

[0040]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.135 N/25 mm or less, more preferably 0.1 N/25 mm or less, still more preferably 0.07 N/25 mm or less, still more preferably 0.065 N/25 mm or less, particularly preferably 0.06 N/25 mm or less, most preferably 0.055 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and

a peel rate of 6,000 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength at a peel rate of 6,000 mm/min, which is an extremely high peel rate, falls within the range, the surface protective film of the present invention can express extremely excellent ultralight peelability. Details about the measurement of the peel strength are described later.

[0041]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.023 N/25 mm or less, more preferably 0.022 N/25 mm or less, still more preferably 0.02 N/25 mm or less, particularly preferably 0.015 N/25 mm or less, most preferably 0.013 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 300 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength falls within the range, the surface protective film of the present invention can express ultralight peelability. Details about the measurement of the peel strength are described later.

[0042]

The surface protective film according to one embodiment of

the present invention has a peel strength of preferably 0.35 N/25 mm or less, more preferably 0.3 N/25 mm or less, still more preferably 0.25 N/25 mm or less, still more preferably 0.2 N/25 mm or less, particularly preferably 0.15 N/25 mm or less, most preferably 0.1 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 6,000 mm/min. In reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength after the standing at 80°C for 7 days falls within the range, the peelability of the surface protective film of the present invention can be sufficiently suppressed from becoming heavier with time. Details about the measurement of the peel strength are described later.

[0043]

The surface protective film according to one embodiment of the present invention has a peel strength of preferably 0.05 N/25 mm or less, more preferably 0.045 N/25 mm or less, still more preferably 0.04 N/25 mm or less, particularly preferably 0.035 N/25 mm or less, most preferably 0.03 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 300 mm/min. In

reality, a lower limit for the peel strength is 0.001 N/25 mm or more. When the peel strength falls within the range, the peelability of the surface protective film of the present invention can be suppressed from becoming heavier with time. Details about the measurement of the peel strength are described later.

[0044]

The surface protective film of the present invention has a residual adhesion ratio of preferably 50% or more, more preferably from 55% to 100%, still more preferably from 60% to 100%, particularly preferably from 65% to 100%, most preferably from 70% to 100%. When the residual adhesion ratio falls within the range, the surface protective film of the present invention can express the following effect: the property by which the surface of an adherend is contaminated is low. Details about the measurement of the residual adhesion ratio are described later.

[0045]

The surface protective film of the present invention may be produced by any appropriate method. Such production may be performed in conformity with any appropriate production method, such as:

- (1) a method involving applying a solution or thermally molten liquid of a formation material for the pressure-sensitive adhesive layer onto the base material layer;
- (2) a method involving applying the solution or thermally molten

liquid of the formation material for the pressure-sensitive adhesive layer onto a separator to form the pressure-sensitive adhesive layer, and transferring the layer onto the base material layer;

(3) a method involving extruding the formation material for the pressure-sensitive adhesive layer onto the base material layer to form and apply the pressure-sensitive adhesive layer;

(4) a method involving extruding the base material layer and the pressure-sensitive adhesive layer in two layers or a plurality of layers;

(5) a method involving laminating the pressure-sensitive adhesive layer alone on the base material layer, or a method involving subjecting the pressure-sensitive adhesive layer to two-layer lamination together with a lamination layer; and

(6) a method involving subjecting the pressure-sensitive adhesive layer and a formation material for the base material layer, such as a film or the lamination layer, to two-layer or multilayer lamination.

[0046]

As a method for the application, there may be used, for example, a roll coater method, a comma coater method, a die coater method, a reverse coater method, a silk screen method, and a gravure coater method.

[0047]

<<Base Material Layer>>

The base material layer may be formed of a single layer, or may be formed of two or more layers. The base material layer may be stretched.

[0048]

The thickness of the base material layer is preferably from 4 μm to 450 μm , more preferably from 8 μm to 400 μm , still more preferably from 12 μm to 350 μm , particularly preferably from 16 μm to 250 μm .

[0049]

For the purpose of, for example, forming a winding body that can be easily rewound, for example, the surface of the base material layer on which the pressure-sensitive adhesive layer is not arranged may be subjected to a release treatment through the addition of a fatty acid amide, polyethyleneimine, a long-chain alkyl-based additive, or the like to the base material layer, or a coat layer formed of any appropriate peeling agent, such as a silicone-, long-chain alkyl-, or fluorine-based peeling agent, may be arranged thereon.

[0050]

Any appropriate material may be adopted as a material for the base material layer depending on applications. Examples thereof

include a plastic, paper, a metal film, and a nonwoven fabric. Of those, a plastic is preferred. That is, the base material layer is preferably a plastic film. The base material layer may include one kind of material, or may include two or more kinds of materials. For example, the layer may include two or more kinds of plastics.

[0051]

Examples of the plastic include a polyester-based resin, a polyamide-based resin, and a polyolefin-based resin. Examples of the polyester-based resin include polyethylene terephthalate, polybutylene terephthalate, and polyethylene naphthalate. Examples of the polyolefin-based resin include a homopolymer of an olefin monomer and a copolymer of an olefin monomer. Specific examples of the polyolefin-based resin include: homo-polypropylene; a propylene-based copolymer using an ethylene component as a copolymerization component, such as a block-, random-, or graft-based copolymer; a reactor TPO; an ethylene-based polymer, such as a low-density, high-density, linear and low-density, or ultralow-density polymer; and an ethylene-based copolymer, such as an ethylene-propylene copolymer, an ethylene-vinyl acetate copolymer, an ethylene-methyl acrylate copolymer, an ethylene-ethyl acrylate copolymer, an ethylene-butyl acrylate copolymer, an ethylene-methacrylic acid copolymer, or an ethylene-methyl methacrylate copolymer.

[0052]

The base material layer may contain any appropriate additive as required. Examples of the additive that may be incorporated into the base material layer include an antioxidant, a UV absorbing agent, a light stabilizer, an antistatic agent, a filler, and a pigment. The kinds, number, and amount of the additives that may be incorporated into the base material layer may be appropriately set depending on purposes. In particular, when the material for the base material layer is a plastic, several of the additives are preferably incorporated for the purpose of, for example, deterioration prevention. From the viewpoint of, for example, an improvement in weatherability, particularly preferred examples of the additive include an antioxidant, a UV absorbing agent, a light stabilizer, and a filler.

[0053]

Any appropriate antioxidant may be adopted as the antioxidant. Examples of such antioxidant include a phenol-based antioxidant, a phosphorus-based processing heat stabilizer, a lactone-based processing heat stabilizer, a sulfur-based heat stabilizer, and a phenol-phosphorus-based antioxidant. The content of the antioxidant is preferably 1 wt% or less, more preferably 0.5 wt% or less, still more preferably from 0.01 wt% to 0.2 wt% with respect to the base resin of the base material layer (when the base material layer is a blend, the blend is the base resin).

[0054]

Any appropriate UV absorbing agent may be adopted as the UV absorbing agent. Examples of such UV absorbing agent include a benzotriazole-based UV absorbing agent, a triazine-based UV absorbing agent, and a benzophenone-based UV absorbing agent. The content of the UV absorbing agent is preferably 2 wt% or less, more preferably 1 wt% or less, still more preferably from 0.01 wt% to 0.5 wt% with respect to the base resin forming the base material layer (when the base material layer is a blend, the blend is the base resin).

[0055]

Any appropriate light stabilizer may be adopted as the light stabilizer. Examples of such light stabilizer include a hindered amine-based light stabilizer and a benzoate-based light stabilizer. The content of the light stabilizer is preferably 2 wt% or less, more preferably 1 wt% or less, still more preferably from 0.01 wt% to 0.5 wt% with respect to the base resin forming the base material layer (when the base material layer is a blend, the blend is the base resin).

[0056]

Any appropriate filler may be adopted as the filler. Examples of such filler include inorganic fillers. Specific examples of the

inorganic fillers include carbon black, titanium oxide, and zinc oxide. The content of the filler is preferably 20 wt% or less, more preferably 10 wt% or less, still more preferably from 0.01 wt% to 10 wt% with respect to the base resin forming the base material layer (when the base material layer is a blend, the blend is the base resin).

[0057]

Preferred examples of the additive further include inorganic, low-molecular-weight, and high-molecular-weight antistatic agents, such as a surfactant, an inorganic salt, a polyhydric alcohol, a metal compound, and carbon, intended to impart an antistatic property. Of those, a high-molecular-weight antistatic agent and carbon are preferred from the viewpoints of contamination and the maintenance of pressure-sensitive adhesiveness.

[0058]

<<Pressure-sensitive Adhesive Layer>>

The pressure-sensitive adhesive layer may be manufactured by any appropriate manufacturing method. An example of such manufacturing method is a method involving applying a composition that is a material for forming the pressure-sensitive adhesive layer onto the base material layer to form the pressure-sensitive adhesive layer on the base material layer. Examples of such application method include roll coating, gravure coating, reverse coating, roll

brushing, spray coating, air knife coating, and extrusion coating with a die coater.

[0059]

The thickness of the pressure-sensitive adhesive layer is preferably from 1 μm to 150 μm , more preferably from 2 μm to 140 μm , still more preferably from 3 μm to 130 μm , still more preferably from 4 μm to 120 μm , still more preferably from 5 μm to 100 μm , still more preferably from 10 μm to 90 μm , particularly preferably from 20 μm to 85 μm , most preferably from 30 μm to 80 μm .

[0060]

The pressure-sensitive adhesive layer includes a pressure-sensitive adhesive. The pressure-sensitive adhesive is formed of a pressure-sensitive adhesive composition.

[0061]

The pressure-sensitive adhesive composition preferably contains a base polymer and a silicone-based additive and/or a fluorine-based additive.

[0062]

The content of the silicone-based additive and/or the fluorine-based additive in the pressure-sensitive adhesive composition is preferably from 0.01 part by weight to 50 parts by

weight, more preferably from 0.02 part by weight to 25 parts by weight, still more preferably from 0.025 part by weight to 10 parts by weight, particularly preferably from 0.03 part by weight to 5 parts by weight, most preferably from 0.05 part by weight to 3 parts by weight in terms of the total amount of the silicone-based additive and the fluorine-based additive with respect to 100 parts by weight of the base polymer. When the content of the silicone-based additive and/or the fluorine-based additive in the pressure-sensitive adhesive composition falls within the range, the surface protective film of the present invention can express higher ultralight peelability, and can further reduce the property by which the surface of an adherend is contaminated.

[0063]

<Base Polymer>

The base polymer is preferably at least one kind selected from a urethane-based resin, an acrylic resin, a rubber-based resin, and a silicone-based resin. The base polymer is more preferably the urethane-based resin or the acrylic resin because the effects of the present invention can be further expressed.

[0064]

[Urethane-based Resin]

Any appropriate urethane-based resin may be adopted as the urethane-based resin to the extent that the effects of the present

invention are not impaired. The urethane-based resin is preferably a urethane-based resin formed of a composition containing a polyol (A) and a polyfunctional isocyanate compound (B), or a urethane-based resin formed of a composition containing a urethane prepolymer (C) and the polyfunctional isocyanate compound (B). When such resin as described above is adopted as the urethane-based resin, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0065]

The urethane-based resin may contain any appropriate component to the extent that the effects of the present invention are not impaired. Examples of such component include a resin component other than the urethane-based resin, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0066]

The urethane-based resin preferably contains a deterioration-preventing agent, such as an antioxidant, a UV absorbing agent, or a light stabilizer. When the urethane-based

resin contains the deterioration-preventing agent, the surface protective film can be excellent in adhesive residue-preventing property. Specifically, even when the surface protective film is stored in a warmed state after having been bonded to an adherend, an adhesive residue hardly occurs on the adherend. The number of kinds of the deterioration-preventing agents may be only one, or may be two or more. The deterioration-preventing agent is particularly preferably an antioxidant.

[0067]

Examples of the antioxidant include a radical chain inhibitor and a peroxide decomposer.

[0068]

Examples of the radical chain inhibitor include a phenol-based antioxidant and an amine-based antioxidant.

[0069]

Examples of the peroxide decomposer include a sulfur-based antioxidant and a phosphorus-based antioxidant.

[0070]

Examples of the phenol-based antioxidant include a monophenol-based antioxidant, a bisphenol-based antioxidant, and a high-molecular-weight phenol-based antioxidant.

[0071]

Examples of the monophenol-based antioxidant include 2,6-di-t-butyl-p-cresol, butylated hydroxyanisole, 2,6-di-t-butyl-4-ethylphenol, and stearin- β -(3,5-di-t-butyl-4-hydroxyphenyl)propionate.

[0072]

Examples of the bisphenol-based antioxidant include 2,2'-methylenebis(4-methyl-6-t-butylphenol), 2,2'-methylenebis(4-ethyl-6-t-butylphenol), 4,4'-thiobis(3-methyl-6-t-butylphenol), 4,4'-butylidenebis(3-methyl-6-t-butylphenol), and 3,9-bis[1,1-dimethyl-2- $[\beta$ -(3-t-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]2,4,8,10-tetraoxaspiro[5.5]undecane.

[0073]

Examples of the high-molecular-weight phenol-based antioxidant include 1,1,3-tris(2-methyl-4-hydroxy-5-t-butylphenyl)butane, 1,3,5-trimethyl-2,4,6-tris(3,5-di-t-butyl-4-hydroxybenzyl)benzene, tetrakis-[methylene-3-(3',5'-di-t-butyl-4'-hydroxyphenyl)propionate]methane, bis[3,3'-bis-(4'-hydroxy-3'-t-butylphenyl)butyric acid] glycol

ester,

1,3,5-tris(3',5'-di-t-butyl-4'-hydroxybenzyl)-S-triazine-2,4,6-(1H,3H,5H)trione, and tocopherol.

[0074]

Examples of the sulfur-based antioxidant include dilauryl 3,3'-thiodipropionate, dimyristyl 3,3'-thiodipropionate, and distearyl 3,3'-thiodipropionate.

[0075]

Examples of the phosphorus-based antioxidant include triphenyl phosphite, diphenyl isodecyl phosphite, and phenyl diisodecyl phosphite.

[0076]

Examples of the UV absorbing agent include a benzophenone-based UV absorbing agent, a benzotriazole-based UV absorbing agent, a salicylic acid-based UV absorbing agent, an oxalic anilide-based UV absorbing agent, a cyanoacrylate-based UV absorbing agent, and a triazine-based UV absorbing agent.

[0077]

Examples of the benzophenone-based UV absorbing agent include 2,4-dihydroxybenzophenone, 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-octoxybenzophenone,

2-hydroxy-4-dodecyloxybenzophenone,
 2,2'-dihydroxy-4-dimethoxybenzophenone,
 2,2'-dihydroxy-4,4'-dimethoxybenzophenone,
 2-hydroxy-4-methoxy-5-sulfobenzophenone, and
 bis(2-methoxy-4-hydroxy-5-benzoylphenyl)methane.

[0078]

Examples of the benzotriazole-based UV absorbing agent include
 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-4'-octoxyphenyl)benzotriazole,
 2-[2'-hydroxy-3'-(3'',4'',5'',6''-tetrahydrophthalimidomethyl)-5'-methylphenyl]benzotriazole,
 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-(2H-benzotriazol-2-yl)phenol], and
 2-(2'-hydroxy-5'-methacryloxyphenyl)-2H-benzotriazole.

[0079]

Examples of the salicylic acid-based UV absorbing agent include
 phenyl salicylate, p-tert-butylphenyl salicylate, and

p-octylphenyl salicylate.

[0080]

Examples of the cyanoacrylate-based UV absorbing agent include 2-ethylhexyl-2-cyano-3,3'-diphenyl acrylate and ethyl-2-cyano-3,3'-diphenyl acrylate.

[0081]

Examples of the light stabilizer include a hindered amine-based light stabilizer and a UV stabilizer.

[0082]

Examples of the hindered amine-based light stabilizer may include bis(2,2,6,6-tetramethyl-4-piperidyl) sebacate, bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate, and methyl-1,2,2,6,6-pentamethyl-4-piperidyl sebacate.

[0083]

Examples of the UV stabilizer include nickel bis(octylphenyl) sulfide, [2,2'-thiobis(4-tert-octylphenolate)]-n-butylamine nickel, nickel complex-3,5-di-tert-butyl-4-hydroxybenzyl-phosphoric acid monoethylate, a benzoate-type quencher, and nickel dibutyldithiocarbamate.

[0084]

(Urethane-based Resin formed of Composition containing Polyol (A) and Polyfunctional Isocyanate Compound (B))

Specifically, the urethane-based resin formed of the composition containing the polyol (A) and the polyfunctional isocyanate compound (B) is preferably a urethane-based resin obtained by curing the composition containing the polyol (A) and the polyfunctional isocyanate compound (B).

[0085]

The number of kinds of the polyols (A) may be only one, or may be two or more.

[0086]

The number of kinds of the polyfunctional isocyanate compounds (B) may be only one, or may be two or more.

[0087]

Preferred examples of the polyol (A) include a polyester polyol, a polyether polyol, a polycaprolactone polyol, a polycarbonate polyol, and a castor oil-based polyol. The polyol (A) is more preferably a polyether polyol.

[0088]

The polyester polyol may be obtained by, for example, an

esterification reaction between a polyol component and an acid component.

[0089]

Examples of the polyol component include ethylene glycol, diethylene glycol, 1,3-butanediol, 1,4-butanediol, neopentyl glycol, 3-methyl-1,5-pentanediol, 2-butyl-2-ethyl-1,3-propanediol, 2,4-diethyl-1,5-pentanediol, 1,2-hexanediol, 1,6-hexanediol, 1,8-octanediol, 1,9-nonanediol, 2-methyl-1,8-octanediol, 1,8-decanediol, octadecanediol, glycerin, trimethylolpropane, pentaerythritol, hexanetriol, and polypropylene glycol. Examples of the acid component include succinic acid, methylsuccinic acid, adipic acid, pimelic acid, azelaic acid, sebacic acid, 1,12-dodecanedioic acid, 1,14-tetradecanedioic acid, a dimer acid, 2-methyl-1,4-cyclohexanedicarboxylic acid, 2-ethyl-1,4-cyclohexanedicarboxylic acid, terephthalic acid, isophthalic acid, phthalic acid, isophthalic acid, terephthalic acid, 1,4-naphthalenedicarboxylic acid, and 4,4'-biphenyldicarboxylic acid, and acid anhydrides thereof.

[0090]

An example of the polyether polyol is a polyether polyol obtained by the addition polymerization of an alkylene oxide, such as ethylene oxide, propylene oxide, or butylene oxide, with water,

a low-molecular-weight polyol (e.g., propylene glycol, ethylene glycol, glycerin, trimethylolpropane, or pentaerythritol), a bisphenol (e.g., bisphenol A), a dihydroxybenzene (e.g., catechol, resorcin, and hydroquinone), or the like serving as an initiator. Specific examples thereof include polyethylene glycol, polypropylene glycol, and polytetramethylene glycol.

[0091]

An example of the polycaprolactone polyol is a caprolactone-based polyester diol obtained by the ring-opening polymerization of a cyclic ester monomer, such as ϵ -caprolactone or σ -valerolactone.

[0092]

Examples of the polycarbonate polyol include: a polycarbonate polyol obtained by the polycondensation reaction of the polyol component and phosgene; a polycarbonate polyol obtained by the transesterification condensation of the polyol component and a carbonate diester, such as dimethyl carbonate, diethyl carbonate, dipropyl carbonate, diisopropyl carbonate, dibutyl carbonate, ethyl butyl carbonate, ethylene carbonate, propylene carbonate, diphenyl carbonate, or dibenzyl carbonate; a copolymerized polycarbonate polyol obtained by using two or more kinds of the polyol components in combination; a polycarbonate polyol obtained by the esterification reaction of any of the various polycarbonate polyols

and a carboxyl group-containing compound; a polycarbonate polyol obtained by the etherification reaction of any of the various polycarbonate polyols and a hydroxyl group-containing compound; a polycarbonate polyol obtained by the transesterification reaction of any of the various polycarbonate polyols and an ester compound; a polycarbonate polyol obtained by the transesterification reaction of any of the various polycarbonate polyols and a hydroxyl group-containing compound; a polyester-based polycarbonate polyol obtained by the polycondensation reaction of any of the various polycarbonate polyols and a dicarboxylic acid compound; and a copolymerized polyether-based polycarbonate polyol obtained by the copolymerization of any of the various polycarbonate polyols and an alkylene oxide.

[0093]

The castor oil-based polyol is, for example, a castor oil-based polyol obtained by causing a castor oil fatty acid and the polyol component to react with each other. The castor oil-based polyol is specifically, for example, a castor oil-based polyol obtained by causing the castor oil fatty acid and polypropylene glycol to react with each other.

[0094]

The number-average molecular weight M_n of the polyol (A) is preferably from 300 to 100,000, more preferably from 400 to 75,000,

still more preferably from 450 to 50,000, particularly preferably from 500 to 30,000. When the number-average molecular weight M_n of the polyol (A) is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0095]

The polyol (A) preferably contains a polyol (A1) having 3 OH groups and having a number-average molecular weight M_n of from 300 to 100,000. The number of kinds of the polyols (A1) may be only one, or may be two or more.

[0096]

The content of the polyol (A1) in the polyol (A) is preferably 5 wt% or more, more preferably from 25 wt% to 100 wt%, still more preferably from 50 wt% to 100 wt%. When the content of the polyol (A1) in the polyol (A) is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0097]

The number-average molecular weight M_n of the polyol (A1) is preferably from 1,000 to 100,000, more preferably from 1,200 to

80,000, still more preferably from 1,500 to 70,000, still more preferably from 1,750 to 50,000, particularly preferably from 1,750 to 40,000, most preferably from 2,000 to 30,000. When the number-average molecular weight M_n of the polyol (A1) is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0098]

The polyol (A) may contain a polyol (A2) having 3 or more OH groups and having a number-average molecular weight M_n of 20,000 or less. The number of kinds of the polyols (A2) may be only one, or may be two or more. The number-average molecular weight M_n of the polyol (A2) is preferably from 100 to 20,000, more preferably from 150 to 10,000, still more preferably from 200 to 7,500, particularly preferably from 300 to 6,000, most preferably from 300 to 5,000. When the number-average molecular weight M_n of the polyol (A2) deviates from the range, in particular, the property by which the pressure-sensitive adhesive strength of the surface protective film increases with time may become higher, and hence the film may be unable to express excellent reworkability. Preferred examples of the polyol (A2) include a polyol having 3 OH groups (triol), a polyol having 4 OH groups (tetraol), a polyol having 5 OH groups (pentaol), and a polyol having 6 OH groups (hexaol).

[0099]

The total amount of at least one kind of the polyol having 4 OH groups (tetraol), the polyol having 5 OH groups (pentaol), and the polyol having 6 OH groups (hexaol) serving as the polyol (A2) is preferably 70 wt% or less, more preferably 60 wt% or less, still more preferably 40 wt% or less, particularly preferably 30 wt% or less in terms of a content in the polyol (A). When the content of at least one kind of the polyol having 4 OH groups (tetraol), the polyol having 5 OH groups (pentaol), and the polyol having 6 OH groups (hexaol) serving as the polyol (A2) in the polyol (A) is adjusted within the range, a urethane-based resin excellent in transparency can be provided. In addition, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0100]

The content of the polyol (A2) in the polyol (A) is preferably 95 wt% or less, more preferably from 0 wt% to 75 wt%. When the content of the polyol (A2) in the polyol (A) is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0101]

The content of a polyol having 4 or more OH groups and having a number-average molecular weight M_n of 20,000 or less in the polyol (A2) is preferably less than 70 wt%, more preferably 60 wt% or less, still more preferably 50 wt% or less, particularly preferably 40 wt% or less, most preferably 30 wt% or less with respect to the entirety of the polyol (A). When the content of the polyol having 4 or more OH groups and having a number-average molecular weight M_n of 20,000 or less in the polyol (A2) is adjusted within the range, a urethane-based resin excellent in transparency can be provided. In addition, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0102]

The number of kinds of the polyfunctional isocyanate compounds (B) may be only one, or may be two or more.

[0103]

Any appropriate polyfunctional isocyanate compound that may be used in a urethanation reaction may be adopted as the polyfunctional isocyanate compound (B). Examples of such polyfunctional isocyanate compound (B) include a polyfunctional aliphatic isocyanate compound, a polyfunctional alicyclic isocyanate compound, and a polyfunctional aromatic isocyanate compound.

[0104]

Examples of the polyfunctional aliphatic isocyanate compound include trimethylene diisocyanate, tetramethylene diisocyanate, hexamethylene diisocyanate, pentamethylene diisocyanate, 1,2-propylene diisocyanate, 1,3-butylene diisocyanate, dodecamethylene diisocyanate, and 2,4,4-trimethylhexamethylene diisocyanate.

[0105]

Examples of the polyfunctional alicyclic isocyanate compound include 1,3-cyclopentene diisocyanate, 1,3-cyclohexane diisocyanate, 1,4-cyclohexane diisocyanate, isophorone diisocyanate, hydrogenated diphenylmethane diisocyanate, hydrogenated xylylene diisocyanate, hydrogenated tolylene diisocyanate, and hydrogenated tetramethylxylylene diisocyanate.

[0106]

Examples of the polyfunctional aromatic diisocyanate compound include phenylene diisocyanate, 2,4-tolylene diisocyanate, 2,6-tolylene diisocyanate, 2,2'-diphenylmethane diisocyanate, 4,4'-diphenylmethane diisocyanate, 4,4'-toluidine diisocyanate, 4,4'-diphenyl ether diisocyanate, 4,4'-diphenyl diisocyanate, 1,5-naphthalene diisocyanate, and xylylene diisocyanate.

[0107]

Other examples of the polyfunctional isocyanate compound (B) include trimethylolpropane adducts of such various polyfunctional isocyanate compounds as described above, biurets thereof obtained through their reactions with water, and trimers thereof each having an isocyanurate ring. In addition, the compounds may be used in combination.

[0108]

An equivalent ratio "NCO group/OH group" between NCO groups and OH groups in the polyol (A) and the polyfunctional isocyanate compound (B) is preferably 5.0 or less, more preferably from 0.1 to 3.0, still more preferably from 0.2 to 2.5, particularly preferably from 0.3 to 2.25, most preferably from 0.5 to 2.0. When the equivalent ratio "NCO group/OH group" is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0109]

With regard to the content of the polyfunctional isocyanate compound (B), the polyfunctional isocyanate compound (B) is incorporated at preferably from 1.0 wt% to 30 wt%, more preferably from 1.5 wt% to 27 wt%, still more preferably from 2.0 wt% to 25 wt%, particularly preferably from 2.3 wt% to 23 wt%, most preferably from 2.5 wt% to 20 wt% with respect to the polyol (A). When the

content of the polyfunctional isocyanate compound (B) is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0110]

Specifically, the polyurethane-based resin is preferably formed by curing a composition containing the polyol (A) and the polyfunctional isocyanate compound (B).

[0111]

Any appropriate method, such as a urethane-forming reaction method involving using bulk polymerization, solution polymerization, or the like, may be adopted as a method of forming the urethane-based resin by curing the composition containing the polyol (A) and the polyfunctional isocyanate compound (B) to the extent that the effects of the present invention are not impaired.

[0112]

In order to cure the composition containing the polyol (A) and the polyfunctional isocyanate compound (B), a catalyst is preferably used. Examples of such catalyst include an organometallic compound and a tertiary amine compound.

[0113]

Examples of the organometallic compound may include an iron-based compound, a tin-based compound, a titanium-based compound, a zirconium-based compound, a lead-based compound, a cobalt-based compound, and a zinc-based compound. Of those, an iron-based compound and a tin-based compound are preferred from the viewpoints of a reaction rate and the pot life of the pressure-sensitive adhesive layer.

[0114]

Examples of the iron-based compound include iron acetylacetonate and iron 2-ethylhexanoate.

[0115]

Examples of the tin-based compound include dibutyltin dichloride, dibutyltin oxide, dibutyltin dibromide, dibutyltin maleate, dibutyltin dilaurate, dibutyltin diacetate, dibutyltin sulfide, tributyltin methoxide, tributyltin acetate, triethyltin ethoxide, tributyltin ethoxide, dioctyltin oxide, dioctyltin dilaurate, tributyltin chloride, tributyltin trichloroacetate, and tin 2-ethylhexanoate.

[0116]

Examples of the titanium-based compound include dibutyltitanium dichloride, tetrabutyl titanate, and butoxytitanium trichloride.

[0117]

Examples of the zirconium-based compound include zirconium naphthenate and zirconium acetylacetonate.

[0118]

Examples of the lead-based compound include lead oleate, lead 2-ethylhexanoate, lead benzoate, and lead naphthenate.

[0119]

Examples of the cobalt-based compound include cobalt 2-ethylhexanoate and cobalt benzoate.

[0120]

Examples of the zinc-based compound include zinc naphthenate and zinc 2-ethylhexanoate.

[0121]

Examples of the tertiary amine compound include triethylamine, triethylenediamine, and 1,8-diazabicyclo[5.4.0]undecene-7.

[0122]

The number of kinds of the catalysts may be only one, or may be two or more. In addition, the catalyst may be used in combination with a cross-linking retardant or the like. The amount of the

catalyst is preferably from 0.005 wt% to 1.00 wt%, more preferably from 0.01 wt% to 0.75 wt%, still more preferably from 0.01 wt% to 0.50 wt%, particularly preferably from 0.01 wt% to 0.20 wt% with respect to the polyol (A). When the amount of the catalyst is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0123]

The composition containing the polyol (A) and the polyfunctional isocyanate compound (B) may contain any appropriate other component to the extent that the effects of the present invention are not impaired. Examples of such other component include a resin component other than the polyurethane-based resin, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0124]

(Urethane-based Resin formed of Composition containing Urethane Prepolymer (C) and Polyfunctional Isocyanate Compound (B))

Any appropriate urethane-based resin may be adopted as the

urethane-based resin formed of the composition containing the urethane prepolymer (C) and the polyfunctional isocyanate compound (B) as long as the resin is a urethane-based resin obtained by using a so-called "urethane prepolymer" as a raw material.

[0125]

The urethane-based resin formed of the composition containing the urethane prepolymer (C) and the polyfunctional isocyanate compound (B) is, for example, a urethane-based resin formed of a composition containing a polyurethane polyol serving as the urethane prepolymer (C) and the polyfunctional isocyanate compound (B). The number of kinds of the urethane prepolymers (C) may be only one, or may be two or more. The number of kinds of the polyfunctional isocyanate compounds (B) may be only one, or may be two or more.

[0126]

The polyurethane polyol serving as the urethane prepolymer (C) is preferably obtained by causing a polyester polyol (a1) or a polyether polyol (a2) alone, or the mixture of the polyols (a1) and (a2), to react with an organic polyisocyanate compound (a3) in the presence of a catalyst or in the absence of a catalyst.

[0127]

Any appropriate polyester polyol may be used as the polyester polyol (a1). Such polyester polyol (a1) is, for example, a polyester

polyol obtained by causing an acid component and a glycol component to react with each other. Examples of the acid component include terephthalic acid, adipic acid, azelaic acid, sebacic acid, phthalic anhydride, isophthalic acid, and trimellitic acid. Examples of the glycol component include ethylene glycol, propylene glycol, diethylene glycol, butylene glycol, 1,6-hexane glycol, 3-methyl-1,5-pentanediol, 3,3'-dimethylolheptane, polyoxyethylene glycol, polyoxypropylene glycol, 1,4-butanediol, neopentyl glycol, and butyl ethyl pentanediol. Examples of the polyol component include glycerin, trimethylolpropane, and pentaerythritol. Another example of the polyester polyol (a1) is a polyester polyol obtained by the ring-opening polymerization of a lactone, such as polycaprolactone, poly(β -methyl- γ -valerolactone), or polyvalerolactone.

[0128]

Any molecular weight in the range of from a low molecular weight to a high molecular weight may be used as the molecular weight of the polyester polyol (a1). With regard to the molecular weight of the polyester polyol (a1), its number-average molecular weight is preferably from 100 to 100,000. When the number-average molecular weight is less than 100, there is a risk in that the polyol is increased in reactivity and is hence liable to gel. When the number-average molecular weight is more than 100,000, there is a risk in that the reactivity reduces and the cohesive strength of the polyurethane

polyol itself reduces. The usage amount of the polyester polyol (a1) is preferably from 0 mol% to 90 mol% in polyols forming the polyurethane polyol.

[0129]

Any appropriate polyether polyol may be used as the polyether polyol (a2). Such polyether polyol (a2) is, for example, a polyether polyol obtained by the polymerization of an oxirane compound, such as ethylene oxide, propylene oxide, butylene oxide, or tetrahydrofuran, with water or a low-molecular-weight polyol, such as propylene glycol, ethylene glycol, glycerin, or trimethylolpropane, serving as an initiator. Specific examples of such polyether polyol (a2) include polyether polyols each having two or more functional groups, such as polypropylene glycol, polyethylene glycol, and polytetramethylene glycol.

[0130]

Any molecular weight in the range of from a low molecular weight to a high molecular weight may be used as the molecular weight of the polyether polyol (a2). With regard to the molecular weight of the polyether polyol (a2), its number-average molecular weight is preferably from 100 to 100,000. When the number-average molecular weight is less than 100, there is a risk in that the polyol is increased in reactivity and is hence liable to gel. When the number-average molecular weight is more than 100,000, there is a risk in that the

reactivity reduces and the cohesive strength of the polyurethane polyol itself reduces. The usage amount of the polyether polyol (a2) is preferably from 0 mol% to 90 mol% in polyols forming the polyurethane polyol.

[0131]

The polyether polyol (a2) may be used in combination with the polyether polyol (a2) partially replaced by a glycol, such as ethylene glycol, 1,4-butanediol, neopentyl glycol, butyl ethyl pentanediol, glycerin, trimethylolpropane, or pentaerythritol, or a polyvalent amine, such as ethylenediamine, N-aminoethylethanolamine, isophoronediamine, or xylylenediamine, as required.

[0132]

Only a difunctional polyether polyol may be used as the polyether polyol (a2), or a polyether polyol having a number-average molecular weight of from 100 to 100,000 and having at least 3 hydroxyl groups in a molecule thereof may be partially or entirely used. When the polyether polyol having a number-average molecular weight of from 100 to 100,000 and having at least 3 hydroxyl groups in a molecule thereof is partially or entirely used as the polyether polyol (a2), balance between the pressure-sensitive adhesive strength and re-peelability of the surface protective film may be satisfactory. When the number-average molecular weight in such polyether polyol is less than 100, there is a risk in that the polyol

is increased in reactivity and is hence liable to gel. In addition, when the number-average molecular weight in such polyether polyol is more than 100,000, there is a risk in that the reactivity reduces and the cohesive strength of the polyurethane polyol itself reduces. The number-average molecular weight of such polyether polyol is more preferably from 100 to 10,000.

[0133]

Any appropriate organic polyisocyanate compound may be used as the organic polyisocyanate compound (a3). Examples of such organic polyisocyanate compound (a3) include an aromatic polyisocyanate, an aliphatic polyisocyanate, an aromatic-aliphatic polyisocyanate, and an alicyclic polyisocyanate.

[0134]

Examples of the aromatic polyisocyanate include 1,3-phenylene diisocyanate, 4,4'-diphenyl diisocyanate, 1,4-phenylene diisocyanate, 4,4'-diphenylmethane diisocyanate, 2,4-tolylene diisocyanate, 2,6-tolylene diisocyanate, 4,4'-toluidine diisocyanate, 2,4,6-triisocyanatotoluene, 1,3,5-triisocyanatobenzene, dianisidine diisocyanate, 4,4'-diphenyl ether diisocyanate, and 4,4',4''-triphenylmethane triisocyanate.

[0135]

Examples of the aliphatic polyisocyanate include trimethylene diisocyanate, tetramethylene diisocyanate, hexamethylene diisocyanate, pentamethylene diisocyanate, 1,2-propylene diisocyanate, 2,3-butylene diisocyanate, 1,3-butylene diisocyanate, dodecamethylene diisocyanate, and 2,4,4-trimethylhexamethylene diisocyanate.

[0136]

Examples of the aromatic-aliphatic polyisocyanate include ω,ω' -diisocyanato-1,3-dimethylbenzene, ω,ω' -diisocyanato-1,4-dimethylbenzene, ω,ω' -diisocyanato-1,4-diethylbenzene, 1,4-tetramethylxylylene diisocyanate, and 1,3-tetramethylxylylene diisocyanate.

[0137]

Examples of the alicyclic polyisocyanate include 3-isocyanatomethyl-3,5,5-trimethylcyclohexyl isocyanate, 1,3-cyclopentane diisocyanate, 1,3-cyclohexane diisocyanate, 1,4-cyclohexane diisocyanate, methyl-2,4-cyclohexane diisocyanate, methyl-2,6-cyclohexane diisocyanate, 4,4'-methylenebis(cyclohexyl isocyanate), 1,4-bis(isocyanatomethyl)cyclohexane, and 1,4-bis(isocyanatomethyl)cyclohexane.

[0138]

Other examples of the organic polyisocyanate compound (a3) include trimethylolpropane adducts of the polyfunctional isocyanate compounds, biurets thereof obtained through their reactions with water, and trimers thereof each having an isocyanurate ring. In addition, the compounds may be used in combination.

[0139]

Any appropriate catalyst may be used as the catalyst that may be used in obtaining the polyurethane polyol. Examples of such catalyst include a tertiary amine-based compound and an organometallic compound.

[0140]

Examples of the tertiary amine-based compound include triethylamine, triethylenediamine, and 1,8-diazabicyclo[5.4.0]-undecene-7 (DBU).

[0141]

Examples of the organometallic compound include a tin-based compound and a non-tin-based compound.

[0142]

Examples of the tin-based compound include dibutyltin dichloride, dibutyltin oxide, dibutyltin dibromide, dibutyltin dimaleate, dibutyltin dilaurate (DBTDL), dibutyltin diacetate,

dibutyltin sulfide, tributyltin sulfide, tributyltin oxide, tributyltin acetate, triethyltin ethoxide, tributyltin ethoxide, dioctyltin oxide, tributyltin chloride, tributyltin trichloroacetate, and tin 2-ethylhexanoate.

[0143]

Examples of the non-tin-based compound include: titanium-based compounds, such as dibutyltitanium dichloride, tetrabutyl titanate, and butoxytitanium trichloride; lead-based compounds, such as lead oleate, lead 2-ethylhexanoate, lead benzoate, and lead naphthenate; iron-based compounds, such as iron 2-ethylhexanoate and iron acetylacetonate; cobalt-based compounds, such as cobalt benzoate and cobalt 2-ethylhexanoate; zinc-based compounds, such as zinc naphthenate and zinc 2-ethylhexanoate; and zirconium-based compounds, such as zirconium naphthenate.

[0144]

When a catalyst is used in obtaining the polyurethane polyol, in a system in which two kinds of polyols, that is, the polyester polyol and the polyether polyol are present, a problem in that the polyols gel or a reaction solution becomes turbid is liable to occur in a single catalyst system owing to a difference in reactivity between the polyols. In view of the foregoing, when two kinds of catalysts are used in obtaining the polyurethane polyol, a reaction rate, catalyst selectivity, and the like can be easily controlled,

and hence such problem can be solved. Examples of the combination of such two kinds of catalysts include the combination of a tertiary amine and an organometallic catalyst, the combination of a tin-based catalyst and a non-tin-based catalyst, and the combination of a tin-based catalyst and another tin-based catalyst. Of those, the combination of the tin-based catalyst and the other tin-based catalyst is preferred, and the combination of dibutyltin dilaurate and tin 2-ethylhexanoate is more preferred. The compounding ratio "tin 2-ethylhexanoate/dibutyltin dilaurate" of the combination is preferably less than 1, more preferably from 0.2 to 0.6 in terms of a weight ratio. When the compounding ratio is 1 or more, the polyols may be liable to gel owing to balance between the catalytic activities of the catalysts.

[0145]

When a catalyst is used in obtaining the polyurethane polyol, the usage amount of the catalyst is preferably from 0.01 wt% to 1.0 wt% with respect to the total amount of the polyester polyol (a1), the polyether polyol (a2), and the organic polyisocyanate compound (a3).

[0146]

When a catalyst is used in obtaining the polyurethane polyol, a reaction temperature is preferably less than 100°C, more preferably from 85°C to 95°C. When the reaction temperature is 100°C or more,

it may be difficult to control the reaction rate and a cross-linked structure, and hence it may be difficult to obtain a polyurethane polyol having a predetermined molecular weight.

[0147]

No catalyst may be used in obtaining the polyurethane polyol. In that case, the reaction temperature is preferably 100°C or more, more preferably 110°C or more. In addition, when the polyurethane polyol is obtained in the absence of a catalyst, the reaction is preferably performed for 3 hours or more.

[0148]

A method of obtaining the polyurethane polyol is, for example, (1) a method involving loading the total amount of the polyester polyol, the polyether polyol, a catalyst, and the organic polyisocyanate compound into a flask, or (2) a method involving loading the polyester polyol, the polyether polyol, and the catalyst into the flask, and adding the organic polyisocyanate compound. Of those, the method (2) is preferred as the method of obtaining the polyurethane polyol in terms of the control of the reaction.

[0149]

Any appropriate solvent may be used in obtaining the polyurethane polyol. Examples of such solvent include methyl ethyl ketone, ethyl acetate, toluene, xylene, and acetone. Of those

solvents, toluene is preferred.

[0150]

Those described in the foregoing may each be used as the polyfunctional isocyanate compound (B).

[0151]

The composition containing the urethane prepolymer (C) and the polyfunctional isocyanate compound (B) may contain any appropriate other component to the extent that the effects of the present invention are not impaired. Examples of such other component include a resin component other than the polyurethane-based resin, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0152]

Any appropriate production method may be adopted as a method of producing the polyurethane-based resin formed of the composition containing the urethane prepolymer (C) and the polyfunctional isocyanate compound (B) as long as the method is a method of producing the polyurethane-based resin through the use of a so-called "urethane

prepolymer" as a raw material.

[0153]

The number-average molecular weight M_n of the urethane prepolymer (C) is preferably from 3,000 to 1,000,000.

[0154]

An equivalent ratio "NCO group/OH group" between NCO groups and OH groups in the urethane prepolymer (C) and the polyfunctional isocyanate compound (B) is preferably 5.0 or less, more preferably from 0.01 to 3.0, still more preferably from 0.02 to 2.5, particularly preferably from 0.03 to 2.25, most preferably from 0.05 to 2.0. When the equivalent ratio "NCO group/OH group" is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0155]

With regard to the content of the polyfunctional isocyanate compound (B), the polyfunctional isocyanate compound (B) is incorporated at preferably from 0.01 wt% to 30 wt%, more preferably from 0.03 wt% to 20 wt%, still more preferably from 0.05 wt% to 15 wt%, particularly preferably from 0.075 wt% to 10 wt%, most preferably from 0.1 wt% to 8 wt% with respect to the urethane prepolymer (C). When the content of the polyfunctional isocyanate

compound (B) is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved, and hence the surface protective film of the present invention can be bonded without trapping air bubbles.

[0156]

[Acrylic Resin]

Any appropriate acrylic pressure-sensitive adhesive, such as a known acrylic pressure-sensitive adhesive described in JP 2013-241606 A, may be adopted as the acrylic resin to the extent that the effects of the present invention are not impaired.

[0157]

The acrylic resin may contain any appropriate component to the extent that the effects of the present invention are not impaired. Examples of such component include a resin component other than the acrylic resin, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0158]

[Rubber-based Resin]

Any appropriate rubber-based pressure-sensitive adhesive, such as a known rubber-based pressure-sensitive adhesive described in JP 2015-074771 A, may be adopted as the rubber-based resin to the extent that the effects of the present invention are not impaired. The number of kinds of the resins may be only one, or may be two or more.

[0159]

The rubber-based resin may contain any appropriate component to the extent that the effects of the present invention are not impaired. Examples of such component include a resin component other than the rubber-based resin, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0160]

[Silicone-based Resin]

Any appropriate silicone-based resin, such as a known silicone-based resin described in JP 2014-047280 A, may be adopted as the silicone-based resin to the extent that the effects of the present invention are not impaired. The number of kinds of the pressure-sensitive adhesives may be only one, or may be two or more.

[0161]

The silicone-based resin may contain any appropriate component to the extent that the effects of the present invention are not impaired. Examples of such component include a resin component other than the silicone-based resin, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0162]

<Silicone-based Additive>

Any appropriate silicone-based additive may be adopted as the silicone-based additive to the extent that the effects of the present invention are not impaired. Such silicone-based additive is preferably, for example, at least one kind selected from a siloxane bond-containing compound, a hydroxyl group-containing silicone-based compound, and a cross-linkable functional group-containing silicone-based compound.

[0163]

The number of kinds of the silicone-based additives may be only one, or may be two or more.

[0164]

Examples of the siloxane bond-containing compound include: a polyether-modified polyorganosiloxane obtained by introducing a polyether group into the main chain of a polyorganosiloxane skeleton (e.g., polydimethylsiloxane) or a side chain thereof; a polyester-modified polyorganosiloxane obtained by introducing a polyester group into the main chain of a polyorganosiloxane skeleton or a side chain thereof; an organic compound-introduced polyorganosiloxane obtained by introducing an organic compound into the main chain of a polyorganosiloxane skeleton or a side chain thereof; a silicone-modified (meth)acrylic resin obtained by introducing a polyorganosiloxane into a (meth)acrylic resin; a silicone-modified organic compound obtained by introducing a polyorganosiloxane into an organic compound; and a silicone-containing organic compound obtained by copolymerizing an organic compound and a silicone compound. Commercial products of such siloxane bond-containing polymer are, for example, a product available under the product name "LE-302" from Kyoeisha Chemical Co., Ltd., leveling agents of BYK Series manufactured by BYK Japan KK (e.g., "BYK-300", "BYK-301/302", "BYK-306", "BYK-307", "BYK-310", "BYK-315", "BYK-313", "BYK-320", "BYK-322", "BYK-323", "BYK-325", "BYK-330", "BYK-331", "BYK-333", "BYK-337", "BYK-341", "BYK-344", "BYK-345/346", "BYK-347", "BYK-348", "BYK-349", "BYK-370", "BYK-375", "BYK-377", "BYK-378", "BYK-UV 3500", "BYK-UV 3510",

"BYK-UV 3570", "BYK-3550", "BYK-SILCLEAN 3700", and "BYK-SILCLEAN 3720"), leveling agents of AC Series manufactured by Algin-Chemie (e.g., "AC FS180", "AC FS360", and "AC S20"), leveling agents of POLYFLOW Series manufactured by Kyoeisha Chemical Co., Ltd. (e.g., "POLYFLOW KL-400X", "POLYFLOW KL-400HF", "POLYFLOW KL-401", "POLYFLOW KL-402", "POLYFLOW KL-403", and "POLYFLOW KL-404"), leveling agents of KP Series manufactured by Shin-Etsu Chemical Co., Ltd. (e.g., "KP-323", "KP-326", "KP-341", "KP-104", "KP-110", and "KP-112"), X22 Series and KF Series manufactured by Shin-Etsu Chemical Co., Ltd., and leveling agents manufactured by Dow Corning Toray Co., Ltd. (e.g., "LP-7001", "LP-7002", "8032 ADDITIVE", "57 ADDITIVE", "L-7604", "FZ-2110", "FZ-2105", "67 ADDITIVE", "8618 ADDITIVE", "3 ADDITIVE", and "56 ADDITIVE").

[0165]

Examples of the hydroxyl group-containing silicone-based compound include: a polyether-modified polyorganosiloxane obtained by introducing a polyether group into the main chain of a polyorganosiloxane skeleton (e.g., polydimethylsiloxane) or a side chain thereof; a polyester-modified polyorganosiloxane obtained by introducing a polyester group into the main chain of a polyorganosiloxane skeleton or a side chain thereof; an organic compound-introduced polyorganosiloxane obtained by introducing an organic compound into the main chain of a polyorganosiloxane skeleton or a side chain thereof; a silicone-modified (meth)acrylic resin

obtained by introducing a polyorganosiloxane into a (meth)acrylic resin; a silicone-modified organic compound obtained by introducing a polyorganosiloxane into an organic compound; and a silicone-containing organic compound obtained by copolymerizing an organic compound and a silicone compound. In those compounds, the polyorganosiloxane skeleton may have a hydroxyl group, or the polyether group, the polyester group, a (meth)acryloyl group, or the organic compound may have a hydroxyl group. Commercial products of such hydroxyl group-containing silicone are, for example, products available under the product names "X-22-4015", "X-22-4039", "KF6000", "KF6001", "KF6002", "KF6003", "X-22-170BX", "X-22-170DX", "X-22-176DX", and "X-22-176F" from Shin-Etsu Chemical Co., Ltd., and products available under the product names "BYK-370", "BYK-SILCLEAN 3700", and "BYK-SILCLEAN 3720" from BYK Japan KK.

[0166]

Examples of the cross-linkable functional group-containing silicone-based compound include: a polyether-modified polyorganosiloxane obtained by introducing a polyether group into the main chain of a polyorganosiloxane skeleton (e.g., polydimethylsiloxane) or a side chain thereof; a polyester-modified polyorganosiloxane obtained by introducing a polyester group into the main chain of a polyorganosiloxane skeleton or a side chain thereof; an organic compound-introduced polyorganosiloxane obtained by introducing an organic compound into the main chain

of a polyorganosiloxane skeleton or a side chain thereof; a silicone-modified (meth)acrylic resin obtained by introducing a polyorganosiloxane into a (meth)acrylic resin; a silicone-modified organic compound obtained by introducing a polyorganosiloxane into an organic compound; and a silicone-containing organic compound obtained by copolymerizing an organic compound and a silicone compound. In those compounds, the polyorganosiloxane skeleton may have a cross-linkable functional group, or the polyether group, the polyester group, a (meth)acryloyl group, or the organic compound may have a cross-linkable functional group. Examples of the cross-linkable functional group include an amino group, an epoxy group, a mercapto group, a carboxyl group, an isocyanate group, and a methacrylate group. Commercial products of such isocyanate group-containing silicone are, for example, products available under the product names "BY16-855", "SF8413", "BY16-839", "SF8421", "BY16-750", "BY16-880", and "BY16-152C" from Dow Corning Toray Co., Ltd., and products available under the product names "KF-868", "KF-865", "KF-864", "KF-859", "KF-393", "KF-860", "KF-880", "KF-8004", "KF-8002", "KF-8005", "KF-867", "KF-8021", "KF-869", "KF-861", "X-22-343", "KF-101", "X-22-2000", "X-22-4741", "KF-1002", "KF-2001", "X-22-3701E", "X-22-164", "X-22-164A", "X-22-164B", "X-22-164AS", and "X-22-2445" from Shin-Etsu Chemical Co., Ltd.

[0167]

<Fluorine-based Additive>

Any appropriate fluorine-based additive may be adopted as the fluorine-based additive to the extent that the effects of the present invention are not impaired. Such fluorine-based additive is preferably, for example, at least one kind selected from a fluorine-containing compound, a hydroxyl group-containing fluorine-based compound, and a cross-linkable functional group-containing fluorine-based compound.

[0168]

The number of kinds of the fluorine-based additives may be only one, or may be two or more.

[0169]

Examples of the fluorine-containing compound include: a compound having a fluoroaliphatic hydrocarbon skeleton; a fluorine-containing organic compound obtained by copolymerizing an organic compound and a fluorine compound; and a fluorine-containing compound containing an organic compound. Examples of the fluoroaliphatic hydrocarbon skeleton include fluoro C1-C10 alkanes, such as fluoromethane, fluoroethane, fluoropropane, fluoroisopropane, fluorobutane, fluoroisobutane, fluoro-t-butane, fluoropentane, and fluorohexane. Commercial products of such fluorine-containing compound are, for example, leveling agents of SURFLON Series manufactured by AGC Seimi Chemical Co., Ltd. (e.g.,

"S-242", "S-243", "S-420", "S-611", "S-651", and "S-386"), leveling agents of BYK Series manufactured by BYK Japan KK (e.g., "BYK-340"), leveling agents of AC Series manufactured by Algin Chemie (e.g., "AC 110a" and "AC 100a"), leveling agents of MEGAFACE Series manufactured by DIC Corporation (e.g., "MEGAFACE F-114", "MEGAFACE F-410", "MEGAFACE F-444", "MEGAFACE EXP TP-2066", "MEGAFACE F-430", "MEGAFACE F-472SF", "MEGAFACE F-477", "MEGAFACE F-552", "MEGAFACE F-553", "MEGAFACE F-554", "MEGAFACE F-555", "MEGAFACE R-94", "MEGAFACE RS-72-K", "MEGAFACE RS-75", "MEGAFACE F-556", "MEGAFACE EXP TF-1367", "MEGAFACE EXP TF-1437", "MEGAFACE F-558", and "MEGAFACE EXP TF-1537"), leveling agents of FC Series manufactured by Sumitomo 3M Limited (e.g., "FC-4430" and "FC-4432"), leveling agents of FTERGENT Series manufactured by Neos Company Limited (e.g., "FTERGENT 100", "FTERGENT 100C", "FTERGENT 110", "FTERGENT 150", "FTERGENT 150CH", "FTERGENT A-K", "FTERGENT 501", "FTERGENT 250", "FTERGENT 251", "FTERGENT 222F", "FTERGENT 208G", "FTERGENT 300", "FTERGENT 310", and "FTERGENT 400SW"), and leveling agents of PF Series manufactured by Kitamura Chemicals, Co., Ltd. (e.g., "PF-136A", "PF-156A", "PF-151N", "PF-636", "PF-6320", "PF-656", "PF-6520", "PF-651", "PF-652", and "PF-3320").

[0170]

For example, a conventionally known resin may be used as the hydroxyl group-containing fluorine-based compound. Examples thereof include hydroxyl group-containing fluorine resins described

in WO 94/06870 A1, JP 08-12921 A, JP 10-72569 A, JP 04-275379 A, WO 97/11130 A1, and WO 96/26254 A1. Examples thereof include other hydroxyl group-containing fluorine resins, such as fluoroolefin copolymers described in JP 08-231919 A, JP 10-265731 A, JP 10-204374 A, and JP 08-12922 A. Other examples thereof include: a copolymer of a hydroxyl group-containing compound and a compound having a fluorinated alkyl group; a fluorine-containing organic compound obtained by copolymerizing a hydroxyl group-containing compound with a fluorine-containing compound; and a fluorine-containing compound containing a hydroxyl group-containing organic compound. Commercial products of such hydroxyl group-containing fluorine-based compound are, for example, a product available under the product name "LUMIFLON" from Asahi Glass Co., Ltd., a product available under the product name "CEFRAL COAT" from Central Glass Co., Ltd., a product available under the product name "ZAFLON" from Toagosei Co., Ltd., a product available under the product name "ZEFFLE" from Daikin Industries, Ltd., and products available under the product names "MEGAFACE F-571" and "FLUONATE" from DIC Corporation.

[0171]

Examples of the cross-linkable functional group-containing fluorine-based compound include: a carboxylic acid compound having a fluorinated alkyl group, such as perfluorooctanoic acid; a copolymer of a cross-linkable functional group-containing compound

and a compound having a fluorinated alkyl group; a fluorine-containing organic compound obtained by copolymerizing a cross-linkable functional group-containing compound with a fluorine-containing compound; and a fluorine-containing compound containing a cross-linkable functional group-containing compound. Commercial products of such cross-linkable functional group-containing fluorine-based compound are, for example, products available under the product names "MEGAFACE F-570", "MEGAFACE RS-55", "MEGAFACE RS-56", "MEGAFACE RS-72-K", "MEGAFACE RS-75", "MEGAFACE RS-76-E", "MEGAFACE RS-76-NS", "MEGAFACE RS-78", and "MEGAFACE RS-90" from DIC Corporation.

[0172]

<Other Component>

The pressure-sensitive adhesive composition may contain any appropriate other component to the extent that the effects of the present invention are not impaired. Examples of such other component include other resin components, a tackifier, an inorganic filler, an organic filler, metal powder, a pigment, a foil-shaped material, a softener, an age resistor, a conductive agent, a UV absorbing agent, an antioxidant, a light stabilizer, a surface lubricating agent, a leveling agent, a corrosion inhibitor, a heat stabilizer, a polymerization inhibitor, a lubricant, a solvent, and a catalyst.

[0173]

The pressure-sensitive adhesive composition may contain a fatty acid ester. The number of kinds of the fatty acid esters may be only one, or may be two or more.

[0174]

The number-average molecular weight M_n of the fatty acid ester is preferably from 100 to 800, more preferably from 150 to 500, still more preferably from 200 to 480, particularly preferably from 200 to 400, most preferably from 250 to 350. When the number-average molecular weight M_n of the fatty acid ester is adjusted within the range, the wettability of the pressure-sensitive adhesive layer can be improved.

[0175]

Any appropriate fatty acid ester may be adopted as the fatty acid ester to the extent that the effects of the present invention are not impaired. Examples of such fatty acid ester include polyoxyethylene bisphenol A laurate, butyl stearate, 2-ethylhexyl palmitate, 2-ethylhexyl stearate, behenic acid monoglyceride, cetyl 2-ethylhexanoate, isopropyl myristate, isopropyl palmitate, cholesteryl isostearate, lauryl methacrylate, coconut fatty acid methyl ester, methyl laurate, methyl oleate, methyl stearate, myristyl myristate, octyldodecyl myristate, pentaerythritol monooleate, pentaerythritol monostearate, pentaerythritol tetrapalmitate, stearyl stearate, isotridecyl stearate,

2-ethylhexanoic acid triglyceride, butyl laurate, and octyl oleate.

[0176]

When the pressure-sensitive adhesive composition contains the fatty acid ester, the content of the fatty acid ester is preferably from 1 part by weight to 50 parts by weight, more preferably from 1.5 parts by weight to 45 parts by weight, still more preferably from 2 parts by weight to 40 parts by weight, particularly preferably from 2.5 parts by weight to 35 parts by weight, most preferably from 3 parts by weight to 30 parts by weight with respect to 100 parts by weight of the base polymer.

[0177]

The pressure-sensitive adhesive composition may contain an ionic liquid containing a fluoroorganic anion. When the pressure-sensitive adhesive composition contains the ionic liquid containing a fluoroorganic anion, a pressure-sensitive adhesive composition extremely excellent in antistatic property can be provided. The number of kinds of such ionic liquids may be only one, or may be two or more.

[0178]

The term "ionic liquid" as used in the present invention means a molten salt (ionic compound) that is liquid at 25°C.

[0179]

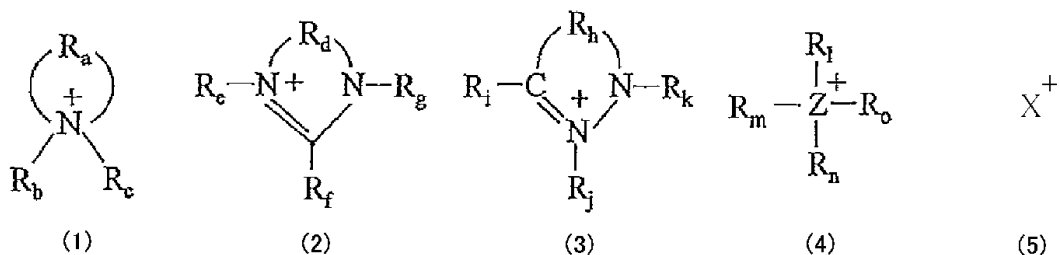
Any appropriate ionic liquid may be adopted as the ionic liquid to the extent that the effects of the present invention are not impaired as long as the ionic liquid contains the fluoroorganic anion. Such ionic liquid is preferably, for example, an ionic liquid including the fluoroorganic anion and an onium cation. The adoption of the ionic liquid including the fluoroorganic anion and the onium cation as the ionic liquid can provide a pressure-sensitive adhesive composition extremely excellent in antistatic property.

[0180]

Any appropriate onium cation may be adopted as the onium cation that may be included in the ionic liquid to the extent that the effects of the present invention are not impaired. Such onium cation is preferably at least one kind selected from a nitrogen-containing onium cation, a sulfur-containing onium cation, and a phosphorus-containing onium cation. The selection of any such onium cation can provide a pressure-sensitive adhesive composition extremely excellent in antistatic property.

[0181]

The onium cation that may be included in the ionic liquid is preferably at least one kind selected from cations having structures represented by the general formulae (1) to (5).



[0182]

In the general formula (1), R_a represents a hydrocarbon group having 4 to 20 carbon atoms and may contain a heteroatom, and R_b and R_c , which may be identical to or different from each other, each represent hydrogen or a hydrocarbon group having 1 to 16 carbon atoms and may each contain a heteroatom, provided that when a nitrogen atom contains a double bond, R_c is absent.

[0183]

In the general formula (2), R_d represents a hydrocarbon group having 2 to 20 carbon atoms and may contain a heteroatom, and R_e , R_f , and R_g , which may be identical to or different from one another, each represent hydrogen or a hydrocarbon group having 1 to 16 carbon atoms and may each contain a heteroatom.

[0184]

In the general formula (3), R_h represents a hydrocarbon group having 2 to 20 carbon atoms and may contain a heteroatom, and R_i , R_j , and R_k , which may be identical to or different from one another,

each represent hydrogen or a hydrocarbon group having 1 to 16 carbon atoms and may each contain a heteroatom.

[0185]

In the general formula (4), Z represents a nitrogen atom, a sulfur atom, or a phosphorus atom, and R_1 , R_m , R_n , and R_o , which may be identical to or different from one another, each represent a hydrocarbon group having 1 to 20 carbon atoms and may each contain a heteroatom, provided that when Z represents a sulfur atom, R_o is absent.

[0186]

In the general formula (5), X represents a Li atom, a Na atom, or a K atom.

[0187]

Examples of the cation represented by the general formula (1) include a pyridinium cation, a pyrrolidinium cation, a piperidinium cation, a cation having a pyrroline skeleton, and a cation having a pyrrole skeleton.

[0188]

Specific examples of the cation represented by the general formula (1) include: a pyridinium cation, such as a 1-ethylpyridinium cation, a 1-butylpyridinium cation, a 1-hexylpyridinium cation,

a 1-ethyl-3-methylpyridinium cation, a 1-butyl-3-methylpyridinium cation, a 1-hexyl-3-methylpyridinium cation, a 1-butyl-4-methylpyridinium cation, a 1-octyl-4-methylpyridinium cation, a 1-butyl-3,4-dimethylpyridinium cation, or a 1,1-dimethylpyrrolidinium cation; a pyrrolidinium cation, such as a 1-ethyl-1-methylpyrrolidinium cation, a 1-methyl-1-propylpyrrolidinium cation, a 1-methyl-1-butylpyrrolidinium cation, a 1-methyl-1-pentylpyrrolidinium cation, a 1-methyl-1-hexylpyrrolidinium cation, a 1-methyl-1-heptylpyrrolidinium cation, a 1-ethyl-1-propylpyrrolidinium cation, a 1-ethyl-1-butylpyrrolidinium cation, a 1-ethyl-1-pentylpyrrolidinium cation, a 1-ethyl-1-hexylpyrrolidinium cation, a 1-ethyl-1-heptylpyrrolidinium cation, a 1,1-dipropylpyrrolidinium cation, a 1-propyl-1-butylpyrrolidinium cation, or a 1,1-dibutylpyrrolidinium cation; a piperidinium cation, such as a 1-propylpiperidinium cation, a 1-pentylpiperidinium cation, a 1-methyl-1-ethylpiperidinium cation, a 1-methyl-1-propylpiperidinium cation, a 1-methyl-1-butylpiperidinium cation, a 1-methyl-1-pentylpiperidinium cation, a 1-methyl-1-hexylpiperidinium cation, a 1-methyl-1-heptylpiperidinium cation,

1-ethyl-1-propylpiperidinium	cation,	a
1-ethyl-1-butylpiperidinium	cation,	a
1-ethyl-1-pentylpiperidinium	cation,	a
1-ethyl-1-hexylpiperidinium	cation,	a
1-ethyl-1-heptylpiperidinium	cation,	a

1-propyl-1-butylpiperidinium cation, a 1,1-dimethylpiperidinium cation, a 1,1-dipropylpiperidinium cation, or a 1,1-dibutylpiperidinium cation; a 2-methyl-1-pyrroline cation; a 1-ethyl-2-phenylindole cation; a 1,2-dimethylindole cation; and a 1-ethylcarbazole cation.

[0189]

Of those cations, from the viewpoint of being capable of additionally expressing the effects of the present invention, preferred examples include: a pyridinium cation, such as a 1-ethylpyridinium cation, a 1-butylpyridinium cation, a 1-hexylpyridinium cation, a 1-ethyl-3-methylpyridinium cation, a 1-butyl-3-methylpyridinium cation, a 1-hexyl-3-methylpyridinium cation, a 1-butyl-4-methylpyridinium cation, or a 1-octyl-4-methylpyridinium cation; a pyrrolidinium cation, such as a 1-ethyl-1-methylpyrrolidinium cation, a 1-methyl-1-propylpyrrolidinium cation, a 1-methyl-1-butylpyrrolidinium cation, a 1-methyl-1-pentylpyrrolidinium cation, a 1-methyl-1-hexylpyrrolidinium cation,

1-methyl-1-heptylpyrrolidinium cation, a
 1-ethyl-1-propylpyrrolidinium cation, a
 1-ethyl-1-butylpyrrolidinium cation, a
 1-ethyl-1-pentylpyrrolidinium cation, a
 1-ethyl-1-hexylpyrrolidinium cation, or a
 1-ethyl-1-heptylpyrrolidinium cation; and a piperidinium cation,
 such as a 1-methyl-1-ethylpiperidinium cation, a
 1-methyl-1-propylpiperidinium cation, a
 1-methyl-1-butylpiperidinium cation, a
 1-methyl-1-pentylpiperidinium cation, a
 1-methyl-1-hexylpiperidinium cation, a
 1-methyl-1-heptylpiperidinium cation, a
 1-ethyl-1-propylpiperidinium cation, a
 1-ethyl-1-butylpiperidinium cation, a
 1-ethyl-1-pentylpiperidinium cation, a
 1-ethyl-1-hexylpiperidinium cation, a
 1-ethyl-1-heptylpiperidinium cation, or a
 1-propyl-1-butylpiperidinium cation. A 1-hexylpyridinium cation,
 a 1-ethyl-3-methylpyridinium cation, a 1-butyl-3-methylpyridinium
 cation, a 1-octyl-4-methylpyridinium cation, a
 1-methyl-1-propylpyrrolidinium cation, or a
 1-methyl-1-propylpiperidinium cation is more preferred.

[0190]

Examples of the cation represented by the general formula (2)

include an imidazolium cation, a tetrahydropyrimidinium cation, and a dihydropyrimidinium cation.

[0191]

Specific examples of the cation represented by the general formula (2) include: an imidazolium cation, such as a 1,3-dimethylimidazolium cation, a 1,3-diethylimidazolium cation, a 1-ethyl-3-methylimidazolium cation, a 1-butyl-3-methylimidazolium cation, a 1-hexyl-3-methylimidazolium cation, a 1-octyl-3-methylimidazolium cation, a 1-decyl-3-methylimidazolium cation, a 1-dodecyl-3-methylimidazolium cation, a 1-tetradecyl-3-methylimidazolium cation, a 1,2-dimethyl-3-propylimidazolium cation, a 1-ethyl-2,3-dimethylimidazolium cation, a 1-butyl-2,3-dimethylimidazolium cation, or a 1-hexyl-2,3-dimethylimidazolium cation; a tetrahydropyrimidinium cation, such as a 1,3-dimethyl-1,4,5,6-tetrahydropyrimidinium cation, a 1,2,3-trimethyl-1,4,5,6-tetrahydropyrimidinium cation, a 1,2,3,4-tetramethyl-1,4,5,6-tetrahydropyrimidinium cation, or a 1,2,3,5-tetramethyl-1,4,5,6-tetrahydropyrimidinium cation; and a dihydropyrimidinium cation, such as a 1,3-dimethyl-1,4-dihydropyrimidinium cation, a 1,3-dimethyl-1,6-dihydropyrimidinium cation, a 1,2,3-trimethyl-1,4-dihydropyrimidinium cation, a

1,2,3-trimethyl-1,6-dihydropyrimidinium cation, a
1,2,3,4-tetramethyl-1,4-dihydropyrimidinium cation, or a
1,2,3,4-tetramethyl-1,6-dihydropyrimidinium cation.

[0192]

Of those cations, from the viewpoint of being capable of additionally expressing the effects of the present invention, preferred is an imidazolium cation, such as a 1,3-dimethylimidazolium cation, a 1,3-diethylimidazolium cation, a 1-ethyl-3-methylimidazolium cation, a 1-butyl-3-methylimidazolium cation, a 1-hexyl-3-methylimidazolium cation, a 1-octyl-3-methylimidazolium cation, a 1-decyl-3-methylimidazolium cation, a 1-dodecyl-3-methylimidazolium cation, or a 1-tetradecyl-3-methylimidazolium cation. A 1-ethyl-3-methylimidazolium cation or a 1-hexyl-3-methylimidazolium cation is more preferred.

[0193]

Examples of the cation represented by the general formula (3) include a pyrazolium cation and a pyrazolinium cation.

[0194]

Specific examples of the cation represented by the general formula (3) include: a pyrazolium cation, such as a

1-methylpyrazolium cation, a 3-methylpyrazolium cation, a 1-ethyl-2-methylpyrazolinium cation, a 1-ethyl-2,3,5-trimethylpyrazolium cation, a 1-propyl-2,3,5-trimethylpyrazolium cation, or a 1-butyl-2,3,5-trimethylpyrazolium cation; and a pyrazolinium cation, such as a 1-ethyl-2,3,5-trimethylpyrazolinium cation, a 1-propyl-2,3,5-trimethylpyrazolinium cation, or a 1-butyl-2,3,5-trimethylpyrazolinium cation.

[0195]

Examples of the cation represented by the general formula (4) include a tetraalkylammonium cation, a trialkylsulfonium cation, a tetraalkylphosphonium cation, and cations obtained by substituting part of the alkyl groups by an alkenyl group or an alkoxyl group, or an epoxy group.

[0196]

Specific examples of the cation represented by the general formula (4) include a tetramethylammonium cation, a tetraethylammonium cation, a tetrabutylammonium cation, a tetrapentylammonium cation, a tetrahexylammonium cation, a tetraheptylammonium cation, a triethylmethylammonium cation, a tributylethylammonium cation, a trimethylpropylammonium cation, a trimethyldecylammonium cation, an N,N-diethyl-N-methyl-N-(2-methoxyethyl)ammonium cation, a

glycidyltrimethylammonium cation, a trimethylsulfonium cation, a triethylsulfonium cation, a tributylsulfonium cation, a trihexylsulfonium cation, a diethylmethylsulfonium cation, a dibutylethylsulfonium cation, a dimethyldecylsulfonium cation, a tetramethylphosphonium cation, a tetraethylphosphonium cation, a tetrabutylphosphonium cation, a tetrahexylphosphonium cation, a tetraoctylphosphonium cation, a triethylmethylphosphonium cation, a tributylethylphosphonium cation, a trimethyldecylphosphonium cation, and a diallyldimethylammonium cation.

[0197]

Of those cations, from the viewpoint of being capable of additionally expressing the effects of the present invention, preferred examples include: an asymmetric tetraalkylammonium cation, trialkylsulfonium cation, or tetraalkylphosphonium cation, such as a triethylmethylammonium cation, a tributylethylammonium cation, a trimethyldecylammonium cation, a diethylmethylsulfonium cation, a dibutylethylsulfonium cation, a dimethyldecylsulfonium cation, a triethylmethylphosphonium cation, a tributylethylphosphonium cation, or a trimethyldecylphosphonium cation; and an N,N-diethyl-N-methyl-N-(2-methoxyethyl)ammonium cation, a glycidyltrimethylammonium cation, a diallyldimethylammonium cation, an N,N-dimethyl-N-ethyl-N-propylammonium cation, an N,N-dimethyl-N-ethyl-N-butylammonium cation, an N,N-dimethyl-N-ethyl-N-pentylammonium cation, an

N,N-dimethyl-N-ethyl-N-hexylammonium	cation,	an
N,N-dimethyl-N-ethyl-N-heptylammonium	cation,	an
N,N-dimethyl-N-ethyl-N-nonylammonium	cation,	an
N,N-dimethyl-N,N-dipropylammonium	cation,	an
N,N-diethyl-N-propyl-N-butylammonium	cation,	an
N,N-dimethyl-N-propyl-N-pentylammonium	cation,	an
N,N-dimethyl-N-propyl-N-hexylammonium	cation,	an
N,N-dimethyl-N-propyl-N-heptylammonium	cation,	an
N,N-dimethyl-N-butyl-N-hexylammonium	cation,	an
N,N-diethyl-N-butyl-N-heptylammonium	cation,	an
N,N-dimethyl-N-pentyl-N-hexylammonium	cation,	an
N,N-dimethyl-N,N-dihexylammonium	cation,	a
trimethylheptylammonium	cation,	an
N,N-diethyl-N-methyl-N-propylammonium	cation,	an
N,N-diethyl-N-methyl-N-pentylammonium	cation,	an
N,N-diethyl-N-methyl-N-heptylammonium	cation,	an
N,N-diethyl-N-propyl-N-pentylammonium	cation,	a
triethylpropylammonium cation,	a triethylpentylammonium cation,	
a triethylheptylammonium	cation,	an
N,N-dipropyl-N-methyl-N-ethylammonium	cation,	an
N,N-dipropyl-N-methyl-N-pentylammonium	cation,	an
N,N-dipropyl-N-butyl-N-hexylammonium	cation,	an
N,N-dipropyl-N,N-dihexylammonium	cation,	an
N,N-dibutyl-N-methyl-N-pentylammonium	cation,	an
N,N-dibutyl-N-methyl-N-hexylammonium	cation,	a

trioctylmethyammonium cation, and an N-methyl-N-ethyl-N-propyl-N-pentylammonium cation. A trimethylpropylammonium cation is more preferred.

[0198]

Any appropriate fluoroorganic anion may be adopted as the fluoroorganic anion that may be included in the ionic liquid to the extent that the effects of the present invention are not impaired. Such fluoroorganic anion may be fully fluorinated (perfluorinated), or may be partially fluorinated.

[0199]

Examples of such fluoroorganic anion include a fluorinated arylsulfonate, a perfluoroalkanesulfonate, bis(fluorosulfonyl)imide, a bis(perfluoroalkanesulfonyl)imide, a cyanoperfluoroalkanesulfonylamide, a bis(cyano)perfluoroalkanesulfonylmethide, a cyano-bis(perfluoroalkanesulfonyl)methide, a tris(perfluoroalkanesulfonyl)methide, trifluoroacetate, a perfluoroalkylate, a tris(perfluoroalkanesulfonyl)methide, and a (perfluoroalkanesulfonyl)trifluoroacetamide.

[0200]

Of those fluoroorganic anions, a perfluoroalkylsulfonate, bis(fluorosulfonyl)imide, or a bis(perfluoroalkanesulfonyl)imide

is more preferred. More specific examples thereof include trifluoromethanesulfonate, pentafluoroethanesulfonate, heptafluoropropanesulfonate, nonafluorobutanesulfonate, bis(fluorosulfonyl)imide, and bis(trifluoromethanesulfonyl)imide.

[0201]

As a specific example of the ionic liquid, there may be used an ionic liquid appropriately selected from the combinations of the cation components and the anion components. Specific examples of such ionic liquid include 1-hexylpyridinium bis(fluorosulfonyl)imide, 1-ethyl-3-methylpyridinium trifluoromethanesulfonate, 1-ethyl-3-methylpyridinium pentafluoroethanesulfonate, 1-ethyl-3-methylpyridinium heptafluoropropanesulfonate, 1-ethyl-3-methylpyridinium nonafluorobutanesulfonate, 1-butyl-3-methylpyridinium trifluoromethanesulfonate, 1-butyl-3-methylpyridinium bis(trifluoromethanesulfonyl)imide, 1-butyl-3-methylpyridinium bis(pentafluoroethanesulfonyl)imide, 1-octyl-4-methylpyridinium bis(fluorosulfonyl)imide, 1,1-dimethylpyrrolidinium bis(trifluoromethanesulfonyl)imide, 1-methyl-1-ethylpyrrolidinium bis(trifluoromethanesulfonyl)imide, 1-methyl-1-propylpyrrolidinium bis(trifluoromethanesulfonyl)imide,

1-methyl-1-propylpyrrolidinium bis(fluorosulfonyl)imide,
 1-methyl-1-butylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-pentylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-hexylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-heptylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-propylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-butylpyrrolidinium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-pentylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-hexylpyrrolidinium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-heptylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide, 1,1-dipropylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide,
 1-propyl-1-butylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide, 1,1-dibutylpyrrolidinium
 bis(trifluoromethanesulfonyl)imide, 1-propylpiperidinium
 bis(trifluoromethanesulfonyl)imide, 1-pentylpiperidinium
 bis(trifluoromethanesulfonyl)imide, 1,1-dimethylpiperidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-ethylpiperidinium bis(trifluoromethanesulfonyl)imide,

1-methyl-1-propylpiperidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-propylpiperidinium bis(fluorosulfonyl)imide,
 1-methyl-1-butylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-pentylpiperidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-hexylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-heptylpiperidinium
 bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-propylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-butylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-pentylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-hexylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-1-heptylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1,1-dipropylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1-propyl-1-butylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1,1-dibutylpiperidinium bis(trifluoromethanesulfonyl)imide,
 1,1-dimethylpyrrolidinium bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-ethylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-propylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-butylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-pentylpyrrolidinium

bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-hexylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-heptylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-propylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-butylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-pentylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-hexylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-heptylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide, 1,1-dipropylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-propyl-1-butylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide, 1,1-dibutylpyrrolidinium
 bis(pentafluoroethanesulfonyl)imide, 1-propylpiperidinium
 bis(pentafluoroethanesulfonyl)imide, 1-pentylpiperidinium
 bis(pentafluoroethanesulfonyl)imide, 1,1-dimethylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-ethylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-propylpiperidinium

bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-butylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-pentylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-hexylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-methyl-1-heptylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-propylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-butylpiperidinium bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-pentylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-hexylpiperidinium bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-1-heptylpiperidinium
 bis(pentafluoroethanesulfonyl)imide, 1,1-dipropylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-propyl-1-butylpiperidinium
 bis(pentafluoroethanesulfonyl)imide, 1,1-dibutylpiperidinium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-3-methylimidazolium trifluoroacetate,
 1-ethyl-3-methylimidazolium heptafluorobutyrate,
 1-ethyl-3-methylimidazolium trifluoromethanesulfonate,
 1-ethyl-3-methylimidazolium heptafluoropropanesulfonate,

1-ethyl-3-methylimidazolium nonafluorobutanesulfonate,
 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-3-methylimidazolium bis(fluorosulfonyl)imide,
 1-ethyl-3-methylimidazolium bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-3-methylimidazolium
 tris(trifluoromethanesulfonyl)methide,
 1-butyl-3-methylimidazolium trifluoroacetate,
 1-butyl-3-methylimidazolium heptafluorobutyrate,
 1-butyl-3-methylimidazolium trifluoromethanesulfonate,
 1-butyl-3-methylimidazolium perfluorobutanesulfonate,
 1-butyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide,
 1-hexyl-3-methylimidazolium trifluoromethanesulfonate,
 1-hexyl-3-methylimidazolium bis(fluorosulfonyl)imide,
 1,2-dimethyl-3-propylimidazolium
 bis(trifluoromethanesulfonyl)imide,
 1-ethyl-2,3,5-trimethylpyrazolium
 bis(trifluoromethanesulfonyl)imide,
 1-propyl-2,3,5-trimethylpyrazolium
 bis(trifluoromethanesulfonyl)imide,
 1-butyl-2,3,5-trimethylpyrazolium
 bis(trifluoromethanesulfonyl)imide,
 1-ethyl-2,3,5-trimethylpyrazolium
 bis(pentafluoroethanesulfonyl)imide,
 1-propyl-2,3,5-trimethylpyrazolium
 bis(pentafluoroethanesulfonyl)imide,

1-butyl-2,3,5-trimethylpyrazolium
 bis(pentafluoroethanesulfonyl)imide,
 1-ethyl-2,3,5-trimethylpyrazolium
 (trifluoromethanesulfonyl)trifluoroacetamide,
 1-propyl-2,3,5-trimethylpyrazolium
 (trifluoromethanesulfonyl)trifluoroacetamide,
 1-butyl-2,3,5-trimethylpyrazolium
 (trifluoromethanesulfonyl)trifluoroacetamide,
 trimethylpropylammonium bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-ethyl-N-propylammonium
 bis(trifluoromethanesulfonyl)imide,
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 bis(trifluoromethanesulfonyl)imide,
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 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-ethyl-N-hexylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-ethyl-N-heptylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-ethyl-N-nonylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N,N-dipropylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-propyl-N-butylammonium
 bis(trifluoromethanesulfonyl)imide,

N,N-dimethyl-N-propyl-N-pentylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-propyl-N-hexylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-propyl-N-heptylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-butyl-N-hexylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-butyl-N-heptylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N-pentyl-N-hexylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dimethyl-N,N-dihexylammonium
 bis(trifluoromethanesulfonyl)imide, trimethylheptylammonium
 bis(trifluoromethanesulfonyl)imide,
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 bis(trifluoromethanesulfonyl)imide,
 N,N-diethyl-N-methyl-N-pentylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-diethyl-N-methyl-N,N-heptylammonium
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 bis(trifluoromethanesulfonyl)imide, triethylpentylammonium
 bis(trifluoromethanesulfonyl)imide, triethylheptylammonium

bis(trifluoromethanesulfonyl)imide,
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 bis(trifluoromethanesulfonyl)imide,
 N,N-dipropyl-N-methyl-N-pentylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dipropyl-N-butyl-N-hexylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dipropyl-N,N-dihexylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dibutyl-N-methyl-N-pentylammonium
 bis(trifluoromethanesulfonyl)imide,
 N,N-dibutyl-N-methyl-N-hexylammonium
 bis(trifluoromethanesulfonyl)imide, trioctylmethylammonium
 bis(trifluoromethanesulfonyl)imide,
 N-methyl-N-ethyl-N-propyl-N-pentylammonium
 bis(trifluoromethanesulfonyl)imide, 1-butylpyridinium
 (trifluoromethanesulfonyl)trifluoroacetamide,
 1-butyl-3-methylpyridinium
 (trifluoromethanesulfonyl)trifluoroacetamide,
 1-ethyl-3-methylimidazolium
 (trifluoromethanesulfonyl)trifluoroacetamide,
 tetrahexylammonium bis(trifluoromethanesulfonyl)imide,
 diallyldimethylammonium trifluoromethanesulfonate,
 diallyldimethylammonium bis(trifluoromethanesulfonyl)imide,
 diallyldimethylammonium bis(pentafluoroethanesulfonyl)imide,

N,N-diethyl-N-methyl-N-(2-methoxyethyl) ammonium
 trifluoromethanesulfonate,
 N,N-diethyl-N-methyl-N-(2-methoxyethyl) ammonium
 bis(trifluoromethanesulfonyl) imide,
 N,N-diethyl-N-methyl-N-(2-methoxyethyl) ammonium
 bis(pentafluoroethanesulfonyl) imide, glycidyltrimethylammonium
 trifluoromethanesulfonate, glycidyltrimethylammonium
 bis(trifluoromethanesulfonyl) imide, glycidyltrimethylammonium
 bis(pentafluoroethanesulfonyl) imide, diallyldimethylammonium
 bis(trifluoromethanesulfonyl) imide,
 diallyldimethylbis(pentafluoroethanesulfonyl) imide, lithium
 bis(trifluoromethanesulfonyl) imide, and lithium
 bis(fluorosulfonyl) imide.

[0202]

Of those ionic liquids, 1-hexylpyridinium
 bis(fluorosulfonyl) imide, 1-ethyl-3-methylpyridinium
 trifluoromethanesulfonate, 1-ethyl-3-methylpyridinium
 pentafluoroethanesulfonate, 1-ethyl-3-methylpyridinium
 heptafluoropropanesulfonate, 1-ethyl-3-methylpyridinium
 nonafluorobutanesulfonate, 1-butyl-3-methylpyridinium
 trifluoromethanesulfonate, 1-butyl-3-methylpyridinium
 bis(trifluoromethanesulfonyl) imide, 1-octyl-4-methylpyridinium
 bis(fluorosulfonyl) imide, 1-methyl-1-propylpyrrolidinium
 bis(trifluoromethanesulfonyl) imide,

1-methyl-1-propylpyrrolidinium bis(fluorosulfonyl)imide,
 1-methyl-1-propylpiperidinium
 bis(trifluoromethanesulfonyl)imide,
 1-methyl-1-propylpiperidinium bis(fluorosulfonyl)imide,
 1-ethyl-3-methylimidazolium trifluoromethanesulfonate,
 1-ethyl-3-methylimidazolium heptafluoropropanesulfonate,
 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide,
 1-ethyl-3-methylimidazolium bis(fluorosulfonyl)imide,
 1-hexyl-3-methylimidazolium bis(fluorosulfonyl)imide,
 trimethylpropylammonium bis(trifluoromethanesulfonyl)imide,
 lithium bis(trifluoromethanesulfonyl)imide, or lithium
 bis(fluorosulfonyl)imide is more preferred.

[0203]

Although a commercial product may be used as the ionic liquid,
 the ionic liquid may be synthesized as described below. Although
 a method of synthesizing the ionic liquid is not particularly limited
 as long as a targeted ionic liquid is obtained, for example, such
 a halide method, hydroxide method, acid ester method, complexation
 method, and neutralization method as described in the literature
 "Ionic Liquid: The Front and Future of Material Development"
 (published by CMC Publishing CO., LTD.) are each generally employed.

[0204]

Although the halide method, the hydroxide method, the acid

ester method, the complexation method, and the neutralization method are described below by taking a synthesis method for a nitrogen-containing onium salt as an example, any other ionic liquid, such as a sulfur-containing onium salt or a phosphorus-containing onium salt, may also be obtained by the same approach.

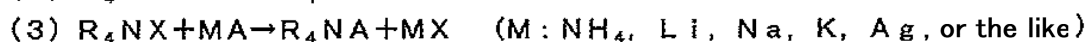
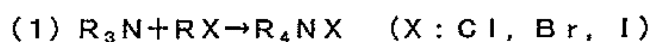
[0205]

The halide method is a method performed by such reactions as represented by the reaction formulae (1) to (3). First, a tertiary amine and an alkyl halide are caused to react with each other to provide a halide (the reaction formula (1), chlorine, bromine, or iodine is used as a halogen).

[0206]

The targeted ionic liquid (R_4NA) is obtained by causing the resultant halide to react with an acid (HA) or salt (MA where M represents a cation that forms a salt with a targeted anion, such as ammonium, lithium, sodium, or potassium) having the anion structure (A^-) of the targeted ionic liquid.

[0207]



[0208]

The hydroxide method is a method performed by such reactions as represented by the reaction formulae (4) to (8). First, a hydroxide (R_4NOH) is obtained from a halide (R_4NX) by ion exchange membrane-method electrolysis (the reaction formula (4)), an OH-type ion exchange resin method (the reaction formula (5)), or a reaction with silver oxide (Ag_2O) (the reaction formula (6)) (chlorine, bromine, or iodine is used as a halogen).

[0209]

The targeted ionic liquid (R_4NA) is obtained by using the reactions represented by the reaction formulae (7) and (8) for the resultant hydroxide as in the halide method.

[0210]

- (4) $R_4NX + H_2O \rightarrow R_4NOH + 1/2 H_2 + 1/2 X_2$ ($X: Cl, Br, I$)
- (5) $R_4NX + P-OH \rightarrow R_4NOH + P-X$ ($P-OH$: an OH-type ion exchange resin)
- (6) $R_4NX + 1/2 Ag_2O + 1/2 H_2O \rightarrow R_4NOH + AgX$
- (7) $R_4NOH + HA \rightarrow R_4NA + H_2O$
- (8) $R_4NOH + MA \rightarrow R_4NA + MOH$ ($M: NH_4, Li, Na, K, Ag, \text{ or the like}$)

[0211]

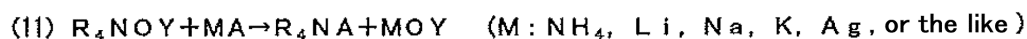
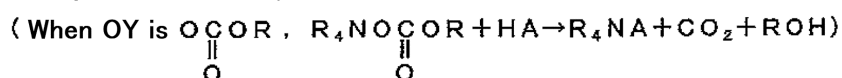
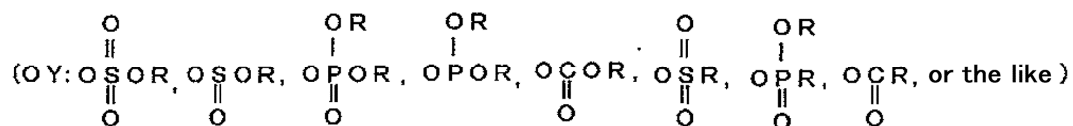
The acid ester method is a method performed by such reactions as represented by the reaction formulae (9) to (11). First, a tertiary amine (R_3N) and an acid ester are caused to react with each other to provide an acid esterified product (the reaction formula (9)), an ester of an inorganic acid, such as sulfuric acid, sulfurous acid, phosphoric acid, phosphorous acid, or carbonic acid, an ester

of an organic acid, such as methanesulfonic acid, methylphosphonic acid, or formic acid, or the like is used as the acid ester).

[0212]

The targeted ionic liquid (R_4NA) is obtained by using the reactions represented by the reaction formulae (10) and (11) for the resultant acid esterified product as in the halide method. In addition, the ionic liquid may be directly obtained by using, for example, methyl trifluoromethanesulfonate or methyl trifluoroacetate as the acid ester.

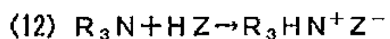
[0213]



[0214]

The neutralization method is a method performed by such a reaction as represented by the reaction formula (12). The ionic liquid may be obtained by causing a tertiary amine and an organic acid, such as CF_3COOH , CF_3SO_3H , $(CF_3SO_2)_2NH$, $(CF_3SO_2)_3CH$, or $(C_2F_5SO_2)_2NH$, to react with each other.

[0215]



[HZ : an organic acid, such as CF_3COOH , $\text{CF}_3\text{SO}_3\text{H}$, $(\text{CF}_3\text{SO}_2)_2\text{NH}$,
 $(\text{CF}_3\text{SO}_2)_3\text{CH}$, $(\text{C}_2\text{F}_5\text{SO}_2)_2\text{NH}$]

[0216]

R's represented in the reaction formulae (1) to (12) each represent hydrogen or a hydrocarbon group having 1 to 20 carbon atoms and may each contain a heteroatom.

[0217]

Although the compounding amount of the ionic liquid cannot be indiscriminately defined because the compounding amount varies depending on compatibility between the polymer to be used and the ionic liquid, in general, the compounding amount is preferably from 0.001 part by weight to 50 parts by weight, more preferably from 0.01 part by weight to 40 parts by weight, still more preferably from 0.01 part by weight to 30 parts by weight, particularly preferably from 0.01 part by weight to 20 parts by weight, most preferably from 0.01 part by weight to 10 parts by weight with respect to 100 parts by weight of the base polymer. The adjustment of the compounding amount of the ionic liquid within the range can provide a pressure-sensitive adhesive composition extremely excellent in antistatic property. When the compounding amount of the ionic liquid is less than 0.01 part by weight, a sufficient antistatic

characteristic may not be obtained. When the compounding amount of the ionic liquid exceeds 50 parts by weight, the extent to which the adherend is contaminated tends to enlarge.

[0218]

The pressure-sensitive adhesive composition may contain a modified silicone oil to the extent that the effects of the present invention are not impaired. When the pressure-sensitive adhesive composition contains the modified silicone oil, an antistatic characteristic effect can be expressed. In particular, when the oil is used in combination with the ionic liquid, the antistatic characteristic effect can be more effectively expressed.

[0219]

When the pressure-sensitive adhesive composition contains the modified silicone oil, its content is preferably from 0.001 part by weight to 50 parts by weight, more preferably from 0.005 part by weight to 40 parts by weight, still more preferably from 0.007 part by weight to 30 parts by weight, particularly preferably from 0.008 part by weight to 20 parts by weight, most preferably from 0.01 part by weight to 10 parts by weight with respect to 100 parts by weight of the base polymer. When the content of the modified silicone oil is adjusted within the range, the antistatic characteristic effect can be more effectively expressed.

[0220]

Any appropriate modified silicone oil may be adopted as the modified silicone oil to the extent that the effects of the present invention are not impaired. Such modified silicone oil is, for example, a modified silicone oil available from Shin-Etsu Chemical Co., Ltd.

[0221]

The modified silicone oil is preferably a polyether-modified silicone oil. When the polyether-modified silicone oil is adopted, the antistatic characteristic effect can be more effectively expressed.

[0222]

Examples of the polyether-modified silicone oil include a side chain-type polyether-modified silicone oil and a both-terminal-type polyether-modified silicone oil. Of those, a both-terminal-type polyether-modified silicone oil is preferred because the antistatic characteristic effect can be more effectively expressed.

[0223]

<<<<Application>>>>

The surface protective film of the present invention has ultralight peelability and has a low property by which the surface of an adherend is contaminated. Accordingly, the film can be suitably

used in the protection of the surface of an optical member or an electronic member. An optical member of the present invention has bonded thereto the surface protective film of the present invention. An electronic member of the present invention has bonded thereto the surface protective film of the present invention.

Examples

[0224]

The present invention is hereinafter described specifically by way of Examples. However, the present invention is by no means limited to these Examples. Test and evaluation methods in Examples and the like are as described below. The term "part(s)" in the following description means "part(s) by weight" unless otherwise specified, and the term "%" in the following description means "wt%" unless otherwise specified.

[0225]

<Peel Strengths against PET at Peel Rate of 6,000 mm/min (Peel Strength after Standing at 23°C for 30 Minutes and Peel Strength after Standing at 80°C for 7 Days)>

A peel strength when a polyethylene terephthalate film having a thickness of 25 μm was bonded to a pressure-sensitive adhesive layer, and the polyethylene terephthalate film was peeled at 23°C, a peel angle of 180°, and a peel rate of 6,000 mm/min was measured as described below.

A SUS304 plate was bonded to the entirety of the surface of a surface protective film (measuring 50 mm wide by 140 mm long) from which a separator had been peeled opposite to its pressure-sensitive adhesive layer through intermediation of a double-sided adhesive tape (manufactured by Nitto Denko Corporation, product name: "No. 531") with a 2-kilogram hand roller.

Next, a polyethyleneterephthalate film (manufactured by Toray Industries, Inc., product name: "LUMIRROR S-10," thickness: 25 μm , width: 25 mm) was bonded to the surface of the pressure-sensitive adhesive layer (temperature: 23°C, humidity: 65%, one reciprocation of the 2-kilogram roller).

An evaluation sample obtained as described above was subjected to measurement with a tensile tester. A product available under the product name "AUTOGRAPH AG-Xplus HS 6,000 mm/min High-speed Model (AG-50NX plus)" from Shimadzu Corporation was used as the tensile tester. The evaluation sample was set in the tensile tester, and was then left to stand under an environment having a temperature of 23°C for 30 minutes or under an environment having a temperature of 80°C for 7 days. After that, a tensile test was initiated. The tensile test was performed under the conditions of a peel angle of 180° and a peel rate (rate of pulling) of 6,000 mm/min. A load at the time of the peeling of the PET film from the surface protective film was measured, and an average load at that time was defined as the peel strength of the surface protective film.

[0226]

<Peel Strengths against PET at Peel Rate of 300 mm/min (Peel Strength after Standing at 23°C for 30 Minutes and Peel Strength after Standing at 80°C for 7 Days)>

A peel strength when a polyethylene terephthalate film having a thickness of 25 μm was bonded to a pressure-sensitive adhesive layer, and the polyethylene terephthalate film was peeled at 23°C, a peel angle of 180°, and a peel rate of 300 mm/min was measured as described below.

A SUS304 plate was bonded to the entirety of the surface of a surface protective film (measuring 50 mm wide by 140 mm long) from which a separator had been peeled opposite to its pressure-sensitive adhesive layer through intermediation of a double-sided adhesive tape (manufactured by Nitto Denko Corporation, product name: "No. 531") with a 2-kilogram hand roller.

Next, a polyethylene terephthalate film (manufactured by Toray Industries, Inc., product name: "LUMIRROR S-10," thickness: 25 μm , width: 25 mm) was bonded to the surface of the pressure-sensitive adhesive layer (temperature: 23°C, humidity: 65%, one reciprocation of the 2-kilogram roller).

An evaluation sample obtained as described above was subjected to a tensile test. A product available under the product name "AUTOGRAPH AG-Xplus HS 6000 mm/min High-speed Model (AG-50NX plus)" from Shimadzu Corporation was used as a tensile tester. The evaluation sample was set in the tensile tester, and was then left

to stand under an environment having a temperature of 23°C for 30 minutes or under an environment having a temperature of 80°C for 7 days. After that, the tensile test was initiated. The tensile test was performed under the conditions of a peel angle of 180° and a peel rate (rate of pulling) of 300 mm/min. A load at the time of the peeling of the PET film from the surface protective film was measured, and an average load at that time was defined as the peel strength of the surface protective film.

[0227]

<Residual Adhesion Ratio>

A surface protective film was bonded to the entire surface of a glass plate (manufactured by Matsunami Glass Ind., Ltd., 1.35 mm by 10 cm by 10 cm) with a hand roller, and the resultant was stored under an atmosphere having a temperature of 23°C and a humidity of 55%RH for 24 hours. After that, the surface protective film was peeled at a rate of 0.3 m/min, and No. 31B Tape (manufactured by Nitto Denko Corporation, base material thickness: 25 µm) having a width of 19 mm, which had been cut into a length of 150 mm, was bonded to the residue under the atmosphere having a temperature of 23°C and a humidity of 55%RH by reciprocating a 2.0-kilogram roller once. The resultant was aged under the atmosphere having a temperature of 23°C and a humidity of 55%RH for 30 minutes, and then the pressure-sensitive adhesive strength of the tape was measured by peeling the tape with a tensile tester (product available

under the product name "AUTOGRAPH AG-Xplus HS 6,000 mm/min High-speed Model (AG-50NX plus)" from Shimadzu Corporation) at a peel angle of 180° and a rate of pulling of 300 mm/min.

Separately, the pressure-sensitive adhesive strength of No. 31B Tape having a width of 19 mm against a glass plate that had not been subjected to such treatment as described above was also similarly measured, followed by the calculation of a residual adhesion ratio from the following equation.

Residual adhesion ratio (%) = (pressure-sensitive adhesive strength of No. 31B against glass plate after peeling of surface protective film / pressure-sensitive adhesive strength of No. 31B against glass plate) × 100

The residual adhesion ratio serves as an indicator of the extent to which the pressure-sensitive adhesive component of the surface protective film is transferred onto the surface of an adherend to contaminate the surface. As a value for the residual adhesion ratio becomes higher, it can be said that the surface protective film is suppressed from contaminating the adherend and is hence a better surface protective film, and as the value for the residual adhesion ratio becomes lower, it can be said that the surface protective film contaminates the surface of the adherend with the pressure-sensitive adhesive component or the like to a larger extent.

[0228]

<Peel Strengths against Glass at Peel Rate of 6,000 mm/min (Peel

Strength after Standing at 23°C for 30 Minutes and Peel Strength after Standing at 80°C for 7 Days)>

A surface protective film (measuring 25 mm wide by 140 mm long) from which a separator had been peeled was bonded to glass (soda lime glass, manufactured by Matsunami Glass Ind., Ltd.) by reciprocating a 2-kilogram hand roller once.

An evaluation sample obtained as described above was subjected to measurement with a tensile tester. A product available under the product name "AUTOGRAPH AG-Xplus HS 6,000 mm/min High-speed Model (AG-50NX plus)" from Shimadzu Corporation was used as the tensile tester. The evaluation sample was set in the tensile tester, and was then left to stand under an environment having a temperature of 23°C for 30 minutes or under an environment having a temperature of 80°C for 7 days. After that, a tensile test was initiated. The tensile test was performed under the conditions of a peel angle of 180° and a peel rate (rate of pulling) of 6,000 mm/min. A load at the time of the peeling of the surface protective film from the glass was measured, and an average load at that time was defined as the peel strength of the surface protective film.

[0229]

<Peel Strengths against Glass at Peel Rate of 300 mm/min (Peel Strength after Standing at 23°C for 30 Minutes and Peel Strength after Standing at 80°C for 7 Days)>

A surface protective film (measuring 25 mm wide by 140 mm long)

from which a separator had been peeled was bonded to glass (soda lime glass, manufactured by Matsunami Glass Ind., Ltd.) by reciprocating a 2-kilogram hand roller once.

An evaluation sample obtained as described above was subjected to measurement with a tensile tester. A product available under the product name "AUTOGRAPH AG-Xplus HS 6000 mm/min High-speed Model (AG-50NX plus)" from Shimadzu Corporation was used as the tensile tester. The evaluation sample was set in the tensile tester, and was then left to stand under an environment having a temperature of 23°C for 30 minutes or under an environment having a temperature of 80°C for 7 days. After that, a tensile test was initiated. The tensile test was performed under the conditions of a peel angle of 180° and a peel rate (rate of pulling) of 300 mm/min. A load at the time of the peeling of the surface protective film from the glass was measured, and an average load at that time was defined as the peel strength of the surface protective film.

[0230]

[Example 1]

85 Parts by weight of PREMINOL S3011 (manufactured by Asahi Glass Co., Ltd., Mn=10,000), which was a polyol having 3 OH groups, 13 parts by weight of SANNIX GP-3000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=3,000), which was a polyol having 3 OH groups, and 2 parts by weight of SANNIX GP-1000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=1,000), which was a polyol having 3 OH groups,

serving as the polyols (A), 18 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 0.1 part by weight of a catalyst (manufactured by Nihon Kagaku Sangyo Co., Ltd., product name: "Nacem Ferric Iron"), 20 parts by weight of isopropyl myristate (manufactured by Kao Corporation, product name: "EXCEPARL IPM," Mn=270) serving as a fatty acid ester, 1.5 parts by weight of 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide (manufactured by DKS Co., Ltd., product name: "AS-110"), 0.02 part by weight of a both-terminal-type polyether-modified silicone oil (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KF-6004"), 0.25 part by weight of a siloxane bond-containing polymer (manufactured by Kyoeisha Chemical Co., Ltd., product name: LE-302), and ethyl acetate serving as a diluent solvent were loaded, and the materials were mixed and stirred to produce a pressure-sensitive adhesive composition (1).

The resultant pressure-sensitive adhesive composition (1) was applied to a base material "LUMIRROR S-10" formed of a polyester resin (thickness: 38 μm , manufactured by Toray Industries, Inc.) with a fountain roll so that its thickness after drying became 10 μm , followed by curing and drying under the conditions of a drying temperature of 130°C and a drying time of 30 seconds. Thus, a pressure-sensitive adhesive layer was produced on the base material. Next, one surface of a base material (separator) formed of a polyester

resin having a thickness of 25 μm was subjected to silicone treatment, and the silicone-treated surface was bonded to the surface of the pressure-sensitive adhesive layer. Thus, a surface protective film (1) with a separator was obtained.

The results are shown in Table 1.

[0231]

[Example 2]

A pressure-sensitive adhesive composition (2) was produced and a surface protective film (2) with a separator was obtained in the same manner as in Example 1 except that: 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide (manufactured by DKS Co., Ltd., product name: "AS-110") was not used; and 0.50 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was used instead of 0.25 part by weight of the siloxane bond-containing polymer (manufactured by Kyoeisha Chemical Co., Ltd., product name: LE-302).

The results are shown in Table 1.

[0232]

[Example 3]

A pressure-sensitive adhesive composition (3) was produced and a surface protective film (3) with a separator was obtained in the same manner as in Example 2 except that the usage amount

of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 1.00 part by weight.

The results are shown in Table 1.

[0233]

[Example 4]

A pressure-sensitive adhesive composition (4) was produced and a surface protective film (4) with a separator was obtained in the same manner as in Example 1 except that 0.30 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was further used at the time of the production of the pressure-sensitive adhesive composition.

The results are shown in Table 1.

[0234]

[Example 5]

A pressure-sensitive adhesive composition (5) was produced and a surface protective film (5) with a separator was obtained in the same manner as in Example 1 except that 0.30 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was used instead of 0.25 part by weight of the siloxane bond-containing polymer (manufactured by Kyoeisha Chemical Co., Ltd., product name: LE-302).

The results are shown in Table 1.

[0235]

[Example 6]

100 Parts by weight of SANNIX GP-3000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=3,000), which was a polyol having 3 OH groups, serving as the polyol (A), 18 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 0.1 part by weight of a catalyst (manufactured by Nihon Kagaku Sangyo Co., Ltd., product name: "Nacem Ferric Iron"), 0.25 part by weight of a hydroxyl group-containing silicone oil (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "X-22-4015"), and ethyl acetate serving as a diluent solvent were loaded, and the materials were mixed and stirred to produce a pressure-sensitive adhesive composition (6).

A surface protective film (6) with a separator was obtained in the same manner as in Example 1 by using the pressure-sensitive adhesive composition (6).

The results are shown in Table 1.

[0236]

[Comparative Example 1]

85 Parts by weight of PREMINOL S3011 (manufactured by Asahi Glass Co., Ltd., Mn=10,000), which was a polyol having 3 OH groups, 13 parts by weight of SANNIX GP-3000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=3,000), which was a polyol having 3 OH groups,

and 2 parts by weight of SANNIX GP-1000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=1,000), which was a polyol having 3 OH groups, serving as the polyols (A), 18 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 0.1 part by weight of a catalyst (manufactured by Nihon Kagaku Sangyo Co., Ltd., product name: "Nacem Ferric Iron"), and ethyl acetate serving as a diluent solvent were loaded, and the materials were mixed and stirred to produce a pressure-sensitive adhesive composition (C1).

A surface protective film (C1) with a separator was obtained in the same manner as in Example 1 by using the pressure-sensitive adhesive composition (C1).

The results are shown in Table 1.

[0237]

[Comparative Example 2]

A pressure-sensitive adhesive composition (C2) was produced and a surface protective film (C2) with a separator was obtained in the same manner as in Comparative Example 1 except that 0.02 part by weight of a both-terminal-type polyether-modified silicone oil (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KF-6004") was further used at the time of the production of the pressure-sensitive adhesive composition.

The results are shown in Table 1.

[0238]

[Comparative Example 3]

100 Parts by weight of SANNIX GP-3000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=3,000), which was a polyol having 3 OH groups, serving as the polyol (A), 18 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 0.1 part by weight of a catalyst (manufactured by Nihon Kagaku Sangyo Co., Ltd., product name: "Nacem Ferric Iron"), and ethyl acetate serving as a diluent solvent were loaded, and the materials were mixed and stirred to produce a pressure-sensitive adhesive composition (C3).

A surface protective film (C3) with a separator was obtained in the same manner as in Example 1 by using the pressure-sensitive adhesive composition (C3).

The results are shown in Table 1.

[0239]

[Comparative Example 4]

A pressure-sensitive adhesive composition (C4) was produced and a surface protective film (C4) with a separator was obtained in the same manner as in Example 1 except that 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide (manufactured by DKS Co., Ltd., product name: "AS-110") and the

siloxane bond-containing polymer (manufactured by Kyoeisha Chemical Co., Ltd., product name: LE-302) were not used.

The results are shown in Table 1.

[0240]

[Comparative Example 5]

A pressure-sensitive adhesive composition (C5) was produced and a surface protective film (C5) with a separator was obtained in the same manner as in Example 1 except that: the siloxane bond-containing polymer was not used; the usage amount of isopropyl myristate (manufactured by Kao Corporation, product name: "EXCEPARL IPM," Mn=270) was changed to 30 parts by weight; and the usage amount of the both-terminal-type polyether-modified silicone oil (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KF-6004") was changed to 0.01 part by weight.

The results are shown in Table 1.

[0241]

[Comparative Example 6]

A pressure-sensitive adhesive composition (C6) was produced and a surface protective film (C6) with a separator was obtained in the same manner as in Comparative Example 1 except that 25 parts by weight of isopropyl myristate (manufactured by Kao Corporation, product name: "EXCEPARL IPM," Mn=270) was further used at the time of the production of the pressure-sensitive adhesive composition.

The results are shown in Table 1.

[0242]

[Comparative Example 7]

A pressure-sensitive adhesive composition (C7) was produced and a surface protective film (C7) with a separator was obtained in the same manner as in Comparative Example 5 except that 0.15 part by weight of a silicone peeling agent (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KS-776A") was used instead of 0.01 part by weight of the both-terminal-type polyether-modified silicone oil (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KF-6004") and that 20 parts by weight of isopropyl myristate (manufactured by Kao Corporation, product name: "EXCEPARL IPM," Mn=270) was used instead of 30 parts by weight of isopropyl myristate (manufactured by Kao Corporation, product name: "EXCEPARL IPM," Mn=270).

The results are shown in Table 1.

Table 1

	Formulation (part(s) by weight)								Peel strength against PET after standing at 23°C for 30 minutes (N/25 mm)		Residual adhesion ratio (%)
	Base polymer	AS110	KS-776A	KF-6004	IPM	LE-302	F-571	X-22-4015	Peel rate of 300 mm/min	Peel rate of 6,000 mm/min	
Example 1	100	1.5	-	0.02	20	0.25	-	-	0.010	0.055	72
Example 2	100	-	-	0.02	20	-	0.50	-	0.007	0.051	70
Example 3	100	-	-	0.02	20	-	1.00	-	0.006	0.043	67
Example 4	100	1.5	-	0.02	20	0.25	0.30	-	0.006	0.049	68
Example 5	100	1.5	-	0.02	20	-	0.30	-	0.006	0.046	72
Example 6	100	-	-	-	-	-	-	0.25	0.016	0.061	91
Comparative Example 1	100	-	-	-	-	-	-	-	0.038	0.194	94
Comparative Example 2	100	-	-	0.02	-	-	-	-	0.049	0.207	81
Comparative Example 3	100	-	-	-	-	-	-	-	0.047	0.146	98
Comparative Example 4	100	-	-	0.02	20	-	-	-	0.020	0.094	83
Comparative Example 5	100	1.5	-	0.01	30	-	-	-	0.020	0.090	77
Comparative Example 6	100	-	-	-	25	-	-	-	0.032	0.112	97
Comparative Example 7	100	1.5	0.15	-	20	-	-	-	0.008	0.043	38

[0244]

[Example 7]

100 Parts by weight of "CYABINE SH-109" (solid content: 54%, containing a fatty acid ester, manufactured by Toyo Ink Co., Ltd.) serving as the urethane prepolymer (C), 7.05 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 1.00 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571"), and 208 parts by weight of toluene serving as a diluent solvent were compounded, and the mixture was stirred with a disper to produce a pressure-sensitive adhesive composition (7).

The resultant pressure-sensitive adhesive composition (7) was applied to a base material "LUMIRROR S-10" formed of a polyester resin (thickness: 38 μm , manufactured by Toray Industries, Inc.) with a fountain roll so that its thickness after drying became 10 μm , followed by curing and drying under the conditions of a drying temperature of 130°C and a drying time of 30 seconds. Thus, a pressure-sensitive adhesive layer was produced on the base material. Next, one surface of a base material (separator) formed of a polyester resin having a thickness of 25 μm was subjected to silicone treatment, and the silicone-treated surface was bonded to the surface of the pressure-sensitive adhesive layer. Thus, a surface protective film (7) with a separator was obtained.

The results are shown in Table 2.

[0245]

[Example 8]

A pressure-sensitive adhesive composition (8) was produced and a surface protective film (8) with a separator was obtained in the same manner as in Example 7 except that the usage amount of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 2.00 parts by weight.

The results are shown in Table 2.

[0246]

[Example 9]

A pressure-sensitive adhesive composition (9) was produced and a surface protective film (9) with a separator was obtained in the same manner as in Example 7 except that the usage amount of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 3.00 parts by weight.

The results are shown in Table 2.

[0247]

Table 2

	Formulation (part(s) by weight)			Peel strength against PET after standing at 23°C for 30 minutes (N/25 mm)		Residual adhesion ratio (%)
	Base polymer SH-109	CORONATE HX	F-571	Peel rate of 300 mm/min	Peel rate of 6,000 mm/min	
Example 7	100	7.05	1.00	0.014	0.074	97
Example 8	100	7.05	2.00	0.014	0.068	96
Example 9	100	7.05	3.00	0.015	0.058	98

[0248]

[Example 10]

100 Parts by weight of "CYABINE SH-109" (solid content: 54%, containing a fatty acid ester, manufactured by Toyo Ink Co., Ltd.) serving as the urethane prepolymer (C), 3.6 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 1.00 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571"), and 208 parts by weight of toluene serving as a diluent solvent were compounded, and the mixture was stirred with a disper to produce a pressure-sensitive adhesive composition (10).

The resultant pressure-sensitive adhesive composition (10) was applied to a base material "LUMIRROR S-10" formed of a polyester

resin (thickness: 38 μm , manufactured by Toray Industries, Inc.) with a fountain roll so that its thickness after drying became 50 μm , followed by curing and drying under the conditions of a drying temperature of 130°C and a drying time of 30 seconds. Thus, a pressure-sensitive adhesive layer was produced on the base material. Next, one surface of a base material (separator) formed of a polyester resin having a thickness of 25 μm was subjected to silicone treatment, and the silicone-treated surface was bonded to the surface of the pressure-sensitive adhesive layer. Thus, a surface protective film (10) with a separator was obtained.

The results are shown in Table 3 and Table 4.

[0249]

[Example 11]

A pressure-sensitive adhesive composition (11) was produced and a surface protective film (11) with a separator was obtained in the same manner as in Example 10 except that the usage amount of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 3.00 parts by weight.

The results are shown in Table 3 and Table 4.

[0250]

[Example 12]

A pressure-sensitive adhesive composition (12) was produced and a surface protective film (12) with a separator was obtained

in the same manner as in Example 10 except that the usage amount of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 5.00 parts by weight.

The results are shown in Table 3 and Table 4.

[0251]

[Comparative Example 8]

A pressure-sensitive adhesive composition (C8) was produced and a surface protective film (C8) with a separator was obtained in the same manner as in Example 10 except that the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was not used.

The results are shown in Table 3 and Table 4.

[0252]

[Comparative Example 9]

A pressure-sensitive adhesive composition (C9) was produced and a surface protective film (C9) with a separator was obtained in the same manner as in Example 10 except that: the usage amount of the CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.) was changed to 7.05 parts by weight; and the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was not used.

The results are shown in Table 3 and Table 4.

[0253]

[Example 13]

100 Parts by weight of "CYABINE SH-109" (solid content: 54%, containing a fatty acid ester, manufactured by Toyo Ink Co., Ltd.) serving as the urethane prepolymer (C), 7.05 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 1.00 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571"), and 208 parts by weight of toluene serving as a diluent solvent were compounded, and the mixture was stirred with a disper to produce a pressure-sensitive adhesive composition (13).

The resultant pressure-sensitive adhesive composition (13) was applied to a base material "LUMIRROR S-10" formed of a polyester resin (thickness: 38 μm , manufactured by Toray Industries, Inc.) with a fountain roll so that its thickness after drying became 50 μm , followed by curing and drying under the conditions of a drying temperature of 130°C and a drying time of 30 seconds. Thus, a pressure-sensitive adhesive layer was produced on the base material. Next, one surface of a base material (separator) formed of a polyester resin having a thickness of 25 μm was subjected to silicone treatment, and the silicone-treated surface was bonded to the surface of the pressure-sensitive adhesive layer. Thus, a surface protective film (13) with a separator was obtained.

The results are shown in Table 3 and Table 4.

[0254]

[Example 14]

A pressure-sensitive adhesive composition (14) was produced and a surface protective film (14) with a separator was obtained in the same manner as in Example 13 except that the usage amount of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 3.00 parts by weight.

The results are shown in Table 3 and Table 4.

[0255]

[Example 15]

A pressure-sensitive adhesive composition (15) was produced and a surface protective film (15) with a separator was obtained in the same manner as in Example 13 except that the usage amount of the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was changed to 5.00 parts by weight.

The results are shown in Table 3 and Table 4.

[0256]

[Comparative Example 10]

A pressure-sensitive adhesive composition (C10) was produced and a surface protective film (C10) with a separator was obtained in the same manner as in Example 13 except that: the

fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was not used; and 1 part by weight of a silicone peeling agent (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KS-776A") was used.

The results are shown in Table 3 and Table 4.

[0257]

[Comparative Example 11]

A pressure-sensitive adhesive composition (C11) was produced and a surface protective film (C11) with a separator was obtained in the same manner as in Example 13 except that: the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was not used; and 3 parts by weight of a silicone peeling agent (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "KS-776A") was used.

The results are shown in Table 3 and Table 4.

[0258]

[Comparative Example 12]

A pressure-sensitive adhesive composition (C12) was produced and a surface protective film (C12) with a separator was obtained in the same manner as in Example 13 except that: the usage amount of the CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.) was changed to 17.7 parts by weight; the fluorine-containing polymer (manufactured by DIC Corporation,

product name: "MEGAFACE F-571") was not used; and the composition was applied so that the thickness of a pressure-sensitive adhesive layer to be obtained became 10 μm .

The results are shown in Table 3 and Table 4.

[0259]

[Comparative Example 13]

A pressure-sensitive adhesive composition (C13) was produced and a surface protective film (C13) with a separator was obtained in the same manner as in Example 13 except that: the usage amount of the CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.) was changed to 17.7 parts by weight; the fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571") was not used; and the composition was applied so that the thickness of a pressure-sensitive adhesive layer to be obtained became 25 μm .

The results are shown in Table 3 and Table 4.

[0260]

[Example 16]

85 Parts by weight of PREMINOL S3011 (manufactured by Asahi Glass Co., Ltd., Mn=10,000), which was a polyol having 3 OH groups, 13 parts by weight of SANNIX GP-3000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=3,000), which was a polyol having 3 OH groups, and 2 parts by weight of SANNIX GP-1000 (manufactured by Sanyo Chemical

Industries, Ltd., Mn=1,000), which was a polyol having 3 OH groups, serving as the polyols (A), 17.7 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 0.3 part by weight of a fluorine-containing polymer (manufactured by DIC Corporation, product name: "MEGAFACE F-571"), and 200 parts by weight of ethyl acetate serving as a diluent solvent were compounded, and the mixture was stirred with a disper to produce a pressure-sensitive adhesive composition (16).

The resultant pressure-sensitive adhesive composition (16) was applied to a base material "LUMIRROR S-10" formed of a polyester resin (thickness: 38 μm , manufactured by Toray Industries, Inc.) with a fountain roll so that its thickness after drying became 10 μm , followed by curing and drying under the conditions of a drying temperature of 130°C and a drying time of 30 seconds. Thus, a pressure-sensitive adhesive layer was produced on the base material. Next, one surface of a base material (separator) formed of a polyester resin having a thickness of 25 μm was subjected to silicone treatment, and the silicone-treated surface was bonded to the surface of the pressure-sensitive adhesive layer. Thus, a surface protective film (16) with a separator was obtained.

The results are shown in Table 3 and Table 4.

[0261]

[Example 17]

A pressure-sensitive adhesive composition (17) was produced and a surface protective film (17) with a separator was obtained in the same manner as in Example 16 except that the composition was applied so that the thickness of a pressure-sensitive adhesive layer to be obtained became 25 μm .

The results are shown in Table 3 and Table 4.

[0262]

[Example 18]

85 Parts by weight of PREMINOL S3011 (manufactured by Asahi Glass Co., Ltd., Mn=10,000), which was a polyol having 3 OH groups, 13 parts by weight of SANNIX GP-3000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=3,000), which was a polyol having 3 OH groups, and 2 parts by weight of SANNIX GP-1000 (manufactured by Sanyo Chemical Industries, Ltd., Mn=1,000), which was a polyol having 3 OH groups, serving as the polyols (A), 17.7 parts by weight of CORONATE HX (manufactured by Nippon Polyurethane Industry Co., Ltd.), which was a polyfunctional alicyclic isocyanate compound, serving as the polyfunctional isocyanate compound (B), 0.3 part by weight of a hydroxyl group-containing silicone oil (manufactured by Shin-Etsu Chemical Co., Ltd., product name: "X-22-4015"), and 200 parts by weight of ethyl acetate serving as a diluent solvent were compounded, and the mixture was stirred with a disper to produce a pressure-sensitive adhesive composition (18).

The resultant pressure-sensitive adhesive composition (18) was applied to a base material "LUMIRROR S-10" formed of a polyester resin (thickness: 38 μm , manufactured by Toray Industries, Inc.) with a fountain roll so that its thickness after drying became 10 μm , followed by curing and drying under the conditions of a drying temperature of 130°C and a drying time of 30 seconds. Thus, a pressure-sensitive adhesive layer was produced on the base material. Next, one surface of a base material (separator) formed of a polyester resin having a thickness of 25 μm was subjected to silicone treatment, and the silicone-treated surface was bonded to the surface of the pressure-sensitive adhesive layer. Thus, a surface protective film (18) with a separator was obtained.

The results are shown in Table 3 and Table 4.

[0263]

[Example 19]

A pressure-sensitive adhesive composition (19) was produced and a surface protective film (19) with a separator was obtained in the same manner as in Example 18 except that the composition was applied so that the thickness of a pressure-sensitive adhesive layer to be obtained became 25 μm .

The results are shown in Table 3 and Table 4.

[0264]

Table 3

	Base resin		HX	F-571	X-22-4015	KS-776A
	Urethane prepolymer SH-109	Polyether polyol	Cross-linking agent	Fluorine-containing polymer	Hydroxyl group-containing silicone oil	Silicone peeling agent
Example 10	100		3.6	1		
Example 11	100		3.6	3		
Example 12	100		3.6	5		
Comparative Example 8	100		3.6			
Comparative Example 9	100		7.05			
Example 13	100		7.05	1		
Example 14	100		7.05	3		
Example 15	100		7.05	5		
Comparative Example 10	100		7.05			1
Comparative Example 11	100		7.05			3
Comparative Example 12	100		17.7			
Comparative Example 13	100		17.7			
Example 16		100	17.7	0.3		
Example 17		100	17.7	0.3		
Example 18		100	17.7		0.3	
Example 19		100	17.7		0.3	

Table 4

	Residual adhesion ratio	Peel strength against glass (N/25 mm)				Peel strength against PET (N/25 mm)			
		After standing at 23°C for 30 minutes Peel rate of 300 mm/min	After standing at 80°C for 7 days Peel rate of 300 mm/min	After standing at 23°C for 30 minutes Peel rate of 6,000 mm/min	After standing at 80°C for 7 days Peel rate of 6,000 mm/min	After standing at 23°C for 30 minutes Peel rate of 300 mm/min	After standing at 80°C for 30 minutes Peel rate of 6,000 mm/min	After standing at 23°C for 30 minutes Peel rate of 6,000 mm/min	After standing at 80°C for 7 days Peel rate of 6,000 mm/min
Example 10	76%	0.010	0.020	0.036	0.192	0.007	0.035	0.045	0.223
Example 11	71%	0.012	0.031	0.035	0.144	0.011	0.022	0.049	0.157
Example 12	67%	0.013	0.035	0.039	0.096	0.011	0.030	0.042	0.164
Comparative Example 8	81%	0.024	0.211	0.140	1.461	0.051	0.806	0.373	4.579
Comparative Example 9	79%	0.016	0.078	0.060	0.383	0.020	0.149	0.109	1.164
Example 13	74%	0.010	0.012	0.020	0.064	0.009	0.014	0.032	0.068
Example 14	76%	0.009	0.013	0.020	0.045	0.008	0.012	0.021	0.052
Example 15	72%	0.009	0.015	0.022	0.048	0.010	0.015	0.025	0.047
Comparative Example 10	13%	0.007	0.008	0.015	0.021	0.012	0.086	0.060	0.872
Comparative Example 11	13%	0.007	0.007	0.018	0.023	—	—	—	—
Comparative Example 12	102%	0.036	0.073	0.304	0.385	0.035	0.079	0.188	0.360
Comparative Example 13	100%	0.049	0.076	0.327	0.392	0.032	0.072	0.189	0.393
Example 16	91%	0.013	0.028	0.030	0.097	0.012	0.038	0.051	0.130
Example 17	94%	0.010	0.026	0.027	0.083	0.011	0.038	0.046	0.092
Example 18	93%	0.019	0.045	0.053	0.154	0.016	0.039	0.059	0.155
Example 19	94%	0.022	0.045	0.065	0.143	0.014	0.037	0.065	0.166

[0266]

[Example 20]

The separator of the surface protective film (1) with a separator obtained in Example 1 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0267]

[Example 21]

The separator of the surface protective film (2) with a separator obtained in Example 2 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0268]

[Example 22]

The separator of the surface protective film (3) with a separator obtained in Example 3 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded

to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0269]

[Example 23]

The separator of the surface protective film (4) with a separator obtained in Example 4 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0270]

[Example 24]

The separator of the surface protective film (5) with a separator obtained in Example 5 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0271]

[Example 25]

The separator of the surface protective film (6) with a separator obtained in Example 6 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0272]

[Example 26]

The separator of the surface protective film (1) with a separator obtained in Example 1 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0273]

[Example 27]

The separator of the surface protective film (2) with a separator obtained in Example 2 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded

to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0274]

[Example 28]

The separator of the surface protective film (3) with a separator obtained in Example 3 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0275]

[Example 29]

The separator of the surface protective film (4) with a separator obtained in Example 4 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0276]

[Example 30]

The separator of the surface protective film (5) with a separator obtained in Example 5 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0277]

[Example 31]

The separator of the surface protective film (6) with a separator obtained in Example 6 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0278]

[Example 32]

The separator of the surface protective film (7) with a separator obtained in Example 7 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded

to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0279]

[Example 33]

The separator of the surface protective film (10) with a separator obtained in Example 10 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0280]

[Example 34]

The separator of the surface protective film (13) with a separator obtained in Example 13 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0281]

[Example 35]

The separator of the surface protective film (16) with a separator obtained in Example 16 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0282]

[Example 36]

The separator of the surface protective film (18) with a separator obtained in Example 18 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a polarizing plate (manufactured by Nitto Denko Corporation, product name: "TEG1465DUHC") serving as an optical member. Thus, an optical member having bonded thereto a surface protective film was obtained.

[0283]

[Example 37]

The separator of the surface protective film (7) with a separator obtained in Example 7 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded

to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0284]

[Example 38]

The separator of the surface protective film (10) with a separator obtained in Example 10 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0285]

[Example 39]

The separator of the surface protective film (13) with a separator obtained in Example 13 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0286]

[Example 40]

The separator of the surface protective film (16) with a separator obtained in Example 16 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

[0287]

[Example 41]

The separator of the surface protective film (18) with a separator obtained in Example 18 was peeled, and the pressure-sensitive adhesive layer side of the residue was bonded to a conductive film (manufactured by Nitto Denko Corporation, product name: "ELECRYSTA V270L-TFMP") serving as an electronic member. Thus, an electronic member having bonded thereto a surface protective film was obtained.

Industrial Applicability

[0288]

The surface protective film of the present invention can be used in any appropriate application. The surface protective film of the present invention is preferably used in the field of an optical

member or an electronic member.

Reference Signs List

[0289]

- 1** base material layer
- 2** pressure-sensitive adhesive layer
- 10** surface protective film

Claims

[Claim 1]

A surface protective film, comprising a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.08 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 6,000 mm/min.

[Claim 2]

The surface protective film according to claim 1, wherein the surface protective film has a peel strength of 0.02 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 300 mm/min.

[Claim 3]

A surface protective film, comprising a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.35 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7

days, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 6,000 mm/min.

[Claim 4]

The surface protective film according to claim 3, wherein the surface protective film has a peel strength of 0.07 N/25 mm or less when a polyethylene terephthalate film having a thickness of 25 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the polyethylene terephthalate film is peeled at a peel angle of 180° and a peel rate of 300 mm/min.

[Claim 5]

A surface protective film, comprising a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.135 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 6,000 mm/min.

[Claim 6]

The surface protective film according to claim 5, wherein the surface protective film has a peel strength of 0.023 N/25 mm or less when a glass plate having a thickness of 1,000 μm is bonded

to the pressure-sensitive adhesive layer and the resultant is left to stand at 23°C for 30 minutes, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 300 mm/min.

[Claim 7]

A surface protective film, comprising a pressure-sensitive adhesive layer, wherein the surface protective film has a peel strength of 0.35 N/25 mm or less when a glass plate having a thickness of 1,000 µm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 6,000 mm/min.

[Claim 8]

The surface protective film according to claim 7, wherein the surface protective film has a peel strength of 0.05 N/25 mm or less when a glass plate having a thickness of 1,000 µm is bonded to the pressure-sensitive adhesive layer and the resultant is left to stand at 80°C for 7 days, and then the surface protective film is peeled from the glass plate at a peel angle of 180° and a peel rate of 300 mm/min.

[Claim 9]

The surface protective film according to any one of claims

1 to 8, wherein the surface protective film has a residual adhesion ratio of 50% or more.

[Claim 10]

The surface protective film according to any one of claims 1 to 9, wherein a pressure-sensitive adhesive forming the pressure-sensitive adhesive layer is formed of a pressure-sensitive adhesive composition, and the pressure-sensitive adhesive composition contains a base polymer and a silicone-based additive and/or a fluorine-based additive.

[Claim 11]

The surface protective film according to claim 10, wherein the silicone-based additive comprises at least one kind selected from a siloxane bond-containing compound, a hydroxyl group-containing silicone-based compound, and a cross-linkable functional group-containing silicone-based compound.

[Claim 12]

The surface protective film according to claim 10, wherein the fluorine-based additive comprises at least one kind selected from a fluorine-containing compound, a hydroxyl group-containing fluorine-based compound, and a cross-linkable functional group-containing fluorine-based compound.

[Claim 13]

The surface protective film according to claim 10, wherein the base polymer comprises at least one kind selected from a urethane-based resin, an acrylic resin, a rubber-based resin, and a silicone-based resin.

[Claim 14]

The surface protective film according to claim 13, wherein the urethane-based resin comprises a urethane-based resin formed of a composition containing a polyol (A) and a polyfunctional isocyanate compound (B).

[Claim 15]

The surface protective film according to claim 13, wherein the urethane-based resin comprises a urethane-based resin formed of a composition containing a urethane prepolymer (C) and a polyfunctional isocyanate compound (B).

[Claim 16]

The surface protective film according to any one of claims 10 to 15, wherein the pressure-sensitive adhesive composition contains a fatty acid ester.

[Claim 17]

An optical member, comprising the surface protective film of

any one of claims 1 to 16 bonded thereto.

[Claim 18]

An electronic member, comprising the surface protective film of any one of claims 1 to 16 bonded thereto.