

PRESSURE SENSITIVE ADHESIVE SHEET AND PILED BODY THEREOF

TECHNICAL FIELD

[0001] The present invention relates to a pressure sensitive adhesive sheet in which a release film is temporarily adhered to each of both the surfaces of a pressure sensitive adhesive layer.

BACKGROUND ART

[0002] A transparent pressure sensitive adhesive sheet is used for bonding optical members in a display device such as a liquid crystal (LC) display or an organic light emitting diode (OLED) display, or a display input device such as a touch panel. The transparent pressure sensitive adhesive used for bonding the optical members is generally provided as a release film-equipped pressure sensitive adhesive sheet in which a release film is temporarily adhered to each of both surfaces. In using the pressure sensitive adhesive sheet, first, one of release films (light release film) is peeled off, to expose one surface of a pressure sensitive adhesive layer, and the surface of the pressure sensitive adhesive layer is bonded to a first adherend. The other release film (heavy release film) is peeled off to bond a second adherend to the other surface of the pressure sensitive adhesive layer.

[0003] In a pressure sensitive adhesive sheet in which a release film is temporarily adhered to each of both the surfaces of a pressure sensitive adhesive layer, peeling charge may occur when the release film is peeled off from the pressure sensitive adhesive layer. When the charge amount of the pressure sensitive adhesive layer is large, foreign substances such as dust adhere to the surface of the pressure sensitive adhesive layer, which causes defects such as display defect. When bonding is performed in a state where foreign substances adhere to the surface of the pressure sensitive adhesive layer, breakage of an element caused by biting foreign substances may occur. In peeling of the heavy release film from a surface of the pressure sensitive adhesive bonded to the first adherend, large peeling charge may cause alignment failure of liquid crystal molecules, electrostatic destruction, etc. in an image display panel.

[0004] Patent Document 1 describes that an antistatic layer is disposed between a film substrate and a release layer, whereby peeling charge can be reduced when a release film is

peeled off from the surface of a pressure sensitive adhesive layer.

PRIOR ART DOCUMENT

[0005] Patent Document 1: WO 2014/097757

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SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] According to the study by the present inventors, even if a release film having an antistatic layer between a film substrate and a release layer is used, a peeling electrostatic potential may not be sufficiently reduced. In a piled body in which a plural pieces of sheet-like pressure sensitive adhesive cut into a predetermined size are piled up, static electricity can cause blocking between pressure sensitive adhesive sheets, which may make it difficult to pick up a piece of the pressure sensitive adhesive sheet one by one.

[0007] In view of the above, an object of the present invention is to provide a release film-equipped pressure sensitive adhesive sheet, which is less likely to cause blocking even when the pressure sensitive adhesive sheets are piled up to form a piled body and thus is easily picked up, and suppresses peeling charge in peeling of a release film.

MEANS FOR SOLVING THE PROBLEM

[0008] In a pressure sensitive adhesive sheet of the present invention, a first release film (light release film) is temporarily adhered to a first principal surface of a pressure sensitive adhesive layer, and a second release film (heavy release film) is temporarily adhered to a second principal surface of the pressure sensitive adhesive layer. Each of the first release film and the second release film includes a release layer on a first principal surface of a film substrate, and the first principal surface of the release film contacts the pressure sensitive adhesive layer. A peeling force between the first release film and the pressure sensitive adhesive layer is smaller than a peeling force between the second release film and the pressure sensitive adhesive layer.

[0009] At least one of the first release film and the second release film has an antistatic layer on a second principal surface of the film substrate. It is preferable the second release film has an antistatic layer on the second principal surface of the film substrate, and it is

more preferable both the first release film and the second release film has an antistatic layer on the second principal surface of the film substrate. When the antistatic layer is disposed on the second principal surface of the release film, the surface resistance of the second principal surface of the release film is preferably $1 \times 10^8 \Omega/\text{sq}$ or less, and the dynamic friction coefficient of the second principal surface of the release film is preferably 0.4 or less.

[0010] The first release film and/or the second release film may have an antistatic layer between the film substrate and the release layer. In particular, it is preferable that the first release film has an antistatic layer between the film substrate and the release layer.

[0011] A pressure sensitive adhesive constituting the pressure sensitive adhesive layer is preferably an acryl-based pressure sensitive adhesive containing an acryl-based base polymer. The pressure sensitive adhesive constituting the pressure sensitive adhesive layer may be a photocurable pressure sensitive adhesive containing a photocurable composition containing a polyfunctional monomer.

[0012] In the pressure sensitive adhesive sheet cut into a sheet piece, there may be a region where at least one of the first release film and the second release film protrudes outward from the outer peripheral edge of the pressure sensitive adhesive layer. At least one of the first release film and the second release film may protrude outward from the outer peripheral edge of the pressure sensitive adhesive layer over the entire outer periphery of the pressure sensitive adhesive layer. There may be a region where the first release film protrudes outward from the outer peripheral edge of the second release film.

[0013] By providing the release film so as to protrude outward from the outer peripheral edge of the pressure sensitive adhesive layer, defects such as glue contamination and glue missing caused by the protrusion of the pressure sensitive adhesive from the end surface can be suppressed. The release film is arranged so as to protrude outward from the end surface of the pressure sensitive adhesive layer, whereby workability of peeling the release film from the pressure sensitive adhesive layer can be improved.

[0014] When the release film is provided on the outer side of the outer peripheral edge of the pressure sensitive adhesive layer, a notch may be formed along the outer peripheral edge of the pressure sensitive adhesive layer on the first principal surface (the surface bonded to the pressure sensitive adhesive layer) of the release film.

[0015] The pressure sensitive adhesive sheet of the present invention may be piled to form

a piled body. The piled body of the pressure sensitive adhesive sheets may be a stack of ten or more pieces of the pressure sensitive adhesive sheet.

EFFECTS OF THE INVENTION

5 **[0016]** In the pressure sensitive adhesive sheet of the present invention, the antistatic layer is disposed on the back surface of at least one of the release films adhered on the front and back sides of the pressure sensitive adhesive layer, whereby blocking is less likely to occur even when a plural pieces of pressure sensitive adhesive sheet are piled up so that a piece of the pressure sensitive adhesive sheet can be easy picking up. Peeling charge in
10 peeling of the release film from the pressure sensitive adhesive layer is suppressed, which can reduce defects such as adhesion of dust to the pressure sensitive adhesive layer and breakage of an adherend.

BRIEF DESCRIPTION OF THE DRAWINGS

15 **[0017]** FIG. 1 is a cross-sectional view of a pressure sensitive adhesive sheet of one embodiment.

FIG. 2 is a cross-sectional view of a pressure sensitive adhesive sheet of one embodiment.

20 FIG. 3 is a cross-sectional view of a sheet-like pressure sensitive adhesive of one embodiment.

FIG. 4A is a cross-sectional view of a sheet-like pressure sensitive adhesive of one embodiment; and FIG. 4B is a plan view thereof.

FIG. 5A is a cross-sectional view of a sheet-like pressure sensitive adhesive of one embodiment; and FIG. 5B is a plan view thereof.

25 FIG. 6A is a cross-sectional view of a laminated body used for manufacturing a sheet-like pressure sensitive adhesive; FIG. 6B is a cross-sectional view showing a state where a cutting line is formed in the laminated body; FIG. 6C is a cross-sectional view showing a state where a cutting line is formed in the laminated body; FIG. 6D is a cross-sectional view of the laminated body after removing the release film and the cutting line; FIG.
30 6E is a cross-sectional view of the laminate body after laminating a light release film; FIG. 6F is a cross-sectional view showing a state where a cut line is formed in the light release film;

and FIG. 6G is a cross-sectional view of a sheet-like pressure sensitive adhesive obtained by cutting from a mother substrate.

DETAILED DESCRIPTION OF EMBODIMENTS

5 [0018] [Configuration of Pressure Sensitive Adhesive Sheet]

FIG. 1 is a schematic cross-sectional view showing one embodiment of a release film-equipped pressure sensitive adhesive sheet of the present invention. In a release film-equipped pressure sensitive adhesive sheet 100, a first release film 1 is temporarily adhered to one surface of a pressure sensitive adhesive layer 5, and a second release film 2 is temporarily adhered to the other surface of the pressure sensitive adhesive layer 5. Hereinafter, a laminated body in which a release film is temporarily adhered to each of both the surfaces of a pressure sensitive adhesive layer is described as a “pressure sensitive adhesive sheet”, and the pressure sensitive adhesive sheet cut into a predetermined size is referred to as a “sheet-like pressure sensitive adhesive”. The phrase “temporarily adhered” means a releasable adhered state.

[0019] The release films 1 and 2 are equipped for the purpose of protecting the surface of the pressure sensitive adhesive layer 5 until the pressure sensitive adhesive layer 5 is bonded to an adherend. The release films 1 and 2 have release layers 11 and 21, respectively, on a surface adhered to the pressure sensitive adhesive layer 5. By disposing the release layers on the surfaces of film substrates 10 and 20, the peel properties of the release films 1 and 2 from the pressure sensitive adhesive layer 5 are improved.

[0020] A peeling force when the first release film 1 is peeled off from the pressure sensitive adhesive layer 5 is smaller than a peeling force when the second release film is peeled off from the pressure sensitive adhesive layer 5. In practical use of the pressure sensitive adhesive sheet, the first release film 1 (light release film) having a relatively small peeling force is peeled off from the pressure sensitive adhesive layer 5 in first, and the pressure sensitive adhesive layer 5 is bonded to a first adherend. The second release film (heavy release film) having a relatively large peeling force is peeled off, and the pressure sensitive adhesive layer 5 is bonded to a second adherend. By providing a difference in peeling force between the release films attached to the front and back sides of the pressure sensitive adhesive sheet, the light release film can be selectively peeled off during bonding with the first adherend,

whereby the workability of bonding is improved.

[0021] From the viewpoint of preventing the lifting of the second release film 2 from the pressure sensitive adhesive layer 5 when the first release film 1 is peeled from the pressure sensitive adhesive layer 5, the peeling force of the second release film 2 from the pressure sensitive adhesive layer 5 is preferably at least 2 times, more preferably at least 2.5 times, and further preferably at least 3 times the peeling force of the first release film 1 from the pressure sensitive adhesive layer 5. The peeling force of the first release film 1 from the pressure sensitive adhesive layer 5 is preferably about 0.01 to 0.2 N/25 mm. The peeling force of the second release film 2 from the pressure sensitive adhesive layer 5 is preferably about 0.05 to 0.5 N/25 mm. The peeling force between the pressure sensitive adhesive layer and the release film is a value measured by a 180° peel test at a tensile speed of 0.3 m/min.

[0022] In the pressure sensitive adhesive sheet of the present invention, at least one of the first release film 1 as the light release film and the second release film 2 as the heavy release film has an antistatic layer on a surface opposite to an adhesion surface to the pressure sensitive adhesive layer 5 (a surface on which the release layers 11 and 21 are not disposed). Hereinafter, the adhesion surface (the surface on which the release layer is disposed) of the release film with the pressure sensitive adhesive layer 5 is described as a “release surface”, and the surface opposite to the release surface is described as a “back surface”.

[0023] In the pressure sensitive adhesive sheet 100 shown in FIG. 1, the light release film 1 has an antistatic layer 31 on the back surface of the film substrate 10, and the heavy release film 2 has an antistatic layer 32 on the back surface of the film substrate 20. Only one of the light release film 1 and the heavy release film 2 may have an antistatic layer on the back surface.

[0024] As in a pressure sensitive adhesive sheet 102 shown in FIG. 2, an antistatic layer 33 may be disposed on the release surface-side of the light release film 1. The heavy release film 2 may also have an antistatic layer (not shown) on the release surface-side. When the antistatic layer is disposed on the release surface-side of the release films 1 and 2, an antistatic layer is disposed on a side close to the film substrates 10 and 20, and the release layers 11, 21 are disposed on the outermost surfaces of the release surfaces.

[0025] By disposing the antistatic layer on the back surface of at least one of the heavy release film and the light release film, the adhesion of dust due to static electricity can be

suppressed. In roll conveyance for manufacturing a pressure sensitive adhesive sheet and cutting into a predetermined size, charge due to friction with a roll, etc. is suppressed, thereby attaining smooth conveyance.

[0026] By disposing the antistatic layer on the release film, the peeling charges of the release film and pressure sensitive adhesive layer can be reduced in peeling of the release film from the pressure sensitive adhesive layer. By reducing the charge of the pressure sensitive adhesive layer, the adhesion of dust to the exposed surface of the pressure sensitive adhesive layer can be suppressed, and the electrostatic destruction of the adherend (*e.g.*, image display panel) due to static electricity can be prevented. Reduction of the charge of the release film can suppress the electrostatic adsorption of the release film to the pressure sensitive adhesive layer or the other members, so that workability is improved.

[0027] Furthermore, in a piled body of a plural pieces of pressure sensitive adhesive sheet, blocking between the pressure sensitive adhesive sheets due to static electricity can be prevented by disposing an antistatic layer on the back surface of the release film. Slip properties tend to be improved when an antistatic layer is disposed on the back surface of the release film. Therefore, when a piece of pressure sensitive adhesive sheet is picked up from the piled body by *e.g.*, suction, the pressure sensitive adhesive sheet can be surely picked up one by one, and the workability of bonding the pressure sensitive adhesive sheet to the adherend can be remarkably improved.

[0028] Preferred embodiments of the pressure sensitive adhesive layer and the release film constituting the pressure sensitive adhesive sheet will be described below.

[0029] [Pressure Sensitive Adhesive Layer]

The pressure sensitive adhesive layer 5 is obtained by forming a pressure sensitive adhesive in a layer shape. When the pressure sensitive adhesive sheet is used for forming an image display device, it is preferable that the pressure sensitive adhesive layer 5 is transparent, and has small light absorption of visible light. The total light transmittance of the pressure sensitive adhesive layer 5 is preferably 85% or more, and more preferably 90% or more. The haze of the pressure sensitive adhesive layer 5 is preferably 2% or less, and more preferably 1% or less. The total light transmittance and haze are measured in accordance with JIS K7136 using a haze meter.

[0030] As the pressure sensitive adhesive that forms the pressure sensitive adhesive layer

5, one containing as a base polymer an acryl-based polymer, a silicone-based polymer, a polyester, a polyurethane, a polyamide, a polyvinyl ether, a vinyl acetate/vinyl chloride copolymer, a modified polyolefin, an epoxy-based polymer, a fluorine-based polymer, or a polymer based on a rubber such as a natural rubber or a synthetic rubber can be appropriately selected.

[0031] The pressure sensitive adhesive constituting the pressure sensitive adhesive layer 5 may be a photocurable pressure sensitive adhesive which can be cured by light irradiation after being bonded to the adherend. For example, if the photocurable pressure sensitive adhesive is used for bonding a front window (cover glass) or the like having a raised portion (level difference) such as decorative printing, level difference absorbability can be imparted by bonding in a state where the pressure sensitive adhesive before photocuring is soft, whereby generation of air bubbles in the vicinity of the raised portion can be suppressed. After bonding, the pressure sensitive adhesive is irradiated with an ultraviolet ray, etc. to photocure the pressure sensitive adhesive, whereby adhesion reliability can be improved. The photocurable pressure sensitive adhesive preferably contains, for example, a polymer, a monomer or an oligomer having a photopolymerizable functional group, and a photopolymerization initiator. The photocurable pressure sensitive adhesive preferably contains a polyfunctional compound having two or more polymerizable functional groups in one molecule as a photopolymerizable monomer or oligomer.

[0032] An acryl-based pressure sensitive adhesive containing an acryl-based polymer as the base polymer is preferably used for forming the pressure sensitive adhesive layer 5, because it is excellent in optical transparency, exhibits moderate wettability and adhesion characteristics such as cohesiveness and adhesiveness, and is also excellent in weather resistance, heat resistance, etc. The content of the acryl-based base polymer in the acryl-based pressure sensitive adhesive is preferably 50% by weight or more, more preferably 70% by weight or more, and further preferably 80% or more based on a solid content of the pressure sensitive adhesive composition.

[0033] As the acryl-based base polymer, one having a monomer unit of a (meth)acrylic acid alkyl ester as a main skeleton is suitably used. In this specification, the “(meth)acryl” means acryl and/or methacryl.

[0034] As the (meth)acrylic acid alkyl ester, a (meth)acrylic acid alkyl ester with the alkyl

group having 1 to 20 carbon atoms is preferable. The (meth)acrylic acid alkyl ester may have a branched alkyl group. The content of the (meth)acrylic acid alkyl ester is preferably 40% by weight or more, more preferably 50% by weight or more, further preferably 60% by weight or more based on the total amount of monomer components that form the base polymer. The acryl-based base polymer may be a copolymer of a plurality of (meth)acrylic acid alkyl esters. The arrangement of constituent monomer units may be random, or blockwise.

[0035] The acryl-based base polymer preferably contains an acryl-based monomer unit having a crosslinkable functional group as a copolymer component. When the base polymer has a crosslinkable functional group, the gel fraction of the pressure sensitive adhesive can be easily increased by thermal crosslinking, photocuring, etc. of the base polymer. Examples of the acryl-based monomer having a crosslinkable functional group include hydroxy group-containing monomers and carboxyl group-containing monomers. Particularly, it is preferred that a hydroxy group-containing monomer is contained as the copolymer component of the base polymer. When the base polymer has a hydroxy group-containing monomer as a monomer unit, the crosslinkability of the base polymer is improved, and cloudiness of the pressure sensitive adhesive under a high-temperature and high-humidity environment tends to be suppressed, so that a pressure sensitive adhesive having high transparency is obtained.

[0036] Examples of the hydroxy group-containing monomer include 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 4-hydroxybutyl (meth)acrylate, 6-hydroxyhexyl (meth)acrylate, 8-hydroxyoctyl (meth)acrylate, 10-hydroxydecyl (meth)acrylate, 12-hydroxylauryl (meth)acrylate and (4-hydroxymethylcyclohexyl)-methyl acrylate.

[0037] The content of the hydroxy group-containing monomer is preferably 0.1 to 30% by weight, more preferably 0.1 to 25% by weight, further preferably 0.5 to 20% by weight based on the total amount of monomer components that form the base polymer.

[0038] Preferably, the acryl-based base polymer contains, in addition to a hydroxy group-containing monomer unit, a monomer unit having high polarity, such as a nitrogen-containing monomer. When the acryl-based base polymer contains a high-polarity monomer unit such as a nitrogen-containing monomer unit in addition to a hydroxy group-containing monomer unit, the pressure sensitive adhesive has high adhesiveness and retentive strength, and cloudiness under a high-temperature and high-humidity environment is suppressed.

[0039] Examples of the nitrogen containing monomer include vinyl-based monomer such as N-vinylpyrrolidone, methylvinylpyrrolidone, vinylpyridine, vinylpiperidone, vinylpyrimidine, vinylpiperazine, vinylpyrazine, vinylpyrrole, vinylimidazole, vinyloxazole, vinylmorpholine, (meth)acryloylmorpholine, N-vinylcarboxylic acid amides and N-vinylcaprolactam; cyano group containing monomer such as acrylonitrile and methacrylonitrile. Among them, N-vinylpyrrolidone and (meth)acryloylmorpholine are preferably used.

[0040] The content of the nitrogen-containing monomer is preferably 3 to 50% by weight, more preferably 5 to 40% by weight, further preferably 7 to 30% by weight based on the total amount of monomer components that form the base polymer.

[0041] Monomer components that form the acryl-based polymer may include a polyfunctional monomer component. The polyfunctional monomer is a monomer having at least two polymerizable functional groups each having an unsaturated double bond, such as (meth)acryloyl groups or vinyl groups. The amount of the polyfunctional monomer can be determined depending on the molecular weight thereof, the number of functional groups, and the amount is preferably 3% by weight or less, more preferably 2% by weight or less, further preferably 1% by weight or less based on the total amount of monomer units of the base polymer.

[0042] The acryl-based base polymer can be prepared by *e.g.*, solution polymerization, UV polymerization, mass polymerization or emulsification polymerization. Solution polymerization methods or UV polymerization is preferable from the viewpoint of transparency, water resistance, costs and so on. As a solvent for solution polymerization, ethyl acetate, toluene or the like is generally used.

[0043] In preparation of the acryl-based base polymer, a polymerization initiator such as a photopolymerization initiator or a thermopolymerization initiator may be used depending on a type of polymerization reaction. The photopolymerization initiator is not particularly limited as long as it initiates photopolymerization, and examples of the photopolymerization initiator include: a benzoin ether-based photopolymerization initiator, an acetophenone-based photopolymerization initiator, an α -ketol-based photopolymerization initiator, an aromatic sulfonyl chloride-based photopolymerization initiator, a photoactive oxime-based

photopolymerization initiator, a benzoin-based photopolymerization initiator, a benzyl-based photopolymerization initiator, a benzophenone-based photopolymerization initiator, a ketal-based photopolymerization initiator, a thioxanthone-based photopolymerization initiator, an acyl phosphine oxide-based photopolymerization initiator. Examples of the thermopolymerization initiator include: an azo-based initiator, a peroxide-based initiator, a redox-based initiator obtained by combining a peroxide and a reducing agent (*e.g.*, combination of a persulfate and sodium hydrogen sulfite, combination of a peroxide and sodium ascorbate).

[0044] For adjusting the molecular weight of the base polymer, a chain-transfer agent may be used. The chain-transfer agent can receive radicals from a growing polymer chain to stop extension of the polymer, and the chain-transfer agent having received the radicals can attack the monomer to start polymerization again. Accordingly, when a chain-transfer agent is used, an increase in molecular weight of the base polymer is inhibited without reducing the concentration of radicals in the reaction system, so that a pressure sensitive adhesive sheet having small residual stress can be obtained. As the chain-transfer agent, for example, a thiol such as α -thioglycerol, lauryl mercaptan, glycidyl mercaptan, mercaptoacetic acid, 2-mercaptoethanol, thioglycolic acid, 2-ethylhexyl thioglycollate or 2,3-dimercapto-1-propanol is suitably used.

[0045] When a polyfunctional monomer, in addition to a monofunctional monomer, is used as a monomer component that forms the acryl-based polymer, the monofunctional monomer may be first polymerized to form a prepolymer composition with a low polymerization ratio (prepolymerization), followed by polymerizing the prepolymer with the polyfunctional monomer by adding the polyfunctional monomer to a syrup of the prepolymer composition (post-polymerization). By performing prepolymerization followed by post-polymerization of the prepolymer as described above, a diverging point derived from a polyfunctional monomer component can be uniformly introduced into a base polymer. A mixture of a prepolymer composition and a non-polymerized monomer component (pressure sensitive adhesive composition) may be applied onto a base material, and then subjected to post-polymerization on the base material to form a pressure sensitive adhesive layer. The prepolymer composition has a low viscosity and is thus excellent in coatability, and therefore by using a method in

which a pressure sensitive adhesive composition as a mixture of a prepolymer composition and a non-polymerized monomer is applied, and then subjected post-polymerization on a base material, the productivity of a pressure sensitive adhesive layer is improved, and the thickness of the pressure sensitive adhesive layer can be made uniform.

5 **[0046]** The prepolymer composition can be prepared by, for example, partially polymerizing (prepolymerizing) a composition (referred to as a “prepolymer forming composition”) obtained by mixing a monomer component that forms an acryl-based base polymer, and a polymerization initiator. Among the aforementioned monomer components that form the acryl-based polymer, the monomer component in the prepolymer forming composition is
10 preferably a monofunctional monomer component such as a (meth)acrylic acid alkyl ester or a polar group-containing monomer. The prepolymer forming composition may contain a polyfunctional monomer. For example, after a part of a polyfunctional monomer component as a raw material of a base polymer is included in a prepolymer forming composition, and a prepolymer is polymerized, the remaining part of the polyfunctional monomer component
15 may be added and subjected to post-polymerization.

[0047] In addition to the monomer and polymerization initiator, the prepolymer forming composition may contain a chain-transfer agent etc. as necessary. Although the method for polymerizing a prepolymer is not particularly limited, polymerization by irradiation of an active ray such as UV light is preferable for adjusting the reaction time to ensure that the
20 molecular weight (polymerization ratio) of the prepolymer falls within a desired range. The polymerization initiator and the chain-transfer agent to be used for prepolymerization are not particularly limited, and for example, the above-mentioned photopolymerization initiators and chain-transfer agents may be used.

[0048] Although the polymerization ratio of the prepolymer is not particularly limited, it is
25 preferably 3 to 50% by weight, more preferably 5 to 40% by weight for adjusting a viscosity of the prepolymer syrup suitable for application onto a base material. The polymerization ratio can be adjusted to fall within a desired range by adjusting the type and used amount of a photopolymerization initiator, the irradiation intensity/irradiation time of an active ray such as UV light, and so on.

30 **[0049]** A remain part of the monomer component (post-polymerization monomer) that

forms an acryl-based base polymer, and a polymerization initiator, a chain-transfer agent, a silane coupling agent, a crosslinker and additives as necessary are mixed with the prepolymer composition to form a pressure sensitive adhesive composition. Preferably, the post-polymerization monomer contains a polyfunctional monomer. The post-polymerization monomer may contain a monofunctional monomer in addition to a polyfunctional monomer.

[0050] The photopolymerization initiator and the chain-transfer agent to be used for post-polymerization are not particularly limited, and for example, the above-mentioned photopolymerization initiators and chain-transfer agents may be used. When the polymerization initiator in prepolymerization is not deactivated and remains in the prepolymer composition, addition of the polymerization initiator for post-polymerization may be omitted.

[0051] The base polymer may have a crosslinked structure as necessary. The crosslinked structure is formed by, for example, adding a crosslinker after polymerization of the base polymer or after prepolymerization. As the crosslinker, a common cross linker can be used, such as an isocyanate-based crosslinker, an epoxy-based crosslinker, an oxazoline-based crosslinker, an aziridine-based crosslinker, a carbodiimide-based crosslinker or a metal chelate-based crosslinker. The content of the crosslinker is normally 0 to 5 parts by weight, preferably 0 to 3 parts by weight based on 100 parts by weight of the acryl-based base polymer.

[0052] When the pressure sensitive adhesive composition includes a crosslinker, it is preferred to perform a heating for crosslinking to form crosslinked structure before bonding to an adherend. The heating temperature and the heating time in the crosslinking treatment are appropriately set according to a type of crosslinker to be used, and crosslinking is normally performed by heating at 20°C to 160°C for 1 minute to about 7 days.

[0053] For the purpose of adjusting the adhesive strength, a silane coupling agent can also be added in the pressure sensitive adhesive composition. When a silane coupling agent is added to the pressure sensitive adhesive composition, the addition amount thereof is normally about 0.01 to 5.0 parts by weight, preferably 0.03 to 2.0 parts by weight based on 100 parts by weight of the base polymer.

[0054] The pressure sensitive adhesive composition may contain a tackifier as necessary.

Examples of the tackifier include: a terpene-based tackifier, a styrene-based tackifier, a phenol-based tackifier, a rosin-based tackifier, an epoxy-based tackifier, a dicyclopentadiene-based tackifier, a polyamide-based tackifier, a ketone-based tackifier, an elastomer-based tackifier.

5 **[0055]** In addition to the components exemplified above, additives such as a plasticizer, a softener, a degradation inhibitor, a filler, a colorant, an ultraviolet ray absorber, an antioxidant, a surfactant and an antistatic agent can be added in the pressure sensitive adhesive composition within the bounds of not impairing the characteristics of the pressure sensitive adhesive.

10 **[0056]** Preferably, the pressure sensitive adhesive composition has a viscosity (*e.g.*, about 5 to 100 poise) suitable for application of the composition onto a substrate. When the pressure sensitive adhesive composition is a solution, the viscosity can be set within an appropriate range by adjusting the molecular weight and the solid content of the prepolymer, and so on. When the pressure sensitive adhesive composition is photocurable, the viscosity can be set
15 within an appropriate range by adding a polyfunctional polymer, adjusting the polymerization ratio of the prepolymer, and so on. Additives such as thickener may be used for the purpose of, for example, adjusting the viscosity

[0057] <Method for Forming Pressure Sensitive Adhesive Layer>

20 The pressure sensitive adhesive layer can be formed by applying the pressure sensitive adhesive composition onto a substrate in a layer form, and performing drying of solvent and crosslinking and/or curing of the base polymer as necessary. Examples for applying method the pressure sensitive adhesive composition include roll coating, kiss roll coating, gravure coating, reverse coating, roll brushing, spray coating, dip roll coating, bar coating, knife coating, air knife coating, curtain coating, lip coating, die coating and extrusion.

25 **[0058]** When the pressure sensitive adhesive composition contains solvent, applied pressure sensitive adhesive can be dried by an appropriate method. The heating/drying temperature is preferably 40°C to 200°C, more preferably 50°C to 180°C, further preferably 70°C to 170°C. The drying time is preferably 5 seconds to 20 minutes, more preferably 5 seconds to 15 minutes, further preferably 10 seconds to 10 minutes.

30 **[0059]** When the pressure sensitive adhesive composition is photocurable, the pressure

sensitive adhesive composition may be applied onto the supporting substrate, and then irradiated with ultraviolet ray and/or short wavelength visible light to photocure the pressure sensitive adhesive composition. During photocuring, it is preferable to attach a cover sheet to the surface of the applied layer and irradiate the pressure sensitive adhesive composition with light in a state where the pressure sensitive adhesive composition is sandwiched between two sheets, to prevent the inhibition of polymerization due to oxygen.

[0060] The accumulated light amount of irradiated light is preferably about 100 to 5000 mJ/cm². The light source for light irradiation is not particularly limited as long as it can irradiate light having a wavelength range in which the photopolymerization initiator contained in the pressure sensitive adhesive composition has sensitivity. An LED light source, a high pressure mercury lamp, an extra high pressure mercury lamp, a metal halide lamp, a xenon lamp, etc. are preferably used.

[0061] As the support substrate and the cover sheet used for forming the pressure sensitive adhesive layer, any suitable substrate is used. As the support substrate and the cover sheet, a release film having a release layer on a contact surface with the pressure sensitive adhesive layer is preferable. The support substrate and/or the cover sheet may be the same as the heavy release film and/or the light release film of the pressure sensitive adhesive sheet.

[0062] The thickness of the pressure sensitive adhesive layer 5 is not particularly limited, and is generally about 5 to 1000 μm. When the adherend includes a raised portion formed of *e.g.*, decorative printing, and level difference absorbability is required for the pressure sensitive adhesive for the purpose of preventing generation of bubbles in the periphery of the raised portion, the thickness of the pressure sensitive adhesive layer 5 is preferably 40 μm or more, more preferably 50 μm or more, and further preferably 60 μm or more. The thickness of the pressure sensitive adhesive layer 5 is preferably 500 μm or less, more preferably 300 μm or less, and more preferably 250 μm or less from the viewpoints of reduction in the weight and reduction in the thickness of the image display device, and in consideration of ease of forming the pressure sensitive adhesive layer, handling properties, etc.

[0063] [Release Film]

As the release films 1 and 2 temporarily adhered to the pressure sensitive adhesive sheet, release films having the release layers 21 and 22 on the surfaces of the film substrates 10 and 20 are preferably used.

[0064] <Film Substrate>

The film substrates 10 and 20 of the release films 1 and 2 are preferably transparent resin films. Examples of the resin material include polyester-based resins such as polyethylene terephthalate and polyethylene naphthalate, acetate-based resins, 5 polyethersulfone-based resins, polycarbonate-based resins, polyamide-based resins, polyimide-based resins, polyolefin-based resins, (meth)acryl-based resins, polyvinyl chloride-based resins, polyvinylidene chloride-based resins, polystyrene-based resins, polyvinyl alcohol-based resins, polyarylate-based resins, and polyphenylene sulfide-based resins. Among them, polyester-based resins such as polyethylene terephthalate are particularly 10 preferable.

[0065] The thickness of each of the film substrates 10 and 20 is preferably from 10 to 200 μm , and more preferably from 25 to 150 μm . The thickness of the film substrate 10 of the light release film 1 and the thickness of the film substrate 20 of the heavy release film 2 may be the same or different.

15 **[0066]** <Release Layer>

Examples of the material of the release layers 21 and 22 include a silicone-based release agent, a fluorine-based release agent, a long chain alkyl-based release agent, and a fatty acid amide-based release agent. A silicone release agent is preferred because it can achieve both adhesion and peel properties with respect to the acryl-based pressure sensitive 20 adhesive.

[0067] The silicone-based release layer may mainly contain a silicone-based resin, or may be a silicone modified resin obtained by introducing reactive silicone into an organic resin such as a urethane resin, an epoxy resin, or an alkyd resin by graft polymerization, etc. As the silicone resin, various curing reaction types such as an addition-type, a condensation-type, 25 an ultraviolet curing-type, an electron beam curing-type, and a solventless-type can be used. In particular, it is preferable to use a silicone resin which forms a peel property-adjusting coating film by curing according to a heat addition reaction since it has excellent adhesion to the film substrate and can achieve both adequate adhesion and peel properties with respect to the acryl-based pressure sensitive adhesive.

30 **[0068]** The thickness of the release layer is generally from 10 to 2000 nm, preferably from 15 to 1000 nm, and more preferably from 20 to 500 nm. The type of the release agent and the

thickness of the release layer are changed, which makes it possible to provide a difference between the peeling force of the release layer 11 of the light release film 1 from the pressure sensitive adhesive layer 5 and the peeling force of the release layer 21 of the release film 2 from the pressure sensitive adhesive layer 5.

5 **[0069]** <Antistatic Layer>

As described above, at least one of the release films 1 and 2 includes the antistatic layer on the back surface. The release film may include the antistatic layer on the release surface of the film substrate. When the antistatic layer is provided on the release surface, the antistatic layer 33 is preferably disposed between the film substrate 10 and the release layer 11 as in the release film 1 of FIG. 2.

[0070] Examples of the antistatic layer include one in which an antistatic component (conductive material) is contained in each of various resin binders. As the binder resin, various types of resins such as a thermosetting resin, an ultraviolet curable resin, an electron beam curable resin, and a two-liquid mixed type resin can be adopted. Specific examples of the binder resin include a polyester-based resin, a polyurethane-based resin, an acryl-based resin, a silicone-based resin, a styrene resin, a polyamide-based resin, a polyolefin-based resin, a fluorine-based resin, and an alkyd-based resin. Among these, from the viewpoint of improving the slip properties of the release film, a polyester-based resin is preferable.

[0071] Typically, the polyester-based resin is a polycondensation product of one or more compounds (polyvalent carboxylic acid components) selected from polycarboxylic acids having two or more carboxyl groups in one molecule (typically, dicarboxylic acids) and derivatives thereof (anhydrides, esterified products, and halides of the polycarboxylic acids, etc.), and one or more compounds (polyhydric alcohol components) selected from polyhydric alcohols having two or more hydroxyl groups in one molecule (typically diols). When the antistatic layer is disposed on the back surface of the release film, the proportion of the polyester-based resin in the binder resin is preferably 50% by weight or more, more preferably 60% by weight or more, and further preferably 70% by weight or more in order to set the dynamic friction coefficient of the back surface to 0.4 or less.

[0072] Examples of the antistatic component include an organic or inorganic conductive material. Preferred examples of the organic conductive material include various conductive polymers. Examples of the conductive polymer include polyaniline, polypyrrole,

polythiophene, polyethyleneimine, and an allylamine polymer. Examples of the inorganic conductive material include various metals, alloys, and conductive metal oxides. The inorganic conductive material is preferably contained as fine particles having a particle size of 0.1 μm or less (typically 0.01 μm to 0.1 μm) in the antistatic layer. The antistatic component
5 may be a cationic antistatic agent, an anionic antistatic agent, an amphoteric ionic antistatic agent, a nonionic antistatic agent, etc.

[0073] Among the above-mentioned antistatic components, the antistatic component of the antistatic layer disposed on the back surface of the release film is preferably a conductive polymer, and among them, a composite of poly(3,4-ethylenedioxythiophene) and
10 polystyrenesulfonic acid (PEDOT/PSS) is particularly preferred.

[0074] The thickness of the antistatic layer is, for example, about 5 to 100 nm, preferably 10 to 80 nm, more preferably 15 to 60 nm, and further preferably 20 to 50 nm. When the antistatic layer is disposed on each of the back surfaces of both the light release film 1 and the heavy release film 2, the materials and thicknesses of the antistatic layer 31 and the
15 antistatic layer 32 may be the same or different. When the antistatic layer is disposed on the release surface-side, the material and thickness of the antistatic layer on the release surface may be the same as or different from the material and thickness of the antistatic layer on the back surface.

[0075] The surface resistance of the antistatic layer-formed surface of each of the release
20 films 1 and 2 is preferably $1 \times 10^{11} \Omega/\text{sq}$ or less, more preferably $1 \times 10^{10} \Omega/\text{sq}$ or less, and further preferably $1.0 \times 10^9 \Omega/\text{sq}$ or less. When the antistatic layer is disposed on the release surface, the release layer is formed on the antistatic layer, whereas when the antistatic layer is disposed on the back surface, the antistatic layer can be disposed on the outermost surface. Therefore, the surface resistance when the antistatic layer is disposed on the back surface of
25 the release film can be made smaller than that when the antistatic layer is disposed on the release surface. When the antistatic layer is disposed on the back surface of the release film, the surface resistance of the back surface is preferably $1 \times 10^8 \Omega/\text{sq}$ or less, more preferably $1 \times 10^7 \Omega/\text{sq}$ or less, and further preferably $1 \times 10^6 \Omega/\text{sq}$ or less.

[0076] When the antistatic layer is disposed on the back surface of the release film, the
30 dynamic friction coefficient of the back surface is preferably 0.4 or less, and more preferably 0.35 or less. The dynamic friction coefficient is calculated in accordance with JIS K 7125 from

a test force when placing a sliding piece having a mass of 1.5 kg with a surface treatment-free biaxially-stretched polyester film as a sliding surface on the antistatic layer-formed surface of the release film, and moving the sliding piece at a speed of 300 mm/min in a horizontal direction.

5 **[0077]** By disposing the antistatic layer on the back surface of at least one of the release films 1 and 2, the adhesion of dust to the pressure sensitive adhesive sheet due to electrification (static electricity) is suppressed, thereby improving workability. By disposing the antistatic layer on the back surface of the release film, peeling charge in peeling of the release films 1 and 2 from the surface of the pressure sensitive adhesive layer 5 can be
10 suppressed. In addition, electrostatic charge caused by friction between the pressure sensitive adhesive sheet and the feeding roll, the other film, etc. can also be suppressed. By disposing the antistatic layer on the back surface of the release film, the dynamic friction coefficient is reduced, which tends to provide improved handling properties. Furthermore, by disposing the antistatic layer on the back surface of the release film, the blocking between the
15 pressure sensitive adhesive sheets due to charge can be suppressed even when a plural pieces of the pressure sensitive adhesive sheet are piled up. Improvement in slip properties (reduction in dynamic friction coefficient) can also contribute to blocking suppression. Therefore, it is possible to reliably perform the operation of picking up the pressure sensitive adhesive sheets one by one from the piled body, which is advantageous for improvement in
20 workability and automation.

[0078] <Method for Forming Release Layer and Antistatic Layer>

In order to form the release layer and the antistatic layer on the film substrate, known coating methods such as roll coating, gravure coating, reverse coating, roller brushing, spray coating, air knife coating, dip coating, and curtain coating can be applied. After coating,
25 heating may be performed for the purpose of removing a solvent and curing a resin component. Examples of the heating method include heating by hot air. The heating condition may be appropriately set according to the composition of the applied layer, the heat resistance of the substrate, etc., and is usually from about 80 to 150°C for about 10 seconds to 10 minutes. If necessary, a heat treatment and active energy ray irradiation such as
30 ultraviolet irradiation may be performed in combination for the purpose of accelerating the curing reaction of the resin.

[0079] The release layer and the antistatic layer may be formed in the process of manufacturing the film substrate. For example, by multilayer co-extrusion, a film equipped with a release layer or an antistatic layer on the surface of the film substrate can be formed. The release layer or the antistatic layer may be formed by utilizing heating in the process of forming the film substrate. For example, when the film substrate is a stretched film, by applying a composition for forming a release layer or a composition for forming an antistatic layer to the surface of the film before stretching or the film after longitudinal stretching, and drying of solvent and curing of resin can be carried out by utilizing a heat during transverse stretching or simultaneous biaxial stretching using a tenter.

[0080] [Formation of Pressure Sensitive Adhesive Sheet]

By forming the pressure sensitive adhesive layer on the substrate, laminating the light release film 1 onto one surface of the pressure sensitive adhesive layer 5, and laminating the heavy release film 2 to the other surface, the pressure sensitive adhesive sheet having release film on each of both the surfaces of the pressure sensitive adhesive layer 5 can be obtained. One of the light release film 1 and the heavy release film 2 may be used as the substrate for forming the pressure sensitive adhesive layer, and the other may be used as the cover sheet.

[0081] The formation of the pressure sensitive adhesive layer 5 and the lamination of the release films 1 and 2 can be carried out by a roll-to-roll method. In the roll-to-roll method, the pressure sensitive adhesive layer is formed by applying the pressure sensitive adhesive composition while feeding a long-band shape film substrate in a longitudinal direction, and drying the solvent and curing the polymer as necessary. The lamination and delamination of the release film can also be carried out by the roll-to-roll method.

[0082] The pressure sensitive adhesive sheet having a large area (mother substrate) is produced by the roll-to-roll method, and then cut into a predetermined size according to the size of the adherend, to obtain a sheet-like pressure sensitive adhesive. In this method, a large number of sheet-like pressure sensitive adhesives are obtained from the mother substrate, whereby the productivity of the pressure sensitive adhesive sheets can be improved.

[0083] The shape and size of the sheet-like pressure sensitive adhesive (pressure sensitive adhesive layer 5) are set according to the shape and size of the adherend. For example, when

the pressure sensitive adhesive sheet is used by being disposed on the front face of the image display device, the size of the pressure sensitive adhesive sheet is substantially equal to the size of the screen.

[0084] The area of the sheet-like pressure sensitive adhesive is generally from about 5 to 25000 cm². The area of the sheet-like pressure sensitive adhesive may be 10000 cm² or less, 5000 cm² or less, 3000 cm² or less, 1000 cm² or less, or 500 cm² or less. When the pressure sensitive adhesive sheet is rectangular, the length of the diagonal line is from about 3 to 250 cm. The length of the diagonal line of the pressure sensitive adhesive sheet may be 100 cm or less, 50 cm or less, 30 cm or less, or 20 cm or less. When the pressure sensitive adhesive sheet is rectangular, the shape of the pressure sensitive adhesive sheet may be a rectangle having a long side and a short side, or a square having four sides having an equal length. The length of the long side of the rectangle is generally 10 times or less that of the short side, and may be 5 times or less, 3 times or less, or 2 times or less.

[0085] As shown in FIG. 3, in the sheet-like pressure sensitive adhesive 103, the end surface of the pressure sensitive adhesive layer 5 may be located inside the end surfaces of the release films 1 and 2. In FIG. 3 and the subsequent figures, the release layer and the antistatic layer are omitted for simplicity.

[0086] If the end surface of the pressure sensitive adhesive layer 5 is inside the end surface of the release film 1 and/or 2, glue contamination and glue missing caused by the protrusion of the pressure sensitive adhesive during the transportation or process (*e.g.*, laminate) using the pressure sensitive adhesive sheet 103 can be prevented. Particularly, when the thickness of the pressure sensitive adhesive layer is large (for example, 40 μm or more) for the purpose of imparting level difference absorbability, glue contamination and glue missing are apt to occur, whereby the end surface of the pressure sensitive adhesive layer is preferably located inside the release film.

[0087] Examples of a method of locating the end surface of the pressure sensitive adhesive layer 5 inside the end surfaces of the release films 1 and 2 include: a method of controlling a region where the pressure sensitive adhesive layer is attached on the release film; and a method of forming the pressure sensitive adhesive layer and thereafter removing the pressure sensitive adhesive layer in a predetermined region. When the pressure sensitive adhesive sheet is cut to a predetermined size, pressure may be applied from the upper and

lower surfaces of the pressure sensitive adhesive sheet so that the end of the pressure sensitive adhesive layer protrudes from the end of the release film, and the pressure sensitive adhesive layer 5 may be cut together with the release films 1 and 2 in a state where the pressure sensitive adhesive layer protrudes. The pressure is released after cutting so that the end surface of the pressure sensitive adhesive layer 5 retracts to the inside of the end surfaces of the release films 1 and 2, whereby the pressure sensitive adhesive sheet is obtained, in which the end surface of the pressure sensitive adhesive layer 5 is located inside the end surfaces of the release films 1 and 2.

[0088] From the viewpoint of suppressing glue missing and glue contamination due to the protrusion of the pressure sensitive adhesive layer 5, it is preferable that the distance between each of the end surfaces of the release films 1 and 2 and the end surface of the pressure sensitive adhesive layer 5 (the protrusion amount of the release film in the outer periphery of the pressure sensitive adhesive sheet) is preferably 10 μm or more, more preferably 30 μm or more, and further preferably 50 μm or more.

[0089] The end surface of the pressure sensitive adhesive layer 5 is located inside the end surfaces of the release films 1 and 2, and the release films 1 and 2 protrude, whereby the release films 1 and 2 can be peeled off from the pressure sensitive adhesive layer 5 by pinching the outer edge portions of the release films 1 and 2 protruding from the end of the pressure sensitive adhesive layer 5. Therefore, defects due to the protrusion from the end surface of the pressure sensitive adhesive layer 5 can be suppressed. In addition, the workability of peeling the release films 1 and 2 from the pressure sensitive adhesive layer 5 can be improved.

[0090] In order to improve the workability of peeling the release films 1 and 2, the protrusion amount of the release film is preferably 0.5 mm or more, and more preferably 1 mm or more. Although the upper limit of the protrusion amount is not particularly limited, the protrusion amount is preferably 30 mm or less, and more preferably 20 mm or less in consideration of the cutting operation, product acquisition efficiency (area efficiency) of the pressure sensitive adhesive sheet, etc.

[0091] As in a pressure sensitive adhesive sheet 104 shown in FIG. 4A, the protrusion amount of the light release film 1 from the end portion (outer peripheral edge) of the pressure sensitive adhesive layer 5 and the protrusion amount of the heavy release film 2 from the end

portion (outer peripheral edge) of the pressure sensitive adhesive layer 5 may be different from each other. When the protrusion amounts of two release films are different from each other, it is easy to selectively pinch the release film to be peeled off. In particular, when the light release film 1 and the heavy release film 2 are temporarily adhered to the pressure sensitive adhesive layer 5 and the protrusion amount of the light release film 1 is larger than that of the heavy release film 2, it easy to selectively pinch and peel off the light release film. Therefore, it is advantageous for peeling off the release film from the pressure sensitive adhesive sheet and automating the bonding work on the adherend.

[0092] FIG. 4B is a plan view of the pressure sensitive adhesive sheet 104 viewed from the heavy release film 2 side. A cross-sectional view taken along line IV-IV of FIG. 4B corresponds to FIG. 4A. In the pressure sensitive adhesive sheet 104, the heavy release film 2 is arranged to protrude from the end surface of the pressure sensitive adhesive layer 5 over the entire outer periphery, and the light release film 1 is arranged to protrude to the outside of the heavy release film 2.

[0093] When a protruding portion of the release sheet is provided for the purpose of improving the workability of peeling the release film from the pressure sensitive adhesive layer, a portion for picking the release sheet during peeling may selectively protrude from the outer peripheral edge of the pressure sensitive adhesive layer. For example, as in the pressure sensitive adhesive sheet 105 shown in the cross-sectional view of FIG. 5A and the plan view of FIG. 5B, a protruding portion 1a may be provided on a part of the outer periphery of the release film 1, whereby the release film can be peeled off by pinching the protruding portion. A protruding portion may also be provided on the release film 2. When the protruding portion is provided on the outer periphery of each of both the light release film 1 and the heavy release film 2, the positions where the protruding portion is provided may be different from each other such that each of the release films is easily pinched and peeled off selectively.

[0094] As shown in FIG. 4A and FIG. 5A, a notch 5x may be formed along the end (outer peripheral edge) of the pressure sensitive adhesive layer 5 in the release surface of the release film 2. By providing the notch on the release film, the flowage of the pressure sensitive adhesive layer 5 to the outside of the notch 5x is suppressed. Therefore, even when the thickness of the pressure sensitive adhesive layer 5 is large, and the fluidity is high, the shape

change of the pressure sensitive adhesive layer over time can be prevented, whereby the shape stability of the pressure sensitive adhesive sheet during storing is improved, and defects due to the protrusion of the pressure sensitive adhesive layer from the end portion can be suppressed.

5 **[0095]** Examples of a method of providing the notch on the release film 2 along the outer peripheral edge of the pressure sensitive adhesive layer 5 include a method of half-cutting the release film 2 when cutting the pressure sensitive adhesive layer 5. For example, by cutting the pressure sensitive adhesive layer 5 so as to reach the surface of the release film 2 from the first principal surface-side (the side of the surface on which the light release film 1 is
10 attached) of the pressure sensitive adhesive layer 5, the pressure sensitive adhesive layer 5 is cut to a predetermined shape, and the release film 2 is half-cut, whereby the notch 5x is formed on the release surface. As will be described later, half-cutting may be performed in a state where a release film 9 different from the light release film 1 is laminated. The release film 9 is then replaced by the light release film 1, whereby the release film 1 can be provided
15 so as to protrude from the end surface of the pressure sensitive adhesive layer 5.

[0096] The depth of the notch 5x is not particularly limited, and it is necessary that the notch 5x does not reach the back surface of the release film 2. From the viewpoint of preventing the splitting and breaking of the release film in peeling of the release film from the pressure sensitive adhesive layer, the depth of the notch is preferably 1/2 or less of the
20 thickness of the release film, and more preferably 1/3 or less. The notch along the outer peripheral edge of the pressure sensitive adhesive layer may be provided on any one of the release films 1 and 2, or may be provided on each of both the release films 1 and 2.

[0097] <Cut Out of Sheet-like Pressure Sensitive Adhesive from Mother Substrate>

As described above, from the viewpoint of productivity, it is preferable to produce a
25 sheet-like pressure sensitive adhesive by cutting a large-area pressure sensitive adhesive sheet (mother substrate) produced by the roll-to-roll method. From the viewpoint of facilitating the handling of the sheet-like pressure sensitive adhesive cutting out from the mother substrate, the laminated body in which the release film is temporarily adhered to each of both the surfaces of the pressure sensitive adhesive layer 5 may be bonded to a carrier
30 sheet, followed by cutting on the carrier sheet.

[0098] FIGS. 6A to 6G are schematic cross-sectional views showing a series of steps of

cutting the mother substrate on a carrier sheet 7 to form the sheet-like pressure sensitive adhesive.

[0099] The mother substrate 40 may be obtained by temporarily adhering the heavy release film 2 to one surface of the pressure sensitive adhesive layer 5, and temporarily adhering the release film 9 to the other surface of the pressure sensitive adhesive layer 5. The heavy release film 2 is not replaced and thus is laminated in the pressure sensitive adhesive sheet before and after being cut into a sheet form. The release film 9 is temporarily adhered to protect the surface of the pressure sensitive adhesive layer 5 until the light release film 1 is laminated onto the pressure sensitive adhesive layer 5, and after the pressure sensitive adhesive layer 5 is cut, the release film 9 is replaced by the light release film 1.

[0100] As the release film 9, one having a release layer on a surface brought into contact with the pressure sensitive adhesive layer 5 is preferably used. An antistatic layer may be disposed on the release surface and/or back surface of the release film 9. From the viewpoint of reducing the manufacturing cost of the pressure sensitive adhesive sheet, it is preferable that the antistatic layer is not provided on the release film 9. From the viewpoint of suppressing defects due to static electricity during the production and transportation of the mother substrate, it is preferable that the antistatic layer is disposed on the back surface of the heavy release film 2.

[0101] In cutting from the mother substrate 40 to the sheet-like pressure sensitive adhesive, the carrier sheet is first laminated to the surface of the mother substrate 40 on the side of the heavy release film 2 (FIG. 6A). The constituent material of the carrier sheet 7 is preferably a plastic film as with the release film. It is preferable that the dimensional change of the carrier sheet 7 due to feeding tension during roll-to-roll feeding is small. When cutting (half-cutting) is performed so as to reach the surface of the carrier sheet 7 (interface with the heavy release film 2) in cutting the pressure sensitive adhesive layer, it is necessary to prevent a cutting blade from reaching the back surface of the carrier sheet 7. Therefore, the thickness of the carrier sheet 7 is preferably 10 μm or more, and more preferably 20 μm or more.

[0102] It is preferable that the carrier sheet 7 has an adhesive layer (not shown) on a surface thereof for fixing the mother substrate 40 thereon. As the carrier sheet 7, a self-pressure sensitive adhesive film may be used, in which the pressure sensitive adhesive layer

is integrally molded on the surface of the film substrate.

[0103] Cutting (half-cutting) is performed at a depth reaching the surface of the carrier sheet 7 from the release film 9 side of the laminated body 161 in which the mother substrate is bonded on the carrier sheet 7, to form cutting lines 41a and 41b (FIG. 6B). By this cutting step, the cutting lines 41a and 41b are formed in the entire thickness direction on the release film 9, the pressure sensitive adhesive layer 5, and the heavy release film 2. In the carrier sheet 7, a notch may be formed, which has a depth not reaching the back surface. The carrier sheet 7 is laminated to the back surface of the heavy release film 2, whereby the laminated body 151 can be stably transported even after the heavy release film 2 is cut.

[0104] Thereafter, half-cutting is performed at a depth reaching the surface of the heavy release film 2 from the release film 9 side, to form cutting lines 42a and 42b (FIG. 6C). By this cutting step, the cutting lines 42a and 42b are formed in the entire thickness direction in the release film 9 and the pressure sensitive adhesive layer 5. In the heavy release film 2, a notch having a depth not reaching the back surface may be formed. The notch formed on the heavy release film in formation of the cutting lines 42a and 42b corresponds to the notch 5x in the sheet-like pressure sensitive adhesive (see FIGS. 4A, 5A and 6D).

[0105] The cutting lines 41a and 41b correspond to the outer peripheral edge of the heavy release film 2 in the sheet-like pressure sensitive adhesive. The cutting lines 42a and 42b correspond to the outer peripheral edge of the pressure sensitive adhesive layer 5 in the sheet-like pressure sensitive adhesive. By forming the cutting lines 41a and 41b on the outside of the cutting lines 42a and 42b, the pressure sensitive adhesive sheet is obtained, in which the heavy release film 2 is arranged to protrude from the end surface of the pressure sensitive adhesive layer 5. One of the formation of the cutting lines 41a and 41b reaching the carrier sheet 7 and the formation of the cutting lines 42a and 42b reaching the heavy release film 2 may be performed in first, or both the formations may be performed at the same time. The cutting method is not particularly limited, and an appropriate cutting method using a rotary cutter, a pushing blade (*e.g.*, Thomson blade), a laser cutter, etc. can be adopted.

[0106] After the pressure sensitive adhesive layer 5 and the heavy release film 2 are cut from the release film 9 side, the release film 9 is peeled off and removed from the surface of the pressure sensitive adhesive layer 5. Peeling can be performed at an arbitrary interface by adjusting a difference in adhesive strength between the layers and a peel angle. When the

release film 9 is peeled off and removed from the surface of the pressure sensitive adhesive layer 5, in a region between the cutting line 41a and the cutting line 41b, the pressure sensitive adhesive layer 5 and the heavy release film 2, as well as the release film 9 are peeled off and removed from the carrier sheet 7. In a region between the cutting line 42a and the cutting line 42b, the pressure sensitive adhesive layer 5, as well as the release film 9, is peeled off and removed from the surface of the heavy release film. Thus, in addition to the release film 9, the pressure sensitive adhesive layer 5 and the heavy release film 2 in the region surrounded by the cutting lines are peeled off and removed, whereby as shown in FIG. 6D, the laminated body 164 is obtained, in which the laminated product of the heavy release film 2 and the pressure sensitive adhesive layer 5 is provided in an island form on the carrier sheet 7.

[0107] The light release film 1 is laminated onto the pressure sensitive adhesive layer 5 so as to cover the entire laminated body 164 (FIG. 6E). The light release film 1 is cut along the cutting lines 43a and 43b (FIG. 6F), and the carrier sheet 7 is peeled off from the heavy release film 2, whereby the sheet-like pressure sensitive adhesive is obtained, in which the light release film 1 is arranged to protrude to the outside of the heavy release film 2 (FIG. 6G).

[0108] In forming the cutting lines 43a and 43b, only the light release film 1 may be cut, or the carrier sheet 7 may be cut in addition to the light release film 1. After the carrier sheet 7 is peeled off from the heavy release film 2, the light release film may be cut.

[0109] As described above, after forming the cutting lines 41a and 41b corresponding to the outer peripheral edge of the heavy release film 2 and the cutting lines 42a and 42b corresponding to the outer peripheral edge of the pressure sensitive adhesive layer 5, the temporarily adhered release film 9, and the heavy release film and the pressure sensitive adhesive layer in the margin area surrounded by the cutting lines are removed. The light release film 1 is thereafter laminated onto the pressure sensitive adhesive layer 5, and the light release film 1 is cut, whereby a plural pieces of sheet-like pressure sensitive adhesive is obtained from the mother substrate. In this method, the position of each cutting line can be arbitrarily set, whereby the planar shape of the pressure sensitive adhesive layer 5, the planar shape of the light release film 1, and the planar shape of the heavy release film can be arbitrarily set. Therefore, the pressure sensitive adhesive sheet is obtained, in which the

protrusion amount of the light release film 1 from the outer peripheral edge of the pressure sensitive adhesive layer 5 is different from the protrusion amount of the heavy release film 2 from the outer peripheral edge of the pressure sensitive adhesive layer 5.

[0110] [Use of Pressure Sensitive Adhesive Sheet]

5 The pressure sensitive adhesive sheet cut into a sheet form may be used for bonding with the adherend immediately after cutting. The sheet-like pressure sensitive adhesive may be packed in an appropriate form as necessary, transported and used for bonding with the adherend at the other place. When the sheet-like adhesive sheet is transported, it is preferable to pack a plural pieces of pressure sensitive adhesive sheets in a stack. From the
10 viewpoint of improving a transportation efficiency, the number of the laminated pressure sensitive adhesive sheets is preferably 10 or more, more preferably 20 or more, and further preferably 30 or more. The upper limit of the number of laminated sheets is not particularly limited as long as packing and transportation are possible. The upper limit of the number of laminated sheets is generally 5000 or less, and preferably 3000 or less, and more preferably
15 1000 or less in order to stably maintain the piled state.

[0111] The antistatic layer is disposed on the back surface of at least one of the heavy release film and the light release film in the pressure sensitive adhesive sheet of the present invention, whereby, even when a plural pieces of sheet are piled up without interposing applied paper between the pressure sensitive adhesive sheets, the blocking between the
20 pressure sensitive adhesive sheets due to static electricity is less likely to occur. It is preferable that a plural pieces of the pressure sensitive adhesive sheet are piled up in the same direction. For example, when a first pressure sensitive adhesive sheet is disposed so that the heavy release film 1 side forms an upper surface, it is preferable that the second and subsequent pressure sensitive adhesive sheets are also disposed so that the heavy release
25 film 1 side forms an upper surface.

[0112] The pressure sensitive adhesive sheet of the present invention is suitably used, for example, as an optical pressure sensitive adhesive for various display devices and display input devices. Examples of the display device include a liquid crystal (LC) display, an organic light emitting diode (OLED) display, a plasma display panel (PDP), and electronic paper.
30 Examples of the input device include a touch panel.

[0113] For example, the pressure sensitive adhesive layer after the light release film is

peeled off is bonded to the surface of an image display panel as the first adherend, and the heavy release film is then peeled off to bond the pressure sensitive adhesive layer to the touch panel as the second adherend, whereby the image display device with touch panel can be formed. The pressure sensitive adhesive sheet of the present invention is suitably used for bonding the image display panel and the front window (cover glass), and bonding the touch panel and the front window.

[0114] In using the release film-equipped pressure sensitive adhesive sheet in which the release films 1 and 2 are temporarily adhered to both the surfaces of the pressure sensitive adhesive layer 5, the light release film 1 is first peeled off to expose the first principal surface of the pressure sensitive adhesive layer 5, and the first principal surface is bonded to the first adherend.

[0115] When a plural pieces of pressure sensitive adhesive sheet are piled up, it is necessary to pick up the pressure sensitive adhesive sheets one by one before peeling off the light release film. In the pressure sensitive adhesive sheet of the present invention, the antistatic layer is disposed on the back surface of at least one of the light release film 1 and the heavy release film 2, whereby even when a plural pieces are piled up, the blocking between the pressure sensitive adhesive sheets due to static electricity is less likely to occur. Therefore, it is easy to pick up the pressure sensitive adhesive sheets one by one from the piled pressure sensitive adhesive sheets, and the workability can be improved.

[0116] The peeling electrostatic potential of the surface of the pressure sensitive adhesive layer 5 in peeling the light release film 1 from the surface of the pressure sensitive adhesive layer 5 is preferably 2.0 kV or less, more preferably 1.5 kV or less, further preferably 1.2 kV or less, and particularly preferably 1.0 kV or less. By disposing an antistatic layer on the back surface of at least one of the light release film 1 and the heavy release film 2, the peeling electrostatic potential in peeling the light release film 1 can be set within the above range.

[0117] Even when the light release film 1 has no antistatic layer, the peeling electrostatic potential in peeling the light release film 1 may be reduced when an antistatic layer is disposed on the back surface of the heavy release film 2 that is temporarily adhered to the pressure sensitive adhesive layer 5. Peeling electrostatic potential in peeling the light release film 1 can be further reduced when an antistatic layer is disposed on at least one of the back surface and the release surface of the light release film 1, and it is preferable that the

antistatic layer is disposed on the back surface of the light release film 1.

[0118] Thereafter, the heavy release film 2 is peeled off to expose the second principal surface of the pressure sensitive adhesive layer 5, and the pressure sensitive adhesive layer 5 is bonded to the second adherend. The pressure sensitive adhesive layer 5 may be bonded to the first adherend and the second adherend after both the release films 1 and 2 are peeled off.

[0119] The peeling electrostatic potential of the surface of the pressure sensitive adhesive layer 5 when the heavy release film 2 is peeled off from the surface of the pressure sensitive adhesive layer 5 is preferably 2.0 kV or less, more preferably 1.5 kV or less, further preferably 1.2 kV or less, and particularly preferably 1.0 kV or less. In order to set the peeling electrostatic potential of the heavy release film 2 within the above range, it is preferable that an antistatic layer is disposed on the back surface of the heavy release film.

[0120] If the peeling electrostatic potential in peeling of the heavy release film 2 is within the above range, the adhesion of dust to the pressure sensitive adhesive sheet can be suppressed, the workability can be improved, and the adverse influence on the adherend can be prevented. For example, when the heavy release film 2 is peeled off from the second principal surface of the pressure sensitive adhesive layer 5 in a state where an image display panel such as an LC panel or an OLED panel as the first adherend is bonded to the first principal surface of the pressure sensitive adhesive layer 5, it is possible to prevent the electrostatic destruction and defects of the panel due to peeling charge.

[0121] The peeling electrostatic potential of the surface of the pressure sensitive adhesive layer 5 is determined as the charge amount on the surface of the pressure sensitive adhesive layer 5 when the release film is peeled off from the pressure sensitive adhesive layer 5 at a peeling angle of 150° and a peeling rate of 10 m/min in an environment of a temperature of 23°C and a relative humidity of 50%. The peeling electrostatic potential in peeling the heavy release film 2 is measured by peeling off the light release film 1 from the pressure sensitive adhesive layer 5 and peeling off the heavy release film in a state where the first principal surface of the pressure sensitive adhesive layer 5 is bonded to a glass plate.

[0122] When the pressure sensitive adhesive layer 5 is photocurable, the pressure sensitive adhesive layer after bonding with the adherend may be irradiated with an active ray. The adhesion reliability to the adherend can be improved by photocuring the pressure sensitive adhesive layer after bonding with the adherend.

EXAMPLES

[0123] Hereinafter, the present invention will be further described with reference to Examples and Comparative Examples of pressure sensitive adhesive sheets, but the present invention is not limited to the following Examples.

[0124] [Preparation of Photocurable Pressure Sensitive Adhesive Composition]

To a monomer mixture composed of 78 parts by weight of 2-ethylhexyl acrylate (2EHA), 18 parts by weight of N-vinyl-2-pyrrolidone (NVP), and 4 parts by weight of 2-hydroxyethyl acrylate (HEA), 0.035 parts by weight of 1-hydroxycyclohexyl phenyl ketone ("IRGACURE 184" manufactured by BASF) as a photopolymerization initiator and 0.035 parts by weight of 2,2-dimethoxy-1,2-diphenylethan-1-one ("IRGACURE 651" manufactured by BASF) were added. This composition was irradiated with ultraviolet ray, and prepolymerization was carried out until the viscosity at room temperature reached about 20 Pa·s to obtain a prepolymer having a polymerization ratio of about 8%.

[0125] To the prepolymer, 0.15 parts by weight of hexanediol diacrylate, 0.3 parts by weight of a silane coupling agent ("KBM-403" manufactured by Shin-Etsu Chemical Co., Ltd.), and 0.15 parts by weight of bis(2,4,6-trimethylbenzoyl)-phenylphosphine oxide ("IRGACURE 819" manufactured by BASF) as a photopolymerization initiator were added to prepare an ultraviolet curable acryl-based pressure sensitive adhesive composition.

[0126] [Preparation of Coating Solution for Producing Release Film]

<Release Agent Solution for Heavy Release>

10 parts by weight of a 30% toluene solution of vinyl group-containing addition-type silicone ("KS-847T" manufactured by Shin-Etsu Chemical Co., Ltd.) and 1 part by weight of a silicone curing platinum catalyst ("CAT-PL-50T" manufactured by Shin-Etsu Chemical Co., Ltd.) were diluted with a mixed solvent of toluene and hexane at a volume ratio of 1 : 1 so that a silicone concentration was set to 1% by weight to prepare a solution for forming a heavy release layer.

[0127] <Release Agent Solution for Light Release>

30 parts by weight of a 30% toluene solution of hexenyl group-containing addition-type silicone (polyorganosiloxane having a hexenyl group in molecule and an addition-type silicone-based release agent including a hydrosilyl group-containing polyorganosiloxane

crosslinker) ("LTC761" manufactured by Dow Corning Toray Co., Ltd.), 0.9 parts by weight of a silicone dispersion having a solid concentration of 15% ("BY24-850" manufactured by Dow Corning Toray Co., Ltd.), and 2 parts by weight of a silicone curing platinum catalyst ("SRX 212" manufactured by Dow Corning Toray Co., Ltd.) were diluted with a mixed solvent of toluene and hexane at a volume ratio of 1 : 1 so that a silicone concentration was set to 1% by weight to prepare a solution for forming a light release layer.

[0128] <Antistatic Coating Solution P>

100 parts by weight of a solution prepared by diluting 17 parts by weight of a water-soluble polyester resin and 1 part by weight of PEDOT/PSS with a mixed solvent of dimethylsulfoxide and water (weight ratio of 15 : 85) ("S-948" manufactured by Chukyo Yushi Co., Ltd., solid content: 8% by weight), and 10 parts by weight of a 70% by weight aqueous solution of water-soluble methylol melamine ("P-795" manufactured by Chukyo Yushi Co., Ltd.) were diluted to a solid content of 0.3% by weight with a mixed solution of pure water and Ekinen F6 (Japan Alcohol Trading Co., Ltd.) to prepare an antistatic coating solution P.

[0129] <Antistatic Coating Solution Q>

50 parts by weight of a 5% toluene solution of an acryl-based polymer (copolymerized product of methyl methacrylate : n-butyl acrylate : cyclohexyl methacrylate = 67 : 22 : 11 (weight ratio)), 25 parts by weight of a silicone type leveling agent ("BY16-201" manufactured by Dow Corning Toray Co., Ltd.), 25 parts by weight of a 4% aqueous solution of PEDOT/PSS, and 0.1 parts by weight of a melamine-based crosslinker were diluted to a solid content of 0.15% by weight with ethylene glycol monoethyl ether, to prepare an antistatic coating solution Q.

[0130] [Production of Light Release Film]

<Manufacturing Example 1: Light Release Film Having No Antistatic Layer>

The solution for forming a light release layer was applied on one surface of a 50 μm -thick biaxially stretched polyethylene terephthalate (PET) film ("Lumirror S10" manufactured by Toray Industries, Inc.) so that the thickness after drying was set to 100 nm, and heated at 130°C for 3 minutes to dry the solvent and cure silicone, thereby obtaining a release film A having a release layer on one surface of the PET film.

[0131] <Manufacturing Example 2: Light Release Film Having Antistatic layer on Release Treatment Surface>

The antistatic coating solution P was applied on one surface of the PET film so that the thickness after drying was set to 20 nm, and heated at 130°C for 3 minutes to form an antistatic layer on one surface of the PET film. A release layer was formed on the antistatic layer in the same manner as in Manufacturing Example 1 to obtain a release film B having an antistatic layer P and a release layer on one surface of the PET film.

[0132] <Manufacturing Example 3: Light Release Film Having Antistatic Layer on Each of Both Surfaces>

The antistatic coating solution P was applied on each of the both the surfaces of a PET film so that the thickness after drying was set to 20 nm, and heated at 130°C for 3 minutes to form an antistatic layer on each of both the surfaces of the PET film. On the antistatic layer on one surface, a release layer was formed in the same manner as in Manufacturing Example 1, to obtain a release film C in which an antistatic layer P and a release layer were disposed on one surface (release treatment surface) of the PET film, and an antistatic layer P was disposed on the other surface.

[0133] [Production of Heavy Release Film]

<Manufacturing Example 4: Heavy Release Film Having No Antistatic Layer>

The solution for forming a heavy release layer was applied on one surface of a 75 µm-thick biaxially stretched polyethylene terephthalate (PET) film ("Lumirror S10" manufactured by Toray Industries, Inc.) so that the thickness after drying was set to 100 nm, and heated at 130°C for 3 minutes to dry the solvent and cure silicone, thereby obtaining a release film D having a release layer on one surface of the PET film.

[0134] <Manufacturing Example 5: Heavy Release Film Having Antistatic layer on Release Treatment Surface>

The antistatic coating solution P was applied on one surface of the PET film so that the thickness after drying was set to 20 nm, and heated at 130°C for 3 minutes to form an antistatic layer on one surface of the PET film. A release layer was formed on the antistatic layer in the same manner as in Manufacturing Example 4 to obtain a release film E having an antistatic layer P and a release layer on one surface of the PET film.

[0135] <Manufacturing Example 6: Heavy Release Film Having Antistatic layer on Back Surface>

The antistatic coating solution P was applied on one surface of the PET film so that

the thickness after drying was set to 20 nm, and heated at 130°C for 3 minutes to form an antistatic layer on one surface of the PET film. In the same manner as in Manufacturing Example 4, a release layer was formed on the surface having no antistatic layer to obtain a release film F in which a release layer was disposed on one surface (release treatment surface) of the PET film, and an antistatic layer P was disposed on the other surface.

[0136] <Manufacturing Example 7: Heavy Release Film Having Antistatic Layer on Each of Both Surfaces>

The antistatic coating solution P was applied on each of the both the surfaces of a PET film so that the thickness after drying was set to 20 nm, and heated at 130°C for 3 minutes to form an antistatic layer on each of both the surfaces of the PET film. On the antistatic layer on one surface, a release layer was formed in the same manner as in Manufacturing Example 4, to obtain a release film G in which an antistatic layer P and a release layer were disposed on one surface (release treatment surface) of the PET film, and an antistatic layer P was disposed on the other surface.

[0137] <Manufacturing Example 8: Heavy Release Film Having Antistatic layer on Back Surface>

The antistatic coating solution Q was applied on one surface of the PET film so that the thickness after drying was set to 12 nm, and heated at 130°C for 2 minutes to form an antistatic layer on one surface of the PET film. In the same manner as in Manufacturing Example 4, a release layer was formed on the surface having no antistatic layer to obtain a release film H in which a release layer was disposed on one surface (release treatment surface) of the PET film, and an antistatic layer Q was disposed on the other surface.

[0138] [Production of Pressure Sensitive Adhesive Sheet]
<Example 1>

A pressure sensitive adhesive composition was applied at a thickness of 150 μm to the release surface of the light release film A produced in Manufacturing Example 1 to form an applied layer, and the release surface of the heavy release film F produced in Production Example 4 was laminated onto the surface of the applied layer to obtain a laminated body. The laminated body was irradiated with ultraviolet ray under the conditions of an illuminance of 6.5 mW/cm² and an accumulated light amount of 1500 mJ/cm² from the heavy release film side, to photocure the pressure sensitive adhesive composition, thereby obtaining

a pressure sensitive adhesive sheet (mother substrate).

[0139] A weak pressure sensitive adhesive film as a carrier sheet was laminated on the surface of the pressure sensitive adhesive sheet on the heavy release film side, and the laminated body was cut according to processes shown in FIGS. 6A to 6G, followed by peeling off the light release film A. Thereafter, the light release film B produced in Production Example 2 was laminated, and punched to a product size, to obtain a sheet-like pressure sensitive adhesive in which the light release film B and the heavy release film F were respectively bonded to one surface and the other surface of a pressure sensitive adhesive layer so as to protrude to the outside of the end surface of the pressure sensitive adhesive layer.

[0140] <Examples 2 to 4 and Comparative Examples 1 to 3>

Sheet-like pressure sensitive adhesives were obtained in the same manner as in Example 1 except that the kinds of the heavy release film to be laminated to the surface of the applied layer and the light release film to be laminated after cutting were changed as shown in Table 1.

[0141] [Evaluation]

<Surface Resistance of Release Film>

Using a resistivity meter ("Model 152-1" manufactured by TREK Co., Ltd.) under an environment of a temperature of 23°C and a relative humidity of 50% (hereinafter referred to as "standard environment"), a probe ("Model 152P-2P" manufactured by TREK) was brought into contact with the release surface and back surface of the release film, and the surface resistance was measured under the conditions of an applied voltage of 10 V and a voltage application time of 30 seconds. In any of the release films, the surface resistance of the surface on which the antistatic layer was not formed exceeded the measurement upper limit ($1 \times 10^{13} \Omega/\text{sq}$).

[0142] <Coefficient of Dynamic Friction of Back Surface of Release Film>

An acrylic plate (70 mm × 100 mm) was bonded to one surface of a surface treatment-free biaxially-stretched 50 μm-thick PET film (70 mm × 100 mm) via an acrylic-based pressure sensitive adhesive to produce a sliding piece. The release treatment surface of the release film was bonded to a horizontal test base using a double-sided pressure sensitive adhesive tape. The slide piece was placed on the back surface of the release film so that the PET film surface of the slide piece was brought into contact with the back surface of the

release film. A weight was placed thereon. The total mass of the sliding piece and the weight was 1.5 kg. Using a tensile tester, the sliding piece on which the weight was placed was moved at a speed of 300 mm/min in a direction parallel to the long side direction of the sliding piece. A dynamic friction coefficient was calculated according to JIS K 7125.

5 **[0143]** <Peeling Electrostatic Potential on Surface of Pressure Sensitive Adhesive Layer When Light release film is Peeled off>

The pressure sensitive adhesive sheet destaticized beforehand was cut into a size of 70 mm width and 130 mm length. The light release film was peeled off by 30 mm from the end in the longitudinal direction, and fixed to an automatic winder. Under the standard
10 environment, the light release film was peeled off from the surface of the pressure sensitive adhesive layer under the conditions of a peeling angle of 150° and a peeling speed of 10m/min, and the potential of the surface of the pressure sensitive adhesive layer was measured by an electrostatic potential indicator (STATIRON DZ4 "manufactured by Shishido Static Co., Ltd.) fixed at a position having a height of 30 mm from the center of the pressure sensitive
15 adhesive layer.

[0144] <Peeling electrostatic potential on Surface of Pressure Sensitive Adhesive Layer When Heavy release film is Peeled>

The pressure sensitive adhesive sheet destaticized beforehand was cut into a size of 70 mm in width and 130 mm in length, and the light release film was peeled off. The
20 pressure sensitive adhesive layer was bonded to the release layer non-forming surface of the release film B (the PET film having the antistatic layer and the release layer on one surface) destaticized beforehand, followed by pressure bonding by a hand roller. From the surface of the pressure sensitive adhesive layer, the heavy release film was peeled off by 30 mm from the end in the longitudinal direction, and fixed to an automatic winder. Under the standard
25 environment, the heavy release film was peeled off from the surface of the pressure sensitive adhesive layer, and the surface potential of the pressure sensitive adhesive layer was measured under the same conditions as those when the light release film was peeled off.

[0145] <Pickup Test>

Fifty-one sheet-like pressure sensitive adhesives were piled up such that the surface
30 on the light release film side was on a lower side. A suction disk was pressed against the upper side (the surface on the heavy release film side) of the piled pressure sensitive adhesive

5 sheets, to adsorb the pressure sensitive adhesive sheet. The pressure sensitive adhesive sheet on the top was lifted with the suction disk, and picked up. Whether or not only one pressure sensitive adhesive sheet on the top could be picked up was visually confirmed. This operation was repeated and pickup properties were evaluated according to the following criteria.

Excellent: All 50 pressure sensitive adhesive sheets from the top could be picked up one by one.

Good: Two or more sheets were picked up only once.

Poor: Two or more sheets were picked up twice or more.

10 **[0146]** [Evaluation Results]

15 The constitution of the release film of the pressure sensitive adhesive sheet of each of Examples and Comparative Examples (the kind and surface resistance of the antistatic layer of the surface of each of the heavy release film and light release film, and the dynamic friction coefficient of the back surface of the peeling film), the measurement results of the peeling electrostatic potential, and the results of the pickup test are summarized in Table 1.

[0147] [Table 1]

	Release film						Evaluation		
		Kind	Release surface		Back surface		Peeling electrostatic potential (kV)	Pickup properties	
			Antistatic layer	Surface resistance (Ω/sq)	Antistatic layer	Coefficient of dynamic friction			Surface resistance (Ω/sq)
Example 1	Light release	B	P	1 × 10 ⁸	-	0.50	> 10 ¹³	0.8	Excellent
	Heavy release	F	-	> 10 ¹³	P	0.30	1 × 10 ⁵	0.9	
Example 2	Light release	C	P	1 × 10 ⁸	P	0.30	1 × 10 ⁸	0.8	Excellent
	Heavy release	F	-	> 10 ¹³	P	0.30	1 × 10 ⁵	0.9	
Example 3	Light release	C	P	1 × 10 ⁸	P	0.30	1 × 10 ⁸	0.8	Excellent
	Heavy release	G	P	1 × 10 ⁸	P	0.30	1 × 10 ⁵	0.8	
Example 4	Light release	A	-	> 10 ¹³	-	0.50	> 10 ¹³	1.4	Good
	Heavy release	H	-	> 10 ¹³	Q	0.47	1 × 10 ⁸	1.3	
Comparative Example 1	Light release	B	P	1 × 10 ⁸	-	0.50	> 10 ¹³	5.3	Poor
	Heavy release	D	-	> 10 ¹³	-	0.50	> 10 ¹³	5.0	
Comparative Example 2	Light release	A	-	> 10 ¹³	-	0.50	> 10 ¹³	5.1	Poor
	Heavy release	E	P	1 × 10 ⁸	-	0.50	> 10 ¹³	4.5	
Comparative Example 3	Light release	B	P	1 × 10 ⁸	-	0.50	> 10 ¹³	6.0	Poor
	Heavy release	E	P	1 × 10 ⁸	-	0.50	> 10 ¹³	5.8	

[0148] In Comparative Example 1 using the release film B having the antistatic layer on the release layer-formed surface-side as the light release film, the peeling electrostatic potential was 5 kV or more when any release film was peeled off. In Comparative Example 2 using the release film E as the heavy release film in which the antistatic layer is disposed on the release layer-formed surface-side, the peeling electrostatic potential in peeling the release film was slightly smaller than that in Comparative Example 1. In Comparative Example 3 using the release film having the antistatic layer on the release layer-formed surface for both the light release film and the heavy release film, the peeling electrostatic potential in peeling the release film was rather increased without being decreased as compared with Comparative Examples 1 and 2. In Comparative Examples 1 to 3, two or more pressure sensitive adhesive sheets were picked up twice or more in the pickup test.

[0149] In Example 1, in which the release film B having the antistatic layer on the release layer-formed surface-side is used as the light release film and the release film F having the antistatic layer on the back surface is used as the heavy release film, the peeling electrostatic potential was less than 1 kV even when any release film was peeled off, and the peeling electrostatic potential was significantly reduced as compared with Comparative Examples 1 to 3. Also in Examples 2 and 3 using the release film having the antistatic layer on the back surface for both the light release film and the heavy release film, a peeling electrostatic potential reduction effect similar to that in Example 1 was observed. In Examples 1 to 3, it was possible to sequentially pick up all the 50 pressure sensitive adhesive sheets one by one in the pickup test, which provided excellent process workability.

[0150] Also in Example 4, in which the release film H having the antistatic layer Q on the back surface as the heavy release film is used, the peeling electrostatic potential was smaller than those in Comparative Examples 1 to 3. In Example 4, although no antistatic layer was formed on the light release film, the peeling electrostatic potential in peeling the heavy release film and the peeling electrostatic potential in peeling the light release film were smaller than those in Comparative Examples 1 to 3. From these results, it is found that the peeling charge in peeling of the light release film can be suppressed by disposing an antistatic layer on the back surface of the heavy release film, even when no antistatic layer is provided on the light release film. This may be because the heavy release film having an antistatic layer on the back side is attached to the pressure sensitive adhesive layer when the light

release film is peeled off.

[0151] In Example 4, the antistatic layer Q disposed on the back surface of the heavy release film had lower conductivity and a larger dynamic friction coefficient (lower slip properties) than those of the antistatic layer P disposed on the back surface of the heavy release film of Examples 1 to 3, whereby Example 4 had poorer pickup properties than those of Examples 1 to 3, but it had more excellent pickup properties than those of Comparative Examples 1 to 3.

[0152] From the comparison of the results of Examples 1 to 4 with Comparative Examples 1 to 3, it is found that at least one of the release films temporarily adhered to both the surfaces of the pressure sensitive adhesive layer includes the antistatic layer on the back surface, whereby the peeling electrostatic potential in peeling the release film can be reduced, and the blocking in the piled body of the pressure sensitive adhesive sheet is suppressed, which can provide improved workability.

CLAIMS

1. A pressure sensitive adhesive sheet comprising:

a pressure sensitive adhesive layer having a first principal surface and a second principal surface;

a first release film having a first principal surface and a second principal surface, the first principal surface of the first release film being temporarily adhered to the first principal surface of the pressure sensitive adhesive layer; and

a second release film having a first principal surface and a second principal surface, the first principal surface of the second release film being temporarily adhered to the second principal surface of the pressure sensitive adhesive layer, wherein

each of the first release film and the second release film has a release layer on a first principal surface of a film substrate,

a peeling force between the first release film and the pressure sensitive adhesive layer is smaller than a peeling force between the second release film and the pressure sensitive adhesive layer, and

at least one of the first release film and the second release film has an antistatic layer on a second principal surface of the film substrate.

2. The pressure sensitive adhesive sheet according to claim 1, wherein the second release film has an antistatic layer on the second surface of the film substrate.

3. The pressure sensitive adhesive sheet according to claim 1, wherein each of the first release film and the second release film has an antistatic layer on the second principal surface of the film substrate.

4. The pressure sensitive adhesive sheet according to any one of claims 1 to 3, wherein at least one of the first release film and the second release film has a surface resistance of $1 \times 10^8 \Omega/\text{sq}$ or less on the second principal surface.

5. The pressure sensitive adhesive sheet according to any one of claims 1 to 4, wherein at

least one of the first release film and the second release film has a dynamic friction coefficient of 0.4 or less on the second principal surface.

6. The pressure sensitive adhesive sheet according to any one of claims 1 to 5, wherein the first release film has an antistatic layer between the film substrate and the release layer.

7. The pressure sensitive adhesive sheet according to any one of claims 1 to 6, wherein the pressure sensitive adhesive layer is composed of a pressure sensitive adhesive containing an acryl-based base polymer.

8. The pressure sensitive adhesive sheet according to any one of claims 1 to 7, wherein the pressure sensitive adhesive layer is composed of a photocurable pressure sensitive adhesive composition containing a polyfunctional monomer.

9. The pressure sensitive adhesive sheet according to any one of claims 1 to 8, having a region where at least one of the first release film and the second release film protrudes outward from the outer peripheral edge of the pressure sensitive adhesive layer.

10. The pressure sensitive adhesive sheet according to claim 9, wherein at least one of the first release film and the second release film protrudes outward from the outer peripheral edge of the pressure sensitive adhesive layer over the entire outer periphery of the pressure sensitive adhesive layer.

11. The pressure sensitive adhesive sheet according to claim 9 or 10, having a region where the first release film protrudes outward from the outer peripheral edge of the second release film.

12. The pressure sensitive adhesive sheet according to any one of claims 9 to 11, wherein a notch is formed on the first principal surface of at least one of the first release film and the second release film, the notch being provided along the outer peripheral edge of the pressure

sensitive adhesive layer.

13. A piled body, wherein ten or more pieces of the pressure sensitive adhesive sheet according any one of claims 1 to 12 are piled up.