

SPECIFICATION

REMOVABLE PRESSURE-SENSITIVE ADHESIVE SHEET, METHOD
FOR PRODUCING SAME, AND REMOVABLE PRESSURE-SENSITIVE
5 ADHESIVE SHEET LAMINATE

Technical Field

The present invention relates to a removable
pressure-sensitive adhesive sheet with small
10 variations in pressure-sensitive adhesive strength and
peel strength even when pressure applied thereto varies,
having a uniform pressure-sensitive adhesive strength
and peel strength, a method for producing the same, and
a removable pressure-sensitive adhesive sheet laminate
15 using the removable pressure-sensitive adhesive sheet.

Background Art

In recent years, there has been found out a
pressure-sensitive adhesive sheet that micro-spheres
20 of pressure-sensitive adhesive resin are arrayed on the
surface of a substrate sheet and adhered to produce a
pressure-sensitive adhesive sheet, the surface of the
arrayed micro-spheres is stuck on a surface of the other
adherend, then if necessary, the pressure-sensitive
25 adhesive sheet is peeled off and stuck on the adherend
surface again, and such operation can be repeated.

In a pressure-sensitive adhesive sheet used in
this application, a pressure-sensitive adhesive layer

composed of a spherical pressure-sensitive adhesive is formed on one surface of a substrate sheet on which a primer layer is applied conventionally if desired. As such a pressure-sensitive adhesive sheet, for example, there has been proposed a removable pressure-sensitive adhesive sheet using a spherical pressure-sensitive adhesive in a pressure-sensitive adhesive layer (see Japanese Unexamined Patent Application Publication No. 2-194079), further, proposed a removable pressure-sensitive adhesive sheet that a spherical pressure-sensitive adhesive is blended with removable pressure-sensitive adhesives and various compounds (see Japanese Unexamined Patent Application Publication No. 2004-137313).

However, in such a pressure-sensitive adhesive sheet, there have been instances that a pressure-sensitive adhesive strength varies or peel strength increases upon a high pressure being applied thereto. Specifically, for example, in production of laminate of pressure-sensitive adhesive sheets, a pressure-sensitive adhesive sheet is faced to an release surface of a pressure-sensitive adhesive sheet adjacent to the pressure-sensitive adhesive surface and sequentially laminated to produce a laminate of pressure-sensitive adhesive sheets, upon cutting by a cutter blade to a predetermined size, a pressure is applied on the vicinity of the cut part not to generate displacement in the cut part, fixed and cut. In this

case, variations in pressure-sensitive adhesive strength and peel strength have been posed between the pressure-sensitive adhesive layer pressurized and the pressure-sensitive adhesive layer not pressurized.

5 Further, when the pressure-sensitive adhesive sheet is wound up in a roll and left to stand, pressure undergone differs in the parts near the core of roll and near the outside of roll, which has caused variations in pressure-sensitive adhesive strength and peel
10 strength.

Namely, there has also been a problem that it is difficult to obtain a removable pressure-sensitive adhesive sheet with a uniform pressure-sensitive adhesive strength and a uniform peel strength because
15 of large variations in pressure-sensitive adhesive strength and peel strength when pressure varies in higher or lower.

Further, in the case where the pressure-sensitive adhesive layer of the above-described conventional
20 pressure-sensitive adhesive sheet is formed on a part of the surface of a substrate sheet, there has been conducted a method that a pressure-sensitive adhesive is applied on a whole surface of the transfer roll of a roll coater, a part of the pressure-sensitive adhesive
25 is scraped off by a blade to form a pressure-sensitive adhesive layer partly on the roll surface, which is transferred on a substrate sheet. In this case, upon scraping off a pressure-sensitive adhesive by a blade,

there have been a problem that scraping-off cannot be completely done to result in a residual pressure-sensitive adhesive on the surface of the transfer roll, thereby applying the pressure-sensitive adhesive onto unnecessary parts of a pressure-sensitive adhesive layer; even if scraping-off is sufficient, due to poor tearing of the pressure-sensitive adhesive, the pressure-sensitive adhesive of a strip-shaped pressure-sensitive adhesive layer flows out onto the surface of roll scraped off the pressure-sensitive adhesive, so that it becomes difficult to fabricate the width of a strip-shaped pressure-sensitive adhesive layer exactly to a predetermined setting, further aggregate tends to be generated in a pressure-sensitive adhesive and foaming generates at the same time, which disturbs applying.

Disclosure

It is the aim of the embodiments of the present invention to solve the above-described problems and to provide a removable pressure-sensitive adhesive sheet with small variations in pressure-sensitive adhesive strength and peel strength even when a pressure applied thereto varies in higher or lower, having a uniform pressure-sensitive adhesive strength and peel strength; a method for producing a removable pressure-sensitive adhesive sheet such that upon scraping off a pressure-sensitive adhesive by a blade

in partially applying onto a roll surface, tearing of the pressure-sensitive adhesive is good, it is possible to produce the width of a strip-shaped pressure-sensitive adhesive layer to exactly to a
5 predetermined setting, further, aggregate is hardly generated in a pressure-sensitive adhesive, foaming is hardly generated at the same time, exhibiting the above-described characteristics; and a removable pressure-sensitive adhesive sheet laminate using the
10 removable pressure-sensitive adhesive sheet.

The present inventors have keenly studied to solve the above-described problems, as a result, found the following knowledge that can solve the above-described problems and completed the present invention: a
15 pressure-sensitive adhesive layer applied on one surface of a substrate sheet is composed of the pressure-sensitive adhesive containing spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive, further, the spherical
20 pressure-sensitive adhesive is a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1-3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer
25 component, or a spherical pressure-sensitive adhesive obtained by adding 0.1-7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical

pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer.

Namely, the present disclosure provides a removable pressure-sensitive adhesive sheet which comprises a substrate sheet and a pressure-sensitive adhesive layer formed by applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive on one surface of the substrate sheet, wherein the spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1 to 7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive into a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer.

In a first aspect, there is provided a removable pressure-sensitive adhesive sheet which comprises a substrate sheet and a pressure-sensitive adhesive layer formed by applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive on one surface of the substrate sheet, wherein the spherical pressure-sensitive

adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, and 0.1 to 15 parts by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1 to 7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive into a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 15 part by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component.

In a second aspect, there is provided a wind-up roll of removable pressure-sensitive adhesive sheet, wherein the removable pressure-sensitive adhesive sheet as defined above is wound up in a roll.

Furthermore, the present disclosure provides a removable pressure-sensitive adhesive sheet which comprises a substrate sheet and a pressure-sensitive

adhesive layer formed by applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive partly on one surface of a substrate sheet, wherein the spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1-7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer.

In a third aspect, there is provided a removable pressure-sensitive adhesive sheet which comprises a substrate sheet and a pressure-sensitive adhesive layer formed by applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive partly on one surface of a substrate sheet, wherein the spherical 5 pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, and 0.1 to 15 parts by mass of methyl cellulose per 100 parts by mass of

the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1-7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 15 part by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component.

Additionally, the present disclosure provides a removable pressure-sensitive adhesive sheet wherein the pressure-sensitive adhesive has an aggregation rate of 5% or less by mass in Maron test in the removable pressure-sensitive adhesive sheet described above.

Also, the present disclosure provides a removable pressure-sensitive adhesive sheet wherein the pressure-sensitive adhesive strength of the pressure-sensitive adhesive layer to a stainless plate is 1.0 N/105 mm or more, and the ratio of the pressure-sensitive adhesive strength to stainless plate and the pressure-sensitive adhesive strength to

the surface of a substrate sheet is in a range of 1:0.2 to 1:1 in the removable pressure-sensitive adhesive sheet as described above.

In a fourth aspect, there is provided a removable pressure-sensitive adhesive sheet laminate, which is laminated with a plurality of pieces of the removable pressure-sensitive adhesive sheet as described above.

Furthermore, the present disclosure provides a method for producing a removable pressure-sensitive adhesive sheet, which comprises applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive onto a surface of a metal roll for transferring the pressure-sensitive adhesive layer; then forming a strip-shaped pressure-sensitive adhesive layer by partly scraping off the applied pressure-sensitive adhesive by a blade; and producing a removable pressure-sensitive adhesive sheet by transferring said strip-shaped pressure-sensitive adhesive layer onto one surface of a substrate sheet, wherein said spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1

to 7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer.

In a fifth aspect, there is provided a method for producing a removable pressure-sensitive adhesive sheet, which comprises applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive onto a surface of a metal roll for transferring the pressure-sensitive adhesive layer; then forming a strip-shaped pressure-sensitive adhesive layer by partly scraping off the applied pressure-sensitive adhesive by a blade; and producing a removable pressure-sensitive adhesive sheet by transferring said strip-shaped pressure-sensitive adhesive layer onto one surface of a substrate sheet, wherein said spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component and 0.1 to 15 parts by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1 to 7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical pressure-sensitive

adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 15 part by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component.

Brief Description of the Drawings

FIG. 1 is a cross sectional view showing an example of producing equipment of the removable pressure-sensitive adhesive sheet of the present invention.

FIG. 2 is perspective views of the removable pressure-sensitive adhesive sheet of the present invention wound up in a roll, and of the laminate of the removable pressure-sensitive adhesive sheet of the present invention.

In the drawings, there are represented, 1: Substrate sheet, 2: Pressure-sensitive adhesive, 3: Metal roll for transferring pressure-sensitive adhesive layer, 4: Pressure-sensitive adhesive layer, 5: Strip-shaped pressure-sensitive adhesive layer, 6: Blade, 7 : Roll for pressing pressure-sensitive adhesive layer, 8: Scraping plate, 9: Roll for feeding substrate sheet, 10: Container, 11: Removable pressure-sensitive adhesive sheet, 12: Wind-up roll of removable pressure-sensitive adhesive sheet. 13: Substrate sheet surface, 14: Pressure-sensitive adhesive layer forming surface, 15: Strip-shaped pressure-sensitive adhesive

layer, and 16: Removable pressure-sensitive adhesive sheet laminate.

Preferred Embodiments for carrying out the Invention

5 In the removable pressure-sensitive adhesive sheet of the present invention, as a substrate sheet, various substrate sheets can be adopted, may be suitably selected according to purpose of use. As examples of the substrate sheet, there are listed papers such as
10 wood free paper, art paper, coated paper, kraft paper, and laminated paper that these paper substrates are laminated with thermoplastic resins such as polyethylene and synthetic papers; metal foils such as aluminum foil, copper foil and iron foil; porous
15 material sheets such as non-woven clothes; further, plastic sheets of polyolefin resins such as polyethylene resin, polypropylene resin, various olefin copolymer resin, polyester resins such as polyethylene terephthalate resin, polybutylene
20 terephthalate resin and polyethylene naphthalate resin, polystyrene resin, polyvinylchloride resin, acrylic resin, polycarbonate resin, polyamide resin, fluorine resin, and a mixture of two or more kinds of these resins, or a laminate of two or more kinds of these sheets.

25 To provide printability, these plastic sheets may be provided with an ink accepting layer meeting to various kinds of printing methods onto the surface of an opposite side of the pressure-sensitive adhesive

layer. In the case of a transparent plastic sheet, letter and pattern may also be printed on the surface that a pressure-sensitive adhesive layer of the plastic sheet is to be provided.

5 Further, to improve adhesiveness to a pressure-sensitive adhesive layer, the surface that a pressure-sensitive adhesive layer of these plastic sheets is provided can be surface-treated by an oxidation method or concave-convex method if desired.

10 As the oxidation method, for example, there are listed corona discharge surface treatment, chromic acid surface treatment (wet method), flame surface treatment, hot air surface treatment, and ozone/ultraviolet irradiation surface treatment. Further, as the

15 concave-convex method, for example, sand blast method and solvent treatment method are listed. These surface treatment methods are suitably selected in response to the kind of a substrate sheet, generally, corona discharge surface treatment method is preferably used

20 in view of the points of effect and workability. Primer treatment can also be processed.

Additionally, in the case where paper materials and non-woven clothes are used as a substrate sheet, a sealer layer can be provided if desired between a

25 substrate sheet and a pressure-sensitive adhesive layer. As the sealer layer, generally, a layer which is composed of mainly at least one kind of styrene-butadiene copolymer, acrylic resin, polyester

resin, polyurethane resin and polystyrene resin, and according to need, fillers such as clay, silica, calcium carbonate, titanium oxide and zinc oxide is listed. The applied amount of the sealer layer is not particularly limited, generally, it is preferably in a range of 0.1 to 30 g/m².

On the other hand, a surface of an opposite side of the surface forming a pressure-sensitive adhesive layer on a substrate sheet may not be processed by release treatment, but processed by release treatment is preferable. Preferable release treatment is to provide a release layer on one surface of a substrate sheet by applying, printing or transferring a release agent. As the various release agents to be used are listed, for example, there are listed silicone based release agent, fluorine based release agent, olefin based release agent and alkyd based release agent. The applied amount of release layer is preferably 0.1 to 10 g/m², more preferably 0.5 to 4 g/m².

In the present invention, a pressure-sensitive adhesive layer is provided on one surface of the substrate sheets, (or on the surface-treated surface when the surface treatment is processed on the surface of the substrate sheet to improve adhesiveness between the substrate sheet and pressure-sensitive adhesive layer.)

The pressure-sensitive adhesive layer is composed of a pressure-sensitive adhesive containing a spherical

pressure-sensitive adhesive and an emulsion binder
 pressure-sensitive adhesive, wherein the spherical
 pressure-sensitive adhesive is a spherical
 pressure-sensitive adhesive (A) obtained by
 5 polymerizing an ethylenically unsaturated monomer in
 the presence of 0.1 to 3 parts by mass of a polyacrylic
 acid per 100 parts by mass of the ethylenically
 unsaturated monomer component, or a spherical
 pressure-sensitive adhesive (B) obtained by adding 0.1
 10 to 7 parts by mass of a polyacrylic acid per 100 parts
 by mass of the solid content of the spherical
 pressure-sensitive adhesive to a spherical
 pressure-sensitive adhesive obtained by polymerizing
 an ethylenically unsaturated monomer.

15 As the spherical pressure-sensitive adhesive (A) or (B),
 a spherical pressure-sensitive adhesive obtained by
 polymerizing an ethylenically unsaturated monomer is
 preferred, and acrylic spherical pressure-sensitive
 adhesive containing (meth)acrylate monomer is
 20 particularly preferable.

The acrylic spherical pressure-sensitive adhesive
 can be obtained by copolymerizing at least one kind
 selected from (meth)acrylate monomers such as methyl
 (meth)acrylate, ethyl (meth)acrylate, propyl
 25 (meth)acrylate, butyl (meth)acrylate, octyl
 (meth)acrylate, 2-ethyl (meth)acrylate, 2-ethylhexyl
 (meth)acrylate, 2-hydroxyethyl(meth)acrylate,
 N-methylolmethan (meth)acrylate, and glycidyl

(meth)acrylate as main components, and according to need, at least one kind selected from monomers such as (meth)acrylic acid, maleic acid, vinyl acetate, vinyl propionate, styrene and acrylonitrile.

5 As a concrete method for producing the acrylic spherical pressure-sensitive adhesive, for example, there is listed a method for producing water suspension of spherical pressure-sensitive adhesive by various methods such as suspension polymerization method and
10 a method of suspending in water after solution polymerization. The spherical pressure-sensitive adhesive is obtained thereby.

 An average particle diameter of particles of the spherical pressure-sensitive adhesive is not
15 particularly limited, preferably in a range of 20 to 150 μm , particularly preferably in a range of 30 to 80 μm . When the average particle diameter of particles of the spherical pressure-sensitive adhesive is less than 20 μm , it is difficult to exhibit a characteristic as
20 the spherical pressure-sensitive adhesive, and the pressure-sensitive adhesive strength becomes too strong, and therefore removability may be decreased sometimes. Adversely, when the average particle diameter of particles of the spherical
25 pressure-sensitive adhesive is more than 150 μm , adhesion area to adherend becomes small, thus, there is a fear that good pressure-sensitive adhesive strength is difficult to obtain.

The spherical pressure-sensitive adhesive (A) uses a polyacrylic acid as a suspension stabilizer in polymerizing the ethylenically unsaturated monomer, in view of the points of suitably maintaining the stability of polymerization reaction of the ethylenically unsaturated monomer and suitably maintaining a scraping property in partial applying, the amount of polyacrylic acid used is 0.1 to 3 parts by mass per 100 parts by mass of the ethylenically unsaturated monomer component, more preferably 0.5 to 2.8 parts by mass.

The suspension stabilizer may use other suspension stabilizers together with the polyacrylic acid if desired.

As the other suspension stabilizers, for example, there are listed at least one kind of: water-soluble polymers such as gelatin, starch, casein, polyvinyl alcohol, polyvinyl pyrrolidone, carboxymethyl cellulose, methyl cellulose and polyacrylamide; anionic surfactants such as sodium alkylbenzene sulfonate, sodium alkyl diphenyl ether disulfonate, sodium lauryl sulfate, sodium polyoxyethylene alkyl ether sulfate, sodium alkyl naphthalene sulfonate, fatty acid sodium salt, sodium dodecylbenzenesulfonate, sodium alkylene disulfonate, sodium dialkyl sulfosuccinate, sodium monoalkyl sulfosuccinate, sodium polyoxyethylene alkyl ether sulfate, sodium polyoxyethylene alkyl ether phosphate, sodium polyoxyalkylene alkyl ether phosphate, calcium lignin

sulfonate, and melamine resin sodium sulfonate; and nonionic surfactants such as polyoxyethylene octyl phenyl ether, polyoxyethylene nonyl phenol ether, polyoxyethylene lauryl ether, polyoxyethylene alkyl ether, polyoxyalkylene alkyl ether, sorbitan fatty acid ester, polyoxyethylene sorbitan fatty acid ester, polyoxyethylene sorbitol fatty acid ester, glycerin fatty acid ester, polyoxyethylene fatty acid ester, polyoxyethylenealkylamine, and
10 poly(oxyethylene/oxypropylene) block copolymer. Among them, methyl cellulose and polyacrylamide are particularly preferable to use in combination with the polyacrylic acid. The total amount of suspension stabilizers used is preferably 0.1 to 15 parts by mass
15 per 100 parts by mass of the ethylenically unsaturated monomer component. When it is less than 0.1 parts by mass per 100 parts by mass of the ethylenically unsaturated monomer component, scraping property is deteriorated, when more than 15 parts by mass, there
20 is an instance that moisture resistance is decreased.

The spherical pressure-sensitive adhesive (B) is a spherical pressure-sensitive adhesive obtained by adding a polyacrylic acid to a spherical pressure-sensitive adhesive obtained by polymerizing
25 an ethylenically unsaturated monomer in the absence of a polyacrylic acid, wherein the polyacrylic acid is added as a dispersant of a spherical pressure-sensitive adhesive together with an emulsion binder

pressure-sensitive adhesive, the amount of polyacrylic acid used is 0.1 to 7 parts by mass, preferably 1 to 5 parts by mass per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive in view of the point of maintaining good scraping property in partial applying.

Additionally, in polymerization of the ethylenically unsaturated monomer in the absence of a polyacrylic acid, as a suspension stabilizer, the suspension stabilizers described above other than the polyacrylic acid may be used, preferable ones are the same as described above.

The dispersant may use other dispersants together with a polyacrylic acid if desired.

As other dispersants, there are preferably listed at least one kind of water-soluble polymers such as gelatin, starch, casein, polyvinyl alcohol, polyvinyl pyrrolidone, carboxymethyl cellulose, methyl cellulose and polyacrylamide, and aforementioned surfactants. The total amount of dispersants used is preferably 0.1 to 10 parts by mass per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive. When it is less than 0.1 parts by mass per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive, scraping property is worse, when more than 10 parts by mass, there is an instance that moisture resistance becomes poor and therefore, there is an instance that a problem of

deterioration in physical properties arises.

In the pressure-sensitive adhesive of the present invention, any one of the spherical pressure-sensitive adhesives of the (A) or the (B) described above may be
5 used alone or both may be used by mixing thereof.

Further, in using a suspension stabilizer or dispersant, it is preferably added after the suspension stabilizer or the dispersant is dissolved in a suitable amount of water.

10 Herein, as the polyacrylic acid used in the spherical pressure-sensitive adhesives of the (A) and the (B) described above, it may be a homopolymer of polyacrylic acid, may be a copolymer copolymerized with a polymerizable monomer other than a polyacrylic acid,
15 and may be a modified polyacrylic acid being reacted with a modifier, in the range of not to inhibit the object of the present invention. A weight-average molecular weight of the polyacrylic acid is preferably 3000 to 20000, particularly preferably 5000 to 15000.

20 The pressure-sensitive adhesive composing a pressure-sensitive adhesive layer preferably has an aggregation rate of 5% or less by mass in Maron test. When the aggregation rate in Maron test is more than 5% by mass, applying stability of a pressure-sensitive
25 adhesive is sometimes lowered. The aggregation rate in Maron test is preferably 4.0% or less by mass, particularly preferably 3.0% or less by mass. Additionally, the measurement of aggregation rate in

Maron test is conducted pursuant to JIS K6387-1982 or JIS K6392-1982.

The emulsion binder pressure-sensitive adhesive used in the present invention is not particularly limited, and various emulsion binder pressure-sensitive adhesives can be used. An acrylic emulsion binder pressure-sensitive adhesive is preferred in view of the points of performances such as pressure-sensitive adhesion characteristic, weather resistance and heat resistance.

An acrylic emulsion binder pressure-sensitive adhesive contains an acrylic resin as a main component. This acrylic resin is preferably an acrylic acid ester resin which is obtained by polymerizing (meth)acrylate based monomer, and according to need, with other ethylenically unsaturated monomer. As the (meth)acrylic acid ester based monomer and other ethylenically unsaturated monomer, the same ones as the raw materials of acrylic spherical pressure-sensitive adhesive described above are listed.

Further, it is preferable that an acrylic resin is suitably crosslinked by an internal crosslinking agent and/or external crosslinking agent.

Additionally, herein, the internal crosslinking agent denotes a crosslinkable reactive monomer capable of introducing a crosslinked structure into a polymer molecule in polymerization, and an external crosslinking agent denotes a crosslinking agent capable

of reacting with a crosslinkable functional group existed in a polymerized polymer molecule.

The internal crosslinking agent includes a keto group-containing ethylenically unsaturated monomer and
5 an aldo group- containing ethylenically unsaturated monomer preferably. The keto group-containing ethylenically unsaturated monomer, includes, for example, acrolein, diacetoneacrylamide, formylstyrol, vinyl alkyl ketone, diacetone (meth)acrylate, and
10 (meth)acryloxyalkyl acrylate. The internal crosslinking agents may be used alone or in combination with two kinds or more. The internal crosslinking agent is compounded and crosslinked in polymerization of acrylic resin. The amount of the internal crosslinking
15 agent compounded is preferably 0 to 5 parts by mass per 100 parts by mass of acrylic resin.

The external crosslinking agent includes, for example, isocyanate compounds, epoxy compounds, melamine compounds, aziridine (ethyleneimine)
20 compounds, hydrazide compounds, oxazoline compounds, carbodiimide compounds, urea compounds, dialdehyde compounds, metal chelate compounds, metal alkoxide compounds and metal salts. The external crosslinking agents may be used alone or in combination with two kinds
25 or more. The external crosslinking agent is compounded with the acrylic resin obtained by polymerization and crosslinked. The amount of the external crosslinking agent compounded is preferably 0 to 5 parts by mass per

100 parts by mass of acrylic resin.

For the acrylic emulsion binder pressure-sensitive adhesive, either the internal crosslinking agent or the external crosslinking agent, 5 or both of them may be used.

The acrylic emulsion binder pressure-sensitive adhesive is an emulsion, which is in a state that particles of acrylic resin are dispersed in aqueous medium, and the solid content is preferably 15 to 75% 10 by mass.

A method for producing the acrylic emulsion binder pressure-sensitive adhesive is not particularly limited, various methods can be used. As an example of the method for producing the acrylic emulsion binder 15 pressure-sensitive adhesive, for example, there is listed a method that first, to an aqueous medium containing an emulsifier, the (meth)acrylic acid ester monomer, which is material of acrylic resin, and optionally other ethylenically unsaturated monomers 20 are added, emulsification treatment is conducted, and polymerization is conducted in the presence of a polymerization initiator. The emulsification treatment is preferably processed by using a high-pressure homogenizer or ultrasound. Further, the polymerization 25 initiator includes, for example, various initiators used in emulsification radical polymerization, such as organic peroxides, azo compounds, persulfate and various redox type catalysts. The polymerization can

be conducted at various temperatures, 30 to 100°C is preferable, and 40 to 90°C is more preferable.

The content ratio of the spherical pressure-sensitive adhesive and the emulsion binder pressure-sensitive adhesive in the pressure-sensitive adhesive used in the present invention is preferably in a range of 100:5 to 100:50 as mass ratio of solid content, more preferably in a range of 100:10 to 100:35. When the content ratio of the spherical pressure-sensitive adhesive is less than the range described above, there is a fear that removability of the removable pressure-sensitive adhesive sheet obtained is insufficient. On the other hand, when the content ratio of the spherical pressure-sensitive adhesive is more than the range described above, the pressure-sensitive adhesive strength to the adherend is sometimes lowered.

The pressure-sensitive adhesive can be contained with one or more kinds of various additives usually used in a pressure-sensitive adhesive if desired in a range not to damage the object of the present invention. Various kinds of additives include, for example, a tackifier, plasticizer, filler, antioxidant, ultraviolet absorber, antiseptic agent, fungicide, dye, pigment and fragrant.

In the present invention, as applying methods of the pressure-sensitive adhesive, various applying methods can be adopted, for example, there are listed

a roll coating method, roll reverse coating method, knife coating method, roll knife coating method, roll knife reverse coating method and bar coating method.

The thickness of the pressure-sensitive adhesive layer is not particularly limited, it may be 0.5 to 50 g/m² by mass conversion after normal drying, preferably 1 to 30 g/m².

The pressure-sensitive adhesive strength of the pressure-sensitive adhesive layer to a stainless plate is ordinarily preferably 1.0 N/105 mm or more, more preferably 1.5 N/105 mm or more, and particularly preferably 2.0 N/105 mm or more. The upper limit of pressure-sensitive adhesive strength of the pressure-sensitive adhesive layer to the stainless plate is not particularly limited, ordinarily, it is preferably 4.0 N/105mm or less.

Further, the ratio of the pressure-sensitive adhesive strength to the stainless plate and the pressure-sensitive adhesive strength to the surface of the substrate sheet (or the surface of the release treatment in the case where the release treatment is processed on the surface of the substrate sheet to improve release property between the substrate sheet and pressure-sensitive adhesive layer) is preferably in a range of 1:0.2 to 1:1, more preferably in a range of 1:0.2 to 1:0.8, and particularly preferably in a range of 1:0.2 to 1:0.6.

A method for producing the removable

pressure-sensitive adhesive sheet of the present invention by a roll reverse coat method will next be described on the basis of the drawings.

In FIG. 1, a metal roll 3 for transferring the pressure-sensitive adhesive layer and a roll 7 for pressing the pressure-sensitive adhesive layer rotate in the same direction, a pressure-sensitive adhesive 2 stored in a container 10 is applied on the surface of the metal roll 3 for transferring the pressure-sensitive adhesive layer to form a pressure-sensitive adhesive layer 4 with a constant thickness. Additionally, the surface of the roll 7 for pressing the pressure-sensitive adhesive layer is prevented from adhesion of the pressure-sensitive adhesive by a scraping plate 8 of the pressure-sensitive adhesive. Next, a blade 6 scrapes off partially a pressure-sensitive adhesive layer 4 to form a strip-shaped pressure-sensitive adhesive layer 5, the strip-shaped pressure-sensitive adhesive layer 5 is transferred on one surface of a substrate sheet 1 wound onto the surface of a roll 9 for feeding substrate sheet. In this way, a removable pressure-sensitive adhesive sheet 11 that a pressure-sensitive adhesive layer is formed on a part of the surface of the substrate sheet is produced.

The width of the strip-shaped pressure-sensitive adhesive layer may be suitably selected in response to application of the removable pressure-sensitive

adhesive sheet, it is preferable that the area of the strip-shaped pressure-sensitive adhesive layer is set to 3 to 90% of the area of the removable pressure-sensitive adhesive sheet, more preferably is set to 5 to 60%. Further, in the case of producing a pressure-sensitive adhesive memo sheet laminate, it may be set to about 5 to 35% of the area of each laminated removable pressure-sensitive adhesive sheet laminated.

Further, by setting the number of blades to two or more, the number of strip-shaped pressure-sensitive adhesive layers can be a plurality of 2 or, 3 or more. By disposing one or more trenches in one blade preventing a pressure-sensitive adhesive layer from scraping off in the trenches, a plurality of strip-shaped pressure-sensitive adhesive layers can also be provided.

Additionally, in the case where the pressure-sensitive adhesive layer is formed on a whole surface of one side of the substrate sheet, without installing the blade 6, it is possible to produce the removable pressure-sensitive adhesive sheet that the pressure-sensitive adhesive layer is formed on the whole surface of one side by transferring the pressure-sensitive adhesive layer onto one surface of the substrate sheet without scraping-off of the pressure-sensitive adhesive layer 4 applied on the surface of the metal roll 3 for transferring pressure-sensitive adhesive layer.

Regarding the blade 6, blades made of various materials are listed, but blades made of polyester resin such as polyethylene terephthalate resin are preferred.

As shown in FIG. 2 (left figure), the removable
5 pressure-sensitive adhesive sheet of the present invention may be a shape of wind-up roll 12 of removable pressure-sensitive adhesive sheet in a state wound up in a roll. In this wind-up roll 12 of removable pressure-sensitive adhesive sheet, a removable
10 pressure-sensitive adhesive sheet 11 is wound up such that the substrate sheet surface 13 is outside and the pressure-sensitive adhesive layer forming surface 14 is inside. On the pressure-sensitive adhesive layer forming surface 14 of the removable pressure-sensitive
15 adhesive sheet 11, two strip-shaped pressure-sensitive adhesive layers 15 are provided.

As shown in FIG. 2 (right figure), the removable pressure-sensitive adhesive sheet of the present invention may be a shape of a removable
20 pressure-sensitive adhesive sheet laminate 16 that a plurality of removable pressure-sensitive adhesive sheets 11 are laminated so as to contact the surface of the substrate sheet with the pressure-sensitive adhesive layer of the adjacent removable
25 pressure-sensitive adhesive sheets 11. Additionally, in FIG. 2 (right figure), by cutting the laminated removable pressure-sensitive adhesive sheet laminate 16 along a dotted line, a removable pressure-sensitive

adhesive sheet laminate with a suitable size can be obtained. In this case, in cutting, it is preferable to apply pressure onto the vicinity of cut part by a pressing tool for a position of cut part not to be displaced. The removable pressure-sensitive adhesive sheet of the present invention has the characteristics that there are small variations in pressure-sensitive adhesive strength and peel strength when the pressure applied thereto varies in higher or lower.

The removable pressure-sensitive adhesive sheet of the present invention has a uniform pressure-sensitive adhesive strength with small variations in pressure-sensitive adhesive strength when pressure applied thereto varies, and it can repeat attaching and release. Further, by utilizing the method for producing the removable pressure-sensitive adhesive sheet of the present invention, in scraping off a pressure-sensitive adhesive by a blade in partial applying, scraping-off processability is excellent, tearing of the pressure-sensitive adhesive is good, and therefore, the width of strip-shaped pressure-sensitive adhesive layer can be formed exactly to a predetermined setting, and further, aggregate is hardly generated in a pressure-sensitive adhesive, foaming is hardly generated at the same time. Moreover, the removable pressure-sensitive adhesive sheet laminate of the present invention has the characteristics of the removable pressure-sensitive

adhesive sheet and also a uniform and easy release property with small variations in peel strength when pressure varies, which hardly poses curl after the removable pressure-sensitive adhesive sheet is peeled
5 from the laminate.

The removable pressure-sensitive adhesive sheet of the present invention can be used as laminate, and can be attached to other various adherends.

10 Examples

In the following, the present invention is explained in more detail by Examples. Further, the present invention is not restricted at all by these Examples.

15 Test methods of the removable pressure-sensitive adhesive sheet obtained in Examples and Comparative examples are shown hereinafter.

(1) Pressure-sensitive adhesive strength measuring method of removable pressure-sensitive adhesive sheet

20 A removable pressure-sensitive adhesive sheet was stuck to a stainless plate, which is adherend, the pressure-sensitive adhesive strength after 30 minutes was measured pursuant to JIS Z0237. The unit is N/105mm.

(2) Peering force measuring method of removable
25 pressure-sensitive adhesive sheet

Two removable pressure-sensitive adhesive sheets as being laminated were sampled, the surface formed with a pressure-sensitive adhesive layer on one removable

pressure-sensitive adhesive sheet was fixed to a stainless plate by a double-coated pressure-sensitive adhesive tape, another removable pressure-sensitive adhesive sheet was peeled to measure a peel strength (pressure-sensitive adhesive strength) by using a tensile tester, at a peeling speed of 300 mm/min and a peeling angle of 180 degrees. The unit is N/105mm.

(3) Variation in pressure-sensitive adhesive strength and peel strength

After a wind-up roll of removable pressure-sensitive adhesive sheet was left to stand for 1 week, in the methods (1) and (2), pressure-sensitive adhesive strength and peel strength of the removable pressure-sensitive adhesive sheet of surface part of the wind-up roll of removable pressure-sensitive adhesive sheet was measured, further, pressure-sensitive adhesive strength and peel strength of the removable pressure-sensitive adhesive sheet near the core of the wind-up roll of removable pressure-sensitive adhesive sheet was measured, both were compared, which was evaluated as follows: no variation when the difference of both is 20% or less based on the pressure-sensitive adhesive strength and peel strength of the core part; and presence of variation when the difference of both is more than 20% based on the pressure-sensitive adhesive strength and peel strength of the core part.

(5) Aggregation rate measuring test by Maron test

Pursuant to JIS K6387-1982, a rotating circular plate was pressed against a container containing a measuring sample at a constant pressure being rotated at a constant speed, emulsion that aggregation was generated was filtered through a 200 mesh metal wire screen to collect the aggregation, then, dried at 105°C for 1 hour, further left in a desiccator for 30 minutes and weighted. The aggregation rate was calculated from that mass and the mass of sample before measurement. Additionally, the conditions were pressing force of 15 kgf, sample temperature of 25 °C, sample mass of 50g, rotation number of 1000 rpm and rotation time of 10 minutes.

(6) Scraping-off processability test

A metal roll of 59 mm outer diameter on which a applying liquid of pressure-sensitive adhesive adhered was rotated at 100 rpm, to which a blade of polyethylene terephthalate resin was pressed, the applying liquid of pressure-sensitive adhesive on the pressed blade part was scraped off to form a strip-shaped pressure-sensitive adhesive layer on the surface of the metal roll other than the blade part. The degree of bleeding of pressure-sensitive adhesive of the strip-shaped pressure-sensitive adhesive layer onto the surface of the metal roll that the applying liquid of pressure-sensitive adhesive had been scraped off was observed by visual, and evaluated as the following criteria.

○: No pressure-sensitive adhesive bleeds.

△: Pressure-sensitive adhesive bleeds slightly.

×: Pressure-sensitive adhesive bleeds remarkably.

(7) Soaking test of pressure-sensitive adhesive

A pressure-sensitive adhesive memo sheet laminate
 5 produced by a scraping method with a blade in roll
 processing was peeled off by one sheet, which was stuck
 to a rear surface of kraft board (manufactured by
 Fujishiko Co., Ltd, trade name "Ateboard"), soaking was
 accelerated under a forced drying atmosphere at 70°C
 10 for 168 hours. Then, it was left to stand in a standard
 environment for 24 hours, the pressure-sensitive
 adhesive memo sheet was peeled, the condition of soaking
 was observed by visual, and evaluated as the following
 criteria.

15 ○: No soaking occurs.

△: Soaking occurs slightly.

×: Soaking occurs.

(8) Curl after peeling of removable pressure-sensitive
 adhesive sheet

20 A pressure-sensitive adhesive memo sheet laminate was
 peeled by one sheet, the degree of curl of the
 pressure-sensitive adhesive memo sheet was observed by
 visual, and evaluated as the following criteria.

○: No curl occurs.

25 ×: Curl occurs

(Example 1)

(1) Production of spherical pressure-sensitive
 adhesive

Into 260 parts by mass of ion-exchanged water, 100 parts by mass of mixed monomer by mass mixed of 98 parts by mass of 2-ethylhexyl acrylate and 2 parts by mass of acrylic acid, 4 parts by mass of methyl cellulose as a suspension stabilizer, 2 parts by mass of polyacrylic acid (weight-average molecular weight of 10000), and 4 parts by mass of polyoxyethylene nonyl phenol ether were added, further 1 part by mass of polymerization initiator (benzoyl peroxide) was added thereto, suspension polymerization was carried out at 80°C for 5 hours to produce an acrylic suspension spherical pressure-sensitive adhesive (A) with an average particle diameter of 50 μ m and a solid content concentration of 30% by mass.

(2) Preparation of pressure-sensitive adhesive

Per 100 parts of solid content by mass of the spherical pressure-sensitive adhesive obtained in the (1), a solution of 50 parts by mass of an acrylic emulsion binder pressure-sensitive adhesive (manufactured by Toyo Ink Mfg. Co., Ltd., trade name "Oribain BPW5320", solid content of 58.5 % by mass) and 2 parts by mass of carboxymethyl cellulose as a dispersant were dissolved in 65 parts by mass of ion-exchanged water, and 6 parts by mass of a rosin based tackifier having a softening point of 150°C were added and mixed to prepare a pressure-sensitive adhesive.

(3) Production of laminate of removable pressure-sensitive adhesive sheet

A laminate of removable pressure-sensitive adhesive sheet was produced in the method shown in FIG. 1. Specifically, the pressure-sensitive adhesive was applied on the surface of an application roll, which is a metal roll 3 for transferring pressure-sensitive adhesive layer to form a pressure-sensitive adhesive layer 4 with a constant thickness, and then, the pressure-sensitive adhesive layer 4 was partly scraped off by a blade 6 made of polyethylene terephthalate resin to form a strip-shaped pressure-sensitive adhesive layer 5, the strip-shaped pressure-sensitive adhesive layer 5 was transferred on non-release treatment surface of a substrate sheet wound onto a surface of roll 9 for feeding substrate sheet (manufactured by Lintec Corporation, trade name "Release sheet for Fitmate Lemon 72G, area weight: 72 g/m², release agent: long-chain alkyl release agent, applied amount of release agent: 1.5 g/m²) to produce a removable pressure-sensitive adhesive sheet 11 that a pressure-sensitive adhesive layer is formed on a part of the surface of the substrate sheet, wound up in a roll through one layer winding to produce a wind-up roll of removable pressure-sensitive adhesive sheet 12 (the winding number: 300 layers). The applied amount of pressure-sensitive adhesive layer after drying was 7g/m². This one layer-winding pressure-sensitive adhesive sheet was cut to produce a plurality of removable pressure-sensitive adhesive sheets,

respective pressure-sensitive adhesive layer 15 and substrate sheet surface 13 were faced and laminated to produce a removable pressure-sensitive adhesive sheet laminate 16, which was cut along a dotted line shown in Fig. 2 (right figure) to produce a pressure-sensitive adhesive memo sheet laminate. The performances of the pressure-sensitive adhesive sheet are shown in Table 1.

(Example 2)

A pressure-sensitive adhesive memo sheet laminate was produced in the same manner as in Example 1 except that the amount of a polyacrylic acid added in polymerization was 2.8 parts by mass per 100 parts by mass of the mixed monomer, and the weight-average molecular weight of the polyacrylic acid was 7000, and an average particle diameter of the resultant spherical pressure-sensitive adhesive was $35\ \mu\text{m}$. The performances of this pressure-sensitive adhesive sheet are shown in Table 1.

(Example 3)

A pressure-sensitive adhesive was prepared in the same manner as in Example 1 except that in (1) of Example 1, using 100 parts by mass of the mixed monomer, 4 parts by mass of methyl cellulose and 2 parts by mass of polyacrylamide as suspension stabilizer, an acrylic suspension spherical pressure-sensitive adhesive (B) with an average particle diameter of $50\ \mu\text{m}$ was produced (the difference from Example 1 is not adding polyacryl

acid in suspension polymerization, but, polyacrylamide is added), in preparing a pressure-sensitive adhesive, as dispersant, 5 parts by mass of carboxymethyl cellulose and 2 parts by mass of a polyacrylic acid (weight-average molecular weight of 10000) were added; further, a pressure-sensitive adhesive sheet and a pressure-sensitive adhesive sheet laminate were prepared. The performances of the pressure-sensitive adhesive sheet are shown in Table 1.

(Example 4)

A pressure-sensitive adhesive memo sheet laminate was produced in the same manner as in Example 3 except that the amount of added polyacrylic acid was 1 part by mass per 100 parts by mass of solid content of spherical pressure-sensitive adhesive, and the weight-average molecular weight of the polyacrylic acid was 7000. The performances of the pressure-sensitive adhesive sheet are shown in Table 1.

(Comparative example 1)

A pressure-sensitive adhesive sheet and a pressure-sensitive adhesive sheet laminate were produced in the same manner as in Example 1 except that in (1) of Example 1, using 100 parts by mass of the mixed monomer, 4 parts by mass of polyacrylamide and 2 parts by mass of methyl cellulose as suspension stabilizer. The performances of the pressure-sensitive adhesive sheet are shown in Table 2.

(Comparative example 2)

A pressure-sensitive adhesive sheet and a pressure-sensitive adhesive sheet laminate were produced in the same manner as in Example 1 except that
5 in (1) of Example 1, using 100 parts by mass of the mixed monomer, 4 parts by mass of methyl cellulose and 2 parts by mass of polyvinyl alcohol as suspension stabilizer. The performances of the pressure-sensitive adhesive sheet are shown in Table 2.

Table 1

		Example 1	Example 2	Example 3	Example 4
Raw material composition of spherical pressure sensitive adhesive	2-Ethylhexyl acrylate	9 8	9 8	9 8	9 8
	Acrylic acid	2	2	2	2
	Methyl cellulose	4	4	4	4
	Polyacrylic acid	2	2. 8	—	—
	Polyacrylamide	—	—	2	2
	Polyvinyl alcohol	—	—	—	—
	Benzoyl peroxide	1	1	1	1
	Polyoxyethylene nonyl phenol ether	4	4	4	4
	Ion-exchanged water	2 6 0	2 6 0	2 6 0	2 6 0
average particle diameter of spherical pressure sensitive adhesive (μm)		5 0	3 5	5 0	5 0
Composition of pressure sensitive adhesive	Spherical pressure sensitive adhesive (solid content: 30% by mass)	3 3 3. 3	3 3 3. 3	3 3 3. 3	3 3 3. 3
	BPW5320 (solid content: 58.5% by mass)	5 0	5 0	5 0	5 0
	Rosin based tackifier	6	6	6	6
	Carboxymethyl cellulose	2	2	—	—
	Polyacrylic acid	—	—	2	1
	Ion-exchanged water	6 5	6 5	6 5	6 5
Evaluation	Aggregation rate in Maron test	2. 8	0. 8 9	0. 4	1. 0 5
	Scraping processability	○	○	○	○
	Pressure sensitive adhesive strength (N/105mm)	2. 7 3	2. 0 5	2. 2 0	2. 3 0
	Peel strength (N/105mm)	0. 7 6	1. 1 0	0. 5 8	0. 9 3
	Ratio of pressure sensitive adhesive strength and peel strength	0. 2 8	0. 5 3	0. 2 6	0. 4 0
	Pressure sensitive adhesive strength(surface part of roll)	2. 7 3	2. 0 5	2. 2 0	2. 3 0
	Pressure sensitive adhesive strength(core part of roll)	2. 5 2	1. 9 5	2. 0 5	2. 1 0
	Peel strength(surface part of roll)	0. 7 6	1. 1 0	0. 5 8	0. 9 3
	Peel strength(core part of roll)	0. 8 5	1. 0 5	0. 7 0	1. 0 3
	Variation of pressure sensitive adhesive strength and peel strength	No presence	No presence	No presence	No presence
	Soaking of pressure sensitive adhesive	○	○	○	○
	Curl	○	○	○	○

Table 2

		Comparative Example 1	Comparative Example 2
Raw material composition of spherical pressure sensitive adhesive	2-Ethylhexyl acrylate	9.8	9.8
	Acrylic acid	2	2
	Methyl cellulose	2	4
	Polyacrylic acid	—	—
	Polyacrylamide	4	—
	Polyvinyl alcohol	—	2
	Benzoyl peroxide	1	1
	Polyoxyethylene nonyl phenol ether	4	4
	Ion-exchanged water	2.60	2.60
average particle diameter of spherical pressure sensitive adhesive (μm)		5.0	5.0
Composition of pressure sensitive adhesive	Spherical pressure sensitive adhesive (solid content: 30% by mass)	3.33.3	3.33.3
	BPW5320 (solid content: 58.5% by mass)	5.0	5.0
	Rosin based tackifier	6	6
	Carboxymethyl cellulose	2	2
	Polyacrylic acid	—	—
	Ion-exchanged water	6.5	6.5
Evaluation	Aggregation rate in Maron test	6.6	0.4
	Scraping processability	×	×
	Pressure sensitive adhesive strength ($\text{N}/105\text{mm}$)	1.55	2.41
	Peel strength ($\text{N}/105\text{mm}$)	1.86	4.08
	Ratio of pressure sensitive adhesive strength and peel strength	1.20	1.69
	Pressure sensitive adhesive strength(surface part of roll)	1.55	2.41
	Pressure sensitive adhesive strength(core part of roll)	1.10	1.95
	Peel strength(surface part of roll)	1.86	4.08
	Peel strength(core part of roll)	2.50	5.05
	Variation of pressure sensitive adhesive strength and peel strength	Presence	Presence
	Soaking of pressure sensitive adhesive	×	○
	Curl	×	×

CLAIMS

1. A removable pressure-sensitive adhesive sheet which comprises a substrate sheet and a pressure-sensitive adhesive layer formed by applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive on one surface of the substrate sheet, wherein the spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, and 0.1 to 15 parts by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1 to 7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive into a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 15 part by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component.
2. A wind-up roll of removable pressure-sensitive adhesive sheet, wherein the removable pressure-sensitive adhesive sheet according to claim 1 is wound up in a roll.
3. A removable pressure-sensitive adhesive sheet which comprises a substrate sheet and a pressure-sensitive adhesive layer formed by applying

a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive partly on one surface of a substrate sheet, wherein the spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component, and 0.1 to 15 parts by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1-7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 15 part by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component.

4. The removable pressure-sensitive adhesive sheet as claimed in claim 1 or 3, wherein the pressure-sensitive adhesive has an aggregation rate of 5% or less by mass in Maron test.

5. The removable pressure-sensitive adhesive sheet as claimed in claim 1, 3 or 4, wherein the pressure-sensitive adhesive strength of the pressure-sensitive adhesive layer to a stainless plate is 1.0 N/105 mm or more, and the ratio of the pressure-sensitive adhesive strength to stainless plate and the pressure-sensitive adhesive strength to the surface of a substrate sheet is in a range of 1:0.2

to 1:1.

6. A removable pressure-sensitive adhesive sheet laminate, which is laminated with a plurality of pieces of the removable pressure-sensitive adhesive sheet according to claim 1, 3, 4 or 5.

7. A method for producing a removable pressure-sensitive adhesive sheet, which comprises applying a pressure-sensitive adhesive containing a spherical pressure-sensitive adhesive and an emulsion binder pressure-sensitive adhesive onto a surface of a metal roll for transferring the pressure-sensitive adhesive layer; then forming a strip-shaped pressure-sensitive adhesive layer by partly scraping off the applied pressure-sensitive adhesive by a blade; and producing a removable pressure-sensitive adhesive sheet by transferring said strip-shaped pressure-sensitive adhesive layer onto one surface of a substrate sheet, wherein said spherical pressure-sensitive adhesive is a spherical pressure-sensitive adhesive (A) obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 3 parts by mass of a polyacrylic acid per 100 parts by mass of the ethylenically unsaturated monomer component and 0.1 to 15 parts by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component, or a spherical pressure-sensitive adhesive (B) obtained by adding 0.1 to 7 parts by mass of a polyacrylic acid per 100 parts by mass of the solid content of the spherical pressure-sensitive adhesive to a spherical

pressure-sensitive adhesive obtained by polymerizing an ethylenically unsaturated monomer in the presence of 0.1 to 15 part by mass of methyl cellulose per 100 parts by mass of the ethylenically unsaturated monomer component.