

DESCRIPTION

ADHESIVE SHEET AND USAGE METHOD THEREFOR

TECHNICAL FIELD

[0001]

The present invention relates to an adhesive sheet and a method of using the same.

BACKGROUND ART

[0002]

An adhesive sheet needs to allow a cutout step to be stably performed (work stability). In particular, after the cutout step of an adhesive layer, a work stability is required for removing the remnant (waste) of the adhesive layer not forming a cutout (a waste-removal step). More specifically, a process including the cutout step, the waste-removal step and a sticking step to an object needs to be performed on the adhesive sheet by an in-line system without causing unintentional breakage of the adhesive layer (hereinafter occasionally referred to as waste-removal failure) during the removal of the waste after the adhesive layer is cut out.

To solve the above problem, for instance, Patent Literature 1 suggests an adhesive sheet including a facestock, an adhesive, and a release liner. In the adhesive sheet of Patent Literature 1, a release force (180 degrees) for the facestock and the adhesive to be separated from the release liner is adjusted to fall within a predetermined range.

CITATION LIST

PATENT LITERATURE(S)

[0003]

Patent Literature 1 JP 11-181364 A

SUMMARY OF THE INVENTION

PROBLEM(S) TO BE SOLVED BY THE INVENTION

[0004]

Unfortunately, the adhesive sheet of Patent Literature 1 is not capable of sufficiently reducing waste-removal failure.

Accordingly, an object of the invention is to provide an adhesive sheet capable of sufficiently reducing waste-removal failure, and a method of using the

adhesive sheet. More specifically, an object of the invention is to provide an adhesive sheet capable of sufficiently reducing waste-removal failure during a process including a cutout step, a waste-removal step, and a sticking step to an object performed on the adhesive sheet by an in-line system, and a method of using the adhesive sheet.

MEANS FOR SOLVING THE PROBLEM(S)

[0005]

According to an aspect of the invention, an adhesive sheet includes: an adhesive layer; and first sheet and second sheet on both surfaces of the adhesive layer, in which the second sheet includes: a first section that includes opposite ends of the second sheet in a plan view or a neighborhood of the opposite ends; and a second section being the remnant of the second sheet, the first section and the second section having different releasabilities from the adhesive layer, and when a release force for the first sheet to be peeled from the adhesive layer is denoted by F_1 , a release force for the second section of the second sheet to be peeled from the adhesive layer is denoted by F_2 , and a release force for the first section of the second sheet to be peeled from the adhesive layer is denoted by F_3 , F_1 , F_2 and F_3 satisfy conditions represented by a formula (F1) below,

$F_2 < F_1 < F_3 \dots (F1)$.

[0006]

In the above aspect, it is preferable that the first sheet is provided with a first release layer, the adhesive layer and the first sheet are laminated on each other via the first release layer, the second sheet is provided with a second release layer, and the adhesive layer and the second sheet are laminated on each other via the second release layer.

In the above aspect, it is preferable that the first section includes lateral ends of the second sheet in a width direction in the plan view or a neighborhood of the lateral ends.

[0007]

According to another aspect of the invention, a method of using the adhesive sheet includes: half-cutting the adhesive sheet to provide a cut line in the adhesive layer and the second sheet such that the adhesive layer is divided into a

cutout and the remnant of the adhesive layer in a form of a continuous waste; and removing the continuous waste from the adhesive sheet.

In the above aspect, it is preferable that the cutout is formed in the second section.

[0008]

According to the above aspects of the invention, an adhesive sheet capable of sufficiently reducing waste-removal failure and a method of using the adhesive sheet can be provided.

BRIEF DESCRIPTION OF DRAWING(S)

[0009]

Fig. 1 schematically shows an adhesive sheet according to a first exemplary embodiment of the invention.

Fig. 2 shows a cross section viewed along arrows II-II in Fig. 1.

Fig. 3 schematically shows that an auxiliary tape is attached to the adhesive sheet according to the first exemplary embodiment of the invention, which has been provided with a cutout.

Fig. 4 shows a cross section viewed along arrows IV-IV in Fig. 3.

Fig. 5 schematically shows that a continuous waste is removed from the adhesive sheet according to the first exemplary embodiment of the invention.

Fig. 6 shows a cross section viewed along arrows VI-VI in Fig. 5.

Fig. 7 schematically shows an adhesive sheet provided with a cutout according to a second exemplary embodiment of the invention.

DESCRIPTION OF EMBODIMENT(S)

[0010]

First Exemplary Embodiment

The invention is explained below through an exemplary embodiment(s) with reference to the attached drawings. The invention is not limited to the contents of the exemplary embodiment(s). It should be noted that the drawings show some parts on an increased scale or a reduced scale for the convenience of explanation.

[0011]

Adhesive Sheet

Description is first made on an adhesive sheet according to the first

exemplary embodiment.

As shown in Figs. 1 and 2, an adhesive sheet 100 according to the first exemplary embodiment is elongated (belt-shaped) and includes a first sheet 1, a second sheet 2, and an adhesive layer 3. The first sheet 1 and the second sheet 2 are on both surfaces of the adhesive layer 3.

The first sheet 1 includes a first base sheet 11 and a first release layer 12. The first sheet 1 and the adhesive layer 3 are laminated on each other via the first release layer 12. The second sheet 2 includes a second base sheet 21 and a second release layer 22. The second sheet 2 and the adhesive layer 3 are laminated on each other via the second release layer 22.

The second sheet 2 has a first section 21a and a second section 21b in a plan view. A releasability of the first section 21a from the adhesive layer 3 is different from a releasability of the second section 21b from the adhesive layer 3. The first section 21a includes opposite ends, i.e., lateral ends of the second sheet 2 in a width direction in the plan view. More specifically, the first section 21a includes a neighborhood of the lateral ends of the second sheet 2 in the width direction in the plan view and extends continuously in a length direction along the lateral ends.

[0012]

When F_1 denotes a release force for the first sheet 1 to be peeled from the adhesive layer 3, F_2 denotes a release force for the second section 21b of the second sheet 2 to be peeled from the adhesive layer 3, and F_3 denotes a release force for the first section 21a of the second sheet 2 to be peeled from the adhesive layer 3, the adhesive sheet 100 of the first exemplary embodiment satisfies conditions represented by a numerical expression (F1) below.

$$F_2 < F_1 < F_3 \dots (F1)$$

If the conditions of (F1) are not satisfied, a cutout 31 would be easily peeled from the first sheet 1 and thus unlikely to remain on the first sheet 1 during a waste-removal step. Further, a portion of the adhesive layer 3 forming a continuous waste 32 would be likely to remain on the first sheet 1 during the waste-removal step.

[0013]

The release force F_1 , the release force F_2 and the release force F_3 may be measured by fixing a sample (width: 100 mm, length: 100 mm) including a sheet

being peeled (the first sheet 1 or the second sheet 2) and the adhesive layer 3, pulling the sheet being peeled in a 180-degree direction at a rate of 300 mm/min using a tensile tester, and measuring a release force applied to an interface between the sheet being peeled and the adhesive layer 3 (unit: mN/100mm).

It should be noted that the release force F_1 , the release force F_2 and the release force F_3 may be measured in a manner different from the above. This is because an excessively large or small release force cannot be measured by the above method. In such a case, the measurement conditions for the release force (e.g., the size of the sample and speed) may be adjusted as appropriate to determine a magnitude relationship between the release force F_1 , the release force F_2 , and the release force F_3 . For instance, when a release force is too large to measure, a sample requiring such a large release force is determined to be larger than another sample requiring a measurable release force.

[0014]

The release force F_1 and the release force F_2 may be adjusted by changing the respective compositions or thicknesses of the release layers on the first sheet 1 and the second sheet 2, or changing the respective types or thicknesses of the first sheet 1 and the second sheet 2.

The release force F_3 may be adjusted by any one of the following methods (i) to (v). In particular, the release force F_3 for the first section 21a of the second sheet 2 may be made larger than the release force F_2 of the second section 21b.

- (i) Eliminate the second release layer 22 from the first section 21a of the second sheet 2 (see Fig. 2).
- (ii) Modify the second release layer 22 on the first section 21a of the second sheet 2 by, for instance, a corona treatment and/or a plasma treatment.
- (iii) Deactivate the second release layer 22 on the first section 21a of the second sheet 2.
- (iv) Make the first section 21a of the second sheet 2 tight-releasable by, for instance, UV irradiation.
- (v) Form the second release layer 22 on the second section 21b and the second release layer 22 on the first section 21a of the second sheet 2 from different releasing agents.

[0015]

First Sheet and Second Sheet

The first sheet 1 according to the first exemplary embodiment includes the first base sheet 11 and the first release layer 12. The second sheet 2 according to the first exemplary embodiment includes the second base sheet 21 and the second release layer 22.

A thickness of the first sheet 1 usually ranges, but not limited to, from 20 μm to 250 μm , preferably from 38 μm to 100 μm .

A thickness of the second sheet 2 usually ranges, but not limited to, from 20 μm to 250 μm , preferably from 25 μm to 75 μm , more preferably from 25 μm to 50 μm .

[0016]

Examples of the first base sheet 11 and the second base sheet 21 include a resin film and paper. Examples of a resin for the resin film include polyethylene terephthalate, polyethylene, polypropylene, polybutene, polybutadiene, polymethylpentene, polyvinyl chloride, vinyl chloride copolymer, polybutylene terephthalate, polyurethane, ethylene-vinyl acetate copolymer, ionomer resin, ethylene(meta)acrylate copolymer, polystyrene, polycarbonate, fluorine resin, low-density polyethylene, linear low-density polyethylene, and triacetylcellulose. Examples of the paper include high-quality paper, coat paper, glassine paper, and laminated paper. One of these papers may be used alone or two or more thereof may be used in combination. Among the above, a polyethylene terephthalate film is preferable since it is inexpensive and stiff (less bendable).

[0017]

The first release layer 12 and the second release layer 22 may each be formed from a releasing agent.

Examples of the releasing agent include a silicone resin, a fluorine resin, and a long-chain alkyl resin. One of these resins may be used alone or two or more thereof may be used in combination. Among these resins, a silicone resin is preferable since it is inexpensive and provides stable properties.

A thickness of each of the first release layer 12 and the second release layer 22 preferably ranges from 0.01 μm to 2.0 μm , more preferably from 0.05 μm

to 0.5 μm .

[0018]

Adhesive Layer

The adhesive layer 3 according to the first exemplary embodiment may be formed from a known adhesive. Examples of the adhesive include, but not limited to, acrylic adhesive, rubber adhesive, silicone adhesive, polyurethane adhesive, polyester adhesive, epoxy adhesive, and polyimide adhesive. One of these adhesives may be used alone or two or more thereof may be used in combination. Suitable one(s) of these adhesives may be selected depending on the intended use of the adhesive sheet. These adhesives may contain a cure accelerator, an energy ray curable component, and other resin components as needed.

When the adhesive sheet is used as, for instance, a film adhesive for die-bonding a chip or an underfill sheet for flipchip mounting, an epoxy adhesive or a polyimide adhesive are suitably usable.

When the adhesive sheet is used as a dicing die bonding film intended to not only fix a wafer during a dicing process but also bond a die during a die-bonding process, an adhesive containing a binder component such as an acrylic copolymer and an epoxy adhesive is preferable. Such an adhesive may further contain, for instance, an energy ray curable compound, an energy ray curable polymer, and/or a cure accelerator as needed.

When the adhesive sheet is used as a back protective film for semiconductor wafers, an adhesive containing a binding component such as an acrylic polymer, an epoxy adhesive, and a cure accelerator is preferable. Such an adhesive may further contain, for instance, an energy ray curable compound, an energy ray curable polymer, a filler, and/or a coloring agent as needed.

[0019]

A thickness of the adhesive layer 3, which varies depending on the intended use, preferably ranges from 1 μm to 300 μm in terms of workability in the cutout step, more preferably from 5 μm to 200 μm , further preferably from 10 μm to 100 μm .

[0020]

Method of Using Adhesive Sheet

Description is first made on a method of using an adhesive sheet according to the first exemplary embodiment.

The method of using the adhesive sheet according to the first exemplary embodiment, i.e., a method of using the adhesive sheet 100 according to the first exemplary embodiment, includes the later-described cutout step and waste-removal step.

[0021]

In the cutout step, the adhesive sheet 100 is half-cut to provide a cut line 4 in the adhesive layer 3 and the second sheet 2 such that the adhesive layer 3 is divided into the cutout 31 and the remnant in a form of a continuous waste 32 (i.e., a portion not forming the cutout 31) as shown in Figs. 3 and 4.

As shown in Fig. 3, the cutout 31 is preferably formed in the second section 21b of the second sheet 2. Specifically, cutouts 31 are formed at a plurality of positions in the length direction of the adhesive sheet 100.

The half-cutting for the cutout step means providing the cut line 4 in a manner not to cut through the adhesive sheet 100. With the cut line 4 being provided, the adhesive layer 3 and the second sheet 2 are cut through, whereas the first sheet 1 is not cut through. It should be noted that the cut line 4 reaches the first sheet 1 through the second sheet 2 and the adhesive layer 3 from the second sheet 2 of the adhesive sheet 100. It should also be noted that the cut line 4, which is only required to reach at least an interface between the adhesive layer 3 and the first sheet 1, preferably enters a surface of the first sheet 1 completely through the adhesive layer 3.

The above half-cutting may be performed using a suitable known cutter.

In the cutout step, the cutouts 31 are formed by half-cutting the entire circumference of each of the cutouts 31.

The remnant not forming the cutouts 31 is defined as the continuous waste 32, which is peeled together as the second sheet 2 is peeled from the adhesive sheet 100.

[0022]

After the cutout step, an auxiliary tape 5 may be attached to a surface of the second sheet 2 of the adhesive sheet 100 (an auxiliary-tape attaching step) as

shown in Figs. 3 and 4.

By attaching the auxiliary tape 5 across in the length direction, the second sheet 2 having been provided with the cut line 4 can be united. Consequently, the second sheet 2 can be peeled from a surface of the adhesive layer 3 in the later-described waste-removal step.

The auxiliary tape 5 may be a known adhesive tape.

[0023]

In the waste-removal step, the continuous waste 32 is peeled from the first sheet 1 to be removed from the adhesive sheet 100 as shown in Figs. 5 and 6.

The continuous waste 32 is removed along with the second sheet 2 and the auxiliary tape 5. By removing the continuous waste 32 from the adhesive sheet 100, adhesive films in the shape of the cutouts 31 are obtained as shown in Fig. 5.

A shape of the cutouts 31 in a plan view is not limited but may be varied depending on the intended use. Examples of the shape of the cutouts 31 in the plan view include polygons (e.g., triangle, rectangle and pentagon), circle, oval, and star.

[0024]

The thus-obtained adhesive film can be used for a variety of purposes, such as a film adhesive for die-bonding a chip, a dicing die bonding film, an underfill sheet, and a back protective film for semiconductor wafers.

It should be noted that the method of using the adhesive sheet according to the first exemplary embodiment may further include sticking each of the cutouts 31 to an object after the waste-removal step. In such a sticking step, the first sheet 1 is peeled and only the cutout 31 is stuck to the object.

Further, in the method of using the adhesive sheet according to the first exemplary embodiment, the cutout step, the waste-removal step, and the sticking step are preferably sequentially performed by an in-line system.

[0025]

Advantage(s) of First Exemplary Embodiment

The first exemplary embodiment can achieve the following advantages (1) to (3).

(1) The continuous waste 32 is removed along with the second sheet 2. The continuous waste 32 adheres to the first sheet 1 and the second sheet 2 at a

section including the first section 21a. The release force F_3 for the first section 21a of the second sheet 2 to be peeled from the adhesive layer 3 is larger than the release force F_1 for the first sheet 1 to be peeled from the adhesive layer 3. This arrangement can prevent the portion of the adhesive layer 3 forming the continuous waste 32 from remaining on the first sheet 1 during the waste-removal step. Waste-removal failure can thus be sufficiently reduced.

(2) The release force F_1 for the first sheet 1 to be peeled from the adhesive layer 3 is larger than the release force F_2 for the second section 21b of the second sheet 2 to be peeled from the adhesive layer 3. The cutouts 31 can thus remain on the first sheet 1 during the waste-removal step.

(3) In the first exemplary embodiment, the cutout step, the waste-removal step, and the sticking step are preferably sequentially performed by an in-line system. Sequentially performing a set of steps allows the adhesive sheet 100 to be efficiently used, thus improving work efficiency and productivity.

[0026]

Second Exemplary Embodiment

Next, description is made on a second exemplary embodiment of the invention with reference to the drawing(s).

It should be noted that the second exemplary embodiment is the same as the first exemplary embodiment except that the adhesive sheet 100 is replaced with an adhesive sheet 100A, so that description is made only on the adhesive sheet 100A and a method of using the same.

As shown in Fig. 7, the adhesive sheet 100A according to the second exemplary embodiment is elongated and includes the first sheet 1, the second sheet 2, and the adhesive layer 3. The first sheet 1 and the second sheet 2 are on both surfaces of the adhesive layer 3.

The second sheet 2 has the first section 21a and the second section 21b in a plan view as shown in Fig. 7. The first section 21a and the second section 21b are different in releasability from the adhesive layer 3. The first section 21a includes the lateral ends of the second sheet 2 in the width direction in the plan view. Further, the first section 21a includes a neighborhood of the lateral ends of the second sheet 2 in the width direction in the plan view and reaches, partly in the length direction in

the plan view, a neighborhood of a center of the second sheet 2 in the width direction in the plan view. More specifically, a portion of the first section 21a between adjacent ones of the plurality of cutouts 31 reaches the neighborhood of the center in the width direction in the plan view.

[0027]

In the cutout step of the method of using the adhesive sheet according to the second exemplary embodiment, the adhesive sheet 100A is half-cut to provide the cut line 4 penetrating through the adhesive layer 3 and the second sheet 2, thus forming the cutouts 31 as shown in Fig. 7. The cutouts 31 are formed in the second section 21b of the second sheet 2 as shown in Fig. 7.

[0028]

Advantage(s) of Second Exemplary Embodiment

The second exemplary embodiment can achieve the following advantage (4) in addition to the advantages (1) to (3) of the first exemplary embodiment.

(4) The first section 21a includes the neighborhood of the lateral ends of the second sheet 2 in the width direction in the plan view and reaches, partly in the length direction in the plan view, the neighborhood of the center of the second sheet 2 in the width direction in the plan view. This arrangement makes an area of the first section 21a of the second exemplary embodiment larger than an area of the first section 21a of the first exemplary embodiment. The portion of the adhesive layer 3 forming the continuous waste 32 is thus prevented from remaining on the first sheet 1 with further reliability during the waste-removal step.

[0029]

Modification(s) of Exemplary Embodiment(s)

The invention is not limited to the above exemplary embodiments but may include any modifications and improvements not hampering the achievement of an object of the invention.

For instance, in the exemplary embodiment(s), the adhesive film cut out into a predetermined shape is usable as a film adhesive for die-bonding a chip, a dicing die bonding film, an underfill sheet, and a back protective film for semiconductor wafers, but the invention is not limited thereto. Examples of the intended use of the adhesive film cut out into the predetermined shape may include label, sticker and

patch.

[0030]

In the exemplary embodiment(s), the first section 21a includes the lateral ends of the second sheet 2 in the width direction in the plan view, but the invention is not limited thereto. For instance, the first section 21a may include a neighborhood of the lateral ends of the second sheet 2 in the width direction in the plan view, exclusive of the lateral ends.

In the exemplary embodiment(s), the adhesive layer 3 is provided across the entire surface in the plan view, but the invention is not limited thereto. For instance, the adhesive layer 3 may have a void, in which the adhesive is absent, in the plan view.

[0031]

In the second exemplary embodiment, the first section 21a has opposite two portions between adjacent ones of the plurality of cutouts 31 in the plan view, the two portions respectively including the lateral ends and reaching the neighborhood of the center in the width direction as shown in Fig. 7. These two portions of the first section 21a are spaced from each other between adjacent ones of the plurality of cutouts 31, but the invention is not limited thereto. The two portions of the first section 21a, which respectively include the lateral ends, between adjacent ones of the plurality of cutouts 31 may reach the center in the width direction to be connected to each other. This arrangement can prevent the waste-removal failure of not only the continuous waste 32 at the lateral ends but also the continuous waste 32 between the plurality of cutouts 31. The portion of the adhesive layer 3 forming the continuous waste 32 is thus prevented from remaining on the first sheet 1 with further reliability during the waste-removal step.

The adhesive sheet according to the exemplary embodiment(s) may have the following exemplary arrangement: the first sheet 1 is provided with the first release layer 12, the adhesive layer 3 and the first sheet 1 are laminated on each other via the first release layer 12, the second sheet 2 is provided with the second release layer 22, the adhesive layer 3 and the second sheet 2 are laminated on each other via the second release layer 22, and the second release layer 22 on the first section 21a of the second sheet 2 has been subjected to a plasma treatment.

Alternatively, the adhesive sheet according to the exemplary embodiment(s) may have the following exemplary arrangement: the first sheet 1 is provided with the first release layer 12, the adhesive layer 3 and the first sheet 1 are laminated on each other via the first release layer 12, the second sheet 2 is provided with the second release layer 22, the adhesive layer 3 and the second sheet 2 are laminated on each other via the second release layer 22, a material for the first sheet 1 and the second sheet 2 is polyethylene terephthalate, and the second release layer 22 on the first section 21a of the second sheet 2 has been subjected to a plasma treatment.

Example(s)

[0032]

Next, the invention is described in further detail with reference to Examples and Comparative Examples, which are not intended to limit the invention.

Example 1

The following tight-release sheet was prepared as a first sheet and the following easy-release sheet was prepared as a second sheet. It should be noted that the first sheet and the second sheet were each an elongated sheet.

First Sheet (Tight-Release Sheet)

Product Name: SP-PET38T124-2, manufactured by LINTEC Corporation

Thickness: 38 μm

Material of Base Sheet: polyethylene terephthalate (PET)

Second Sheet (Easy-Release Sheet)

Product Name: SP-PET381031, manufactured by LINTEC Corporation

Thickness: 38 μm

Material of Base Sheet: polyethylene terephthalate (PET)

Treatment on the Release Layer: Yes (the first section was formed by applying a plasma treatment to a section of the release layer including a neighborhood of the lateral ends thereof in the width direction and extending along the lateral ends.)

Next, an adhesive layer having a thickness of 25 μm after dried was formed between the first sheet and the second sheet to provide an adhesive sheet. Specifically, an adhesive was first applied on the first sheet (tight-release sheet) using a knife coater such that the resulting adhesive layer had a thickness of 25 μm

after dried, and then dried to form the adhesive layer. The second sheet (easy-release sheet) was then laminated on the first sheet and the adhesive layer and rolled together, thus providing an elongated adhesive sheet.

The thus-obtained elongated adhesive sheet was cut off at a width of 230 mm. The first section formed in the second sheet (easy-release sheet), which included the lateral ends of the second sheet in the width direction in the plan view, had a width of approximately 10 mm from each of the lateral ends.

[0033]

Further, the release force F_1 for the first sheet to be peeled from the adhesive layer and the release force F_2 for the second section of the second sheet to be peeled from adhesive layer were measured using a tensile tester under the following conditions. The resulting release force F_1 was 492 mN/100mm and the resulting release force F_2 was 156 mN/100mm. It should be noted that a plasma treatment has proven to significantly increase a release force, so that the release force F_3 for the first section of the second sheet to be peeled from adhesive layer is supposed to be larger than the release force F_1 .

Sample Size: 100 mm in width × 100 mm in length

Tension Rate: 300 mm/min

Tension Direction: 180-degree direction

[0034]

The obtained adhesive sheet was half-cut using an LC tape laminator (manufactured by LINTEC Corporation, "RAD-3600F/12") under the following conditions to provide a cut line to the adhesive layer and the second sheet, thus defining circular cutouts and the remnant, i.e., a continuous waste. The continuous waste was then removed from the adhesive sheet. By checking the resulting state of the adhesive layer, it was found that neither tear of the adhesive layer in the continuous waste nor unintentional separation of the adhesive layer in the cutouts occurred.

Temperature in the Machine: 30 degrees C

Cutout Diameter: 200 mm

Feed Rate: 20 mm/sec

[0035]

Comparative Example 1

An adhesive sheet was manufactured in the same manner as in Example 1 except that no first section is formed on the second sheet.

A continuous waste was removed from the thus-obtained adhesive sheet in the same manner as in Example 1. By checking the resulting state of the adhesive layer, it was found that a lateral end of the adhesive layer in the continuous waste in the width direction was stretched in the length direction and torn without being peeled from the tight-release sheet.

[0036]

As is apparent from the comparison results between Example 1 and Comparative Example 1, it has been demonstrated that waste-removal failure can be sufficiently reduced when the release force F_1 , the release force F_2 and the release force F_3 satisfy the conditions represented by the numerical expression (F1) (Example 1). In contrast, it has been demonstrated that waste-removal failure fails to be reduced when the second sheet of the adhesive sheet does not have the two sections with different releasabilities from the adhesive layer (Comparative Example 1).

[0037]

Example 2

An adhesive sheet was manufactured in the same manner as in Example 1 except that the following easy-release sheet was used as the second sheet and the following treatment was applied to the release layer.

Second Sheet (Easy-Release Sheet)

Product Name: SP-PET381031, manufactured by LINTEC Corporation

Thickness: 38 μm

Material of Base Sheet: polyethylene terephthalate (PET)

Treatment on the Release Layer: Yes (the first section was formed by applying a plasma treatment to not only a section of the release layer including a neighborhood of the lateral ends in the width direction and extending along the lateral ends but also a section including a neighborhood of the center in the width direction between adjacent ones of the plurality of cutouts in a plan view (see Fig. 7).)

A continuous waste was removed from the thus-obtained adhesive sheet in the same manner as in Example 1. By checking the resulting state of the adhesive layer, it was found that neither tear of the adhesive layer in the continuous waste nor unintentional separation of the adhesive layer in the cutouts occurred.

EXPLANATION OF CODE(S)

[0038]

1...first sheet, 12...first release layer, 2...second sheet, 21a...first section, 21b...second section, 22...second release layer, 3...adhesive layer, 31...cutout, 32...continuous waste, 4...cut line, 100, 100A...adhesive sheet

CLAIM(S)

1. An adhesive sheet comprising:
an adhesive layer; and
first sheet and second sheet on both surfaces of the adhesive layer,
wherein
the second sheet comprises: a first section that comprises opposite ends of the second sheet in a plan view or a neighborhood of the opposite ends; and a second section comprising the remnant of the second sheet, the first section and the second section having different releasabilities from the adhesive layer, and
when a release force for the first sheet to be peeled from the adhesive layer is denoted by F_1 , a release force for the second section of the second sheet to be peeled from the adhesive layer is denoted by F_2 , and a release force for the first section of the second sheet to be peeled from the adhesive layer is denoted by F_3 , F_1 , F_2 and F_3 satisfy conditions represented by a formula (F1) below,
$$F_2 < F_1 < F_3 \dots (F1).$$
2. The adhesive sheet according to claim 1, wherein
the first sheet is provided with a first release layer,
the adhesive layer and the first sheet are laminated on each other via the first release layer,
the second sheet is provided with a second release layer, and
the adhesive layer and the second sheet are laminated on each other via the second release layer.
3. The adhesive sheet according to claim 1 or 2, wherein
the adhesive sheet is elongated, and
the first section comprises lateral ends of the second sheet in a width direction in the plan view or a neighborhood of the lateral ends.
4. A method of using the adhesive sheet according to any one of claims 1 to 3, the method comprising:
half-cutting the adhesive sheet to provide a cut line in the adhesive layer and the second sheet such that the adhesive layer is divided into a cutout and the remnant of the adhesive layer in a form of a continuous waste; and
removing the continuous waste from the adhesive sheet.

5. The method of using the adhesive sheet according to claim 4, wherein the cutout is formed in the second section.