

[DESCRIPTION]

[TITLE OF INVENTION]

SEMICONDUCTOR PROCESSING SHEET

5

[Technical Field]

[0001]

The present invention relates to a sheet for semiconductor processing (semiconductor processing sheet).

10 Priority is claimed on Japanese Patent Application No. 2016-069603, filed March 30, 2016, the content of which is incorporated herein by reference.

[Background Art]

[0002]

15 A dicing sheet is used when dividing a semiconductor wafer into individual semiconductor chips by dicing. The dicing sheet is constituted by having, for example, a pressure-sensitive adhesive layer on a base material, and is used by being adhered to a semiconductor wafer by the pressure-sensitive adhesive layer. After dicing, for example, by decreasing the adhesive force of the pressure-sensitive adhesive layer through curing
20 by the irradiation of energy rays such as ultraviolet rays, the semiconductor chip is separated from the cured pressure-sensitive adhesive layer and is easily picked up.

[0003]

On the other hand, the picked-up semiconductor chip is, for example, die bonded to a circuit surface of a substrate by a film adhesive, and after one or more
25 additional semiconductor chips are further laminated on this semiconductor chip, if

necessary, and wire bonded, the entire constitution is sealed with a resin.

Using a semiconductor package obtained in this manner, an intended semiconductor device is ultimately manufactured. Accordingly, in some cases, the semiconductor chip is configured so as to be picked up in a state of having a film adhesive on a surface to be die-bonded.

[0004]

When a film adhesive is used as described above, a dicing/die bonding sheet in which an uncut film adhesive is provided on the pressure-sensitive adhesive layer of the above-mentioned dicing sheet may be used in some cases. On the other hand, a plurality of semiconductor chips that have been divided into individual pieces in advance are sometimes provided on a film adhesive, and also in this case, a processing sheet having the same configuration as that of the dicing/die bonding sheet is used. In the case of using such a processing sheet, for example, a plurality of semiconductor chips that have been divided into individual pieces in advance are provided on the film adhesive, and the processing sheet is expanded at a low temperature, thereby cutting the film adhesive in accordance with the outer shape of the semiconductor chip to produce a semiconductor chip provided with the cut film adhesive on a target surface in some cases.

[0005]

As a processing sheet (wafer processing tape) suitable for cutting the film adhesive by expansion as described above, for example, those having a shear force of the pressure-sensitive adhesive layer and the film adhesive (adhesive layer) at 25°C of 0.2 N/mm² or more, and a peel force of the pressure-sensitive adhesive layer and the film adhesive of 0.3 N / 25 mm or less at a peeling rate of 300 mm/min and a peeling angle of 180° in a standard state in accordance with JIS-Z 0237 after irradiation of energy rays of 200 mJ/cm² have been disclosed (see Patent Document 1).

[Citation List]

[Patent Document]

[0006]

[Patent Document 1] International Patent Publication No. 2013/103116

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[Summary of Invention]

[Technical Problem]

[0007]

However, the processing sheet disclosed in Patent Document 1 has a problem in
10 that irradiation of energy rays is necessary at the time of use. In this processing sheet, it
is designed so that at the time of cutting the film adhesive by expansion, in order to
suppress the floating or scattering of the semiconductor chip having the film adhesive
from the pressure-sensitive adhesive layer, the adhesive force of the pressure-sensitive
adhesive layer before the energy ray irradiation is increased. On the other hand, in
15 order to facilitate the picking up of the semiconductor chip provided with the film
adhesive, it is designed so that the adhesive force of the pressure-sensitive adhesive layer
after the energy ray irradiation is lowered.

[0008]

Accordingly, the present invention has an object of providing a semiconductor
20 processing sheet configured to include a pressure-sensitive adhesive layer on a base
material, which is a semiconductor processing sheet for use at the time of cutting a film
adhesive adhered to a semiconductor chip, and, without the energy ray irradiation at the
time of use, capable of suppressing the floating or scattering of the semiconductor chip
having the film adhesive from the pressure-sensitive adhesive layer at the time of cutting
25 the film adhesive by expansion, whereby the semiconductor chip provided with the film

adhesive can be easily picked up.

[Solution to Problem]

[0009]

5 In order to solve the above-mentioned problem, the present invention provides a semiconductor processing sheet including a pressure-sensitive adhesive layer on a base material, and in which the storage elastic modulus at 0°C of the aforementioned pressure-sensitive adhesive layer having a thickness of 200 μm is equal to or less than 1,000 MPa, and the adhesive force of the aforementioned pressure-sensitive adhesive layer with
10 respect to a mirror surface of a semiconductor wafer is equal to or less than 200 mN / 25 mm.

In the semiconductor processing sheet of the present invention, the pressure-sensitive adhesive layer is preferably non-energy ray-curable.

15 The semiconductor processing sheet of the present invention may further include a film adhesive on the pressure-sensitive adhesive layer.

[0010]

[1] A semiconductor processing sheet including a pressure-sensitive adhesive layer on a base material and having the following characteristics:

20 when the thickness of the aforementioned pressure-sensitive adhesive layer is 200 μm , the storage elastic modulus of the aforementioned pressure-sensitive adhesive layer having a thickness of 200 μm at 0°C is equal to or less than 1,000 MPa; and

25 when the aforementioned semiconductor processing sheet is adhered to a mirror surface of a semiconductor wafer, the adhesive force of the aforementioned pressure-sensitive adhesive layer with respect to the aforementioned mirror surface is equal to or less than 200 mN / 25 mm.

[2] The semiconductor processing sheet according to [1], wherein the aforementioned pressure-sensitive adhesive layer is non-energy ray-curable.

[3] The semiconductor processing sheet according to [1] or [2], further including a film adhesive on the aforementioned pressure-sensitive adhesive layer.

5

[Advantageous Effects of Invention]

[0011]

According to the present invention, there is provided a semiconductor processing sheet configured to include a pressure-sensitive adhesive layer on a base material, which is a semiconductor processing sheet for use at the time of cutting a film adhesive adhered to a semiconductor chip, and, without the energy ray irradiation at the time of use, capable of suppressing the floating or scattering of the semiconductor chip having the film adhesive from the pressure-sensitive adhesive layer at the time of cutting the film adhesive by expansion, whereby the semiconductor chip provided with the film adhesive can be easily picked up.

15

[Brief Description of Drawings]

[0012]

FIG. 1 is a cross-sectional view schematically showing an embodiment of a semiconductor processing sheet of the present invention.

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FIG. 2 is a cross-sectional view for schematically illustrating an embodiment of a method for manufacturing a semiconductor device in the case of using the semiconductor processing sheet of the present invention.

FIG. 3 is a cross-sectional view for schematically illustrating an embodiment of a method for forming grooves in a semiconductor wafer to obtain semiconductor chips.

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FIG. 4 is a cross-sectional view for schematically illustrating an embodiment of a method for forming a modified layer in a semiconductor wafer to obtain semiconductor chips.

FIG. 5 is a cross-sectional view schematically showing a state of a semiconductor chip at the time of expanding a film adhesive when a conventional semiconductor processing sheet is used.

FIG. 6 is a cross-sectional view schematically showing a state when an attempt is made to pick up a semiconductor chip with a film adhesive in a case where a conventional semiconductor processing sheet is used.

10

[Description of Embodiments]

[0013]

<< Semiconductor processing sheet >>

A semiconductor processing sheet of the present invention includes a pressure-sensitive adhesive layer on a base material, wherein the storage elastic modulus at 0°C of the aforementioned pressure-sensitive adhesive layer having a thickness of 200 μm is equal to or less than 1,000 MPa, and the adhesive force of the aforementioned pressure-sensitive adhesive layer with respect to a mirror surface of a semiconductor wafer is equal to or less than 200 mN / 25 mm.

As another aspect, the semiconductor processing sheet of the present invention is a semiconductor processing sheet including a pressure-sensitive adhesive layer on a base material and having the following characteristics:

when the thickness of the aforementioned pressure-sensitive adhesive layer is 200 μm, the storage elastic modulus of the aforementioned pressure-sensitive adhesive layer having a thickness of 200 μm at 0°C is equal to or less than 1,000 MPa; and

when the aforementioned semiconductor processing sheet is adhered to a mirror surface of a semiconductor wafer, the adhesive force of the aforementioned pressure-sensitive adhesive layer with respect to the aforementioned mirror surface is equal to or less than 200 mN / 25 mm.

5 The semiconductor processing sheet of the present invention is suitable for use in a step of: configuring so that a film adhesive is provided on the pressure-sensitive adhesive layer thereof and a plurality of already divided semiconductor chips are provided on the film adhesive in advance; and then cutting the aforementioned film adhesive in accordance with the outer shape of the aforementioned semiconductor chips
10 by performing the so-called expansion at a low temperature in which the aforementioned film adhesive is expanded together with the aforementioned semiconductor processing sheet in a direction of its surface (the direction along the surface, that is, the direction horizontal to the surface of the film adhesive). A semiconductor chip provided with the aforementioned film adhesive after cutting (sometimes referred to as “semiconductor
15 chip with a film adhesive” in the present specification) on a surface (back surface) opposite to a surface on which a circuit is formed (hereinafter may be abbreviated as “circuit forming surface” in some cases) is used for manufacturing a semiconductor device after being picked up.

[0014]

20 As described above, the semiconductor processing sheet of the present invention is suitable as a so-called expansion sheet for expanding and cutting a film adhesive.

In addition, the semiconductor processing sheet of the present invention is also suitable to be used alone as a dicing sheet.

[0015]

25 According to the semiconductor processing sheet of the present invention, at the

time of cutting a film adhesive provided on the semiconductor processing sheet by expansion, the floating or scattering of the semiconductor chip with the film adhesive from the pressure-sensitive adhesive layer (in other words, the semiconductor processing sheet) can be suppressed, and moreover, it is possible to easily pick up the semiconductor
5 chip with the film adhesive with no process abnormality.

[0016]

The cutting of the film adhesive by expansion as described above is suitable for application when, for example, a semiconductor chip with a film adhesive that includes a thin semiconductor chip is manufactured.

10 A plurality of already divided semiconductor chips can be produced, for example, by forming grooves from a circuit forming surface (front surface) in the semiconductor wafer on the side opposite to the surface to which the film adhesive is adhered (back surface), and grinding the back surface until reaching the grooves. An operation of cutting the semiconductor wafer so as to leave a bottom portion of the
15 groove without dividing the semiconductor wafer as described above is called "half-cut". However, in the present invention, the term "half-cut" means not only an operation of cutting a semiconductor wafer so that the depth of the groove becomes a certain value such as, for example, half the thickness of the semiconductor wafer, but also an operation in general of cutting a semiconductor wafer so as to leave the bottom portion of the
20 groove as described above.

[0017]

As a method of forming the groove, for example, a method of forming a groove by cutting a semiconductor wafer using a blade (that is, blade dicing), a method of forming a groove by cutting a semiconductor wafer through laser irradiation (that is, laser
25 dicing), a method of forming a groove by cutting a semiconductor wafer by spraying

water containing a polishing agent (that is, water dicing) and the like can be mentioned. However, in the case of manufacturing a semiconductor chip by scraping off a part of a semiconductor wafer as in these methods, when the thickness of the semiconductor wafer is thin, a broken semiconductor chip is easily obtained, and the yield tends to decrease.

- 5 In addition, when the whisker-like cutting residue remains on the semiconductor chip or the cutting chips of the semiconductor wafer adhere to the semiconductor chip, abnormalities occur in the picking up of the semiconductor chip with the film adhesive, or the performance of the obtained semiconductor device is deteriorated.

[0018]

- 10 On the other hand, the plurality of already divided semiconductor chips can also be produced by forming a modified layer inside the semiconductor wafer through irradiation of a laser beam in the infrared region so as to converge on a focal point set inside the semiconductor wafer, and then grinding the back surface of the semiconductor wafer while further applying a force at the time of grinding to the semiconductor wafer
- 15 during grinding of the back surface, thereby dividing the semiconductor wafer at a portion where the modified layer has been formed. In this method, since there is no step of scraping off a part of the semiconductor wafer, even if the thickness of the semiconductor wafer is thin, it is possible to suppress cracks in the semiconductor chip as described above, persistence of cutting residue on the semiconductor chip, adhesion of
- 20 cutting chips onto the semiconductor wafer, and the like.

- As described above, the method of dividing the semiconductor wafer at a portion where the modified layer is formed is suitable for the case where the thickness of the semiconductor wafer is thin, and the semiconductor processing sheet of the present invention is suitable for picking up the thin semiconductor chip obtained from such a
- 25 semiconductor wafer together with the film adhesive.

[0019]

<Base material>

The material constituting the base material is preferably various resins, and specific examples thereof include polyethylenes (low density polyethylenes (sometimes
5 abbreviated as LDPE), linear low density polyethylenes (sometimes abbreviated as LLDPE), high density polyethylenes (sometimes abbreviated as HDPE) or the like), polypropylenes, polybutenes, polybutadienes, polymethylpentenes, styrene/ethylenebutylene/styrene block copolymers, polyvinyl chlorides, vinyl chloride copolymers, polyethylene terephthalates, polybutylene terephthalates, polyurethanes,
10 polyurethane acrylates, polyimides, ethylene vinyl acetate copolymers, ionomer resins, ethylene/(meth)acrylic acid copolymers, ethylene/(meth)acrylate copolymers, polystyrenes, polycarbonates, fluororesins, and hydrogenated products, modified products, crosslinked products or copolymers of any of these resins.

Of the various possibilities described above, low density polyethylenes (LDPE)
15 are preferable.

[0020]

It should be noted that in the present specification, the term “(meth)acrylic acid” is a concept that includes both “acrylic acid” and “methacrylic acid”. The same also applies to the terms similar to (meth)acrylic acid, and for example, the term
20 “(meth)acrylate” is a concept including both “acrylate” and “methacrylate”, and the term “(meth)acryloyl group” is a concept including both “acryloyl group” and “methacryloyl group”.

[0021]

The resin constituting the base material may be composed of only one type or
25 may be composed of two or more types, and when it is composed of two or more types,

the combination and ratio thereof can be arbitrarily selected.

[0022]

The base material may be composed of one layer (a single layer), or it may be composed of a plurality of layers of two or more layers. In the case where the base
5 material is composed of a plurality of layers, these plurality of layers may be the same as or different from each other, and the combination of these plurality of layers is not particularly limited as long as the effects of the present invention are not impaired.

It should be noted that in the present specification, and this is not limited to the case of a base material, the expression “the plurality of layers may be the same as or
10 different from each other” means that “all of the layers may be the same, all of the layers may be different, or only some of the layers may be the same”. Moreover, the expression “the plurality of layers are different from each other” means that “at least one of the constituent material and the thickness of each layer is different from each other”.

[0023]

15 The thickness of the base material can be appropriately selected according to the purpose, but it is preferably from 50 to 300 μm , and more preferably from 70 to 150 μm .

Here, the “thickness of the base material” means the thickness of the entire base material, and for example, the thickness of the base material composed of a plurality of layers means the total thickness of all the layers constituting the base material.

20 It should be noted that in the present specification, the term “thickness” means a value represented by an average of thicknesses measured at five arbitrary places with a contact type thickness meter.

[0024]

In order to improve the adhesion to other layers such as a pressure-sensitive
25 adhesive layer provided thereon, the surface of the base material may be subjected to a

roughening treatment by a sandblasting treatment, a solvent treatment or the like, or an oxidation treatment such as a corona discharge treatment, an electron beam irradiation treatment, a plasma treatment, an ozone/ultraviolet irradiation treatment, a flame treatment, a chromic acid treatment, a hot air treatment or the like.

5 Further, the surface of the base material may be subjected to a primer treatment.

In addition, when an antistatic coating layer and the semiconductor processing sheet are superposed and stored, the base material may have a layer for preventing adhesion of the base material to another sheet and adhesion of the base material to the suction table, or the like.

10 [0025]

<Pressure-sensitive adhesive layer>

It is preferable that the pressure-sensitive adhesive layer satisfies the following conditions of storage elastic modulus and is non-energy ray-curable.

In the present invention, the term “non-energy ray-curable” means a property of
15 not being cured even when irradiated with an energy ray. On the contrary, a property of being cured by irradiation with an energy ray is referred to as “energy ray-curable”.

In the present invention, the term “energy ray” means an electromagnetic wave or a charged particle beam having an energy quantum, and examples thereof include ultraviolet rays and electron beams.

20 For example, ultraviolet rays can be irradiated by using a high pressure mercury lamp, a fusion H lamp, a xenon lamp, a light emitting diode or the like as an ultraviolet light source. An electron beam generated by an electron beam accelerator or the like can be irradiated.

[0026]

25 The pressure-sensitive adhesive layer may be composed of one layer (a single

layer), or it may be composed of a plurality of layers of two or more layers. When it is composed of a plurality of layers, the plurality of layers may be the same as or different from each other, and the combination of the plurality of layers is not particularly limited.

[0027]

5 The thickness of the pressure-sensitive adhesive layer can be appropriately selected according to the purpose, but it is preferably from 1 to 100 μm , more preferably from 1 to 60 μm , and particularly preferably from 1 to 30 μm .

 Here, the “thickness of the pressure-sensitive adhesive layer” means the thickness of the entire pressure-sensitive adhesive layer, and for example, the thickness
10 of the pressure-sensitive adhesive layer composed of a plurality of layers means the total thickness of all the layers constituting the pressure-sensitive adhesive layer.

[0028]

 The pressure-sensitive adhesive layer to be determined for the storage elastic modulus may be a pressure-sensitive adhesive layer composed of a single layer having a
15 thickness of 200 μm , or may be a laminate obtained by laminating two or more layers of a pressure-sensitive adhesive layer having a thickness of less than 200 μm so that the total thickness becomes 200 μm .

 It should be noted that in this specification, the pressure-sensitive adhesive layer for which the storage elastic modulus is to be determined may be simply described as
20 “pressure-sensitive adhesive layer” regardless of whether it is a pressure-sensitive adhesive layer composed of a single layer or the laminate.

 Further, in the present specification, unless otherwise specified, the above-mentioned “storage elastic modulus of the pressure-sensitive adhesive layer” and “storage elastic modulus of the laminate” mean, when the pressure-sensitive adhesive
25 layer is curable, “the storage elastic modulus of the pressure-sensitive adhesive layer

before being cured” and “the storage elastic modulus of the laminate before the pressure-sensitive adhesive layer is cured”, respectively.

[0029]

The storage elastic modulus of the pressure-sensitive adhesive layer or laminate
5 at 0°C is equal to or less than 1,000 MPa, and is preferably equal to or less than 996 MPa. By ensuring that the storage elastic modulus is equal to or less than the above upper limit value, floating and scattering of the semiconductor chip with the film adhesive from the pressure-sensitive adhesive layer are suppressed at the time of cutting the film adhesive by expansion, as described later.

10 The lower limit value of the storage elastic modulus of the pressure-sensitive adhesive layer or laminate at 0°C is not particularly limited, and may be set to, for example, any one of 100 MPa, 300 MPa and 500 MPa, but these are only examples.

That is, as one aspect, the storage elastic modulus of the pressure-sensitive adhesive layer or laminate at 0°C is from 100 MPa to 1,000 MPa, preferably from 300
15 MPa to 1,000 MPa, more preferably from 500 MPa to 996 MPa, and particularly preferably from 533 MPa to 994 MPa.

[0030]

In the present invention, the above storage elastic modulus (MPa) can be obtained by measuring the storage elastic modulus (MPa) at the time when the
20 temperature of the pressure-sensitive adhesive layer or laminate to be measured is increased, for example, within a certain temperature range such as from -50°C to 50°C under conditions of a rate of temperature increase of 10°C/min and a frequency of 11 Hz.

More specifically, when the thickness of the pressure-sensitive adhesive layer is set to 200 μm , the storage elastic modulus (MPa) can be obtained by measuring the
25 storage elastic modulus (MPa) at 0°C at the time when the temperature is increased by a

dynamic viscoelasticity measuring device under conditions of a rate of temperature increase of 10°C/min, a frequency of 11 Hz and a temperature of -50 to 50°C.

[0031]

The storage elastic modulus can be appropriately adjusted by, for example,
5 adjusting the type and amount of components contained in the pressure-sensitive adhesive layer, and the like.

For example, by adjusting the ratio of the monomers constituting the adhesive resin described later, the added amount of the crosslinking agent, the content of the filler, and the like, it is possible to easily adjust the storage elastic modulus of the pressure-
10 sensitive adhesive layer and the storage elastic modulus of the laminate.

However, these adjustment methods are only examples.

[0032]

In the semiconductor processing sheet of the present invention, the adhesive force of the pressure-sensitive adhesive layer with respect to the semiconductor wafer
15 (adhesive force with respect to the mirror surface of the semiconductor wafer) is equal to or less than 200 mN / 25 mm, and is preferably equal to or less than 196 mN / 25 mm. By ensuring that the adhesive force is equal to or less than the above upper limit value, the semiconductor chip with the film adhesive can be easily picked up without curing the pressure-sensitive adhesive layer through energy ray irradiation or the like, as described
20 later.

The lower limit value of the adhesive force of the pressure-sensitive adhesive layer with respect to the semiconductor wafer is not particularly limited, and can be set to, for example, any one of 10 mN / 25 mm, 30 mN / 25 mm, and 50 mN / 25 mm, but these are only examples.

25 That is, as one aspect, the adhesive force of the pressure-sensitive adhesive layer

with respect to the semiconductor wafer in the semiconductor processing sheet of the present invention is from 10 to 200 mN / 25 mm, preferably from 30 to 200 mN / 25 mm, more preferably from 50 to 196 mN / 25 mm, and particularly preferably from 55 to 194 mN / 25 mm.

5 [0033]

It should be noted that in the present specification, unless otherwise stated, the “adhesive force of the pressure-sensitive adhesive layer with respect to the semiconductor wafer” means the “adhesive force of the uncured pressure-sensitive adhesive layer with respect to the semiconductor wafer” when the pressure-sensitive
10 adhesive layer is curable. In addition, the measurement of the adhesive force is a measurement of the adhesive force in the standard state prescribed in JIS Z 0237 2008, unless otherwise specified.

[0034]

In the present invention, the adhesive force (mN / 25 mm) can be measured by
15 the following method. That is, the semiconductor processing sheet having a width of 25 mm and an arbitrary length is fabricated. Subsequently, the semiconductor processing sheet is adhered to a semiconductor wafer (that is, a mirror surface of the semiconductor wafer) with the pressure-sensitive adhesive layer at normal temperature (for example, 23°C). Then, while the temperature remains unchanged, the so-called 180° peeling is
20 performed in which the semiconductor processing sheet is peeled off from the semiconductor wafer at a peeling rate of 300 mm/min, so that the surfaces of the pressure-sensitive adhesive layer and the semiconductor wafer that have been brought into contact with each other form an angle of 180°. The peel force at this time is measured, and the measured value is defined as the adhesive force (mN / 25 mm). The
25 length of the semiconductor processing sheet to be subjected to the measurement is not

particularly limited as long as it is within a range in which the peel force can be stably measured. For example, the length of the semiconductor processing sheet to be measured may be 150 mm.

Examples of the semiconductor wafer include a silicon wafer.

5 [0035]

The pressure-sensitive adhesive force of the pressure-sensitive adhesive layer to the semiconductor wafer can be appropriately adjusted by, for example, adjusting the kind and amount of components contained in the pressure-sensitive adhesive layer.

For example, by adjusting the combination of the monomers constituting the
10 adhesive resin to be described later, the ratio of the monomers, the added amount of the crosslinking agent, the content of the filler, and the like, the adhesive force of the pressure-sensitive adhesive layer can be easily adjusted.

However, these adjustment methods are only examples.

[0036]

15 Even if the types of semiconductor wafers such as silicon wafers are different or even if the types are the same but the production lots are different, when the same pressure-sensitive adhesive layer is adhered to the same portion, variations in the adhesive force with the pressure-sensitive adhesive layer are small. Therefore, the adhesive force of the pressure-sensitive adhesive layer can be specified with high
20 accuracy by selecting the semiconductor wafer as a measurement target. In the present invention, by selecting a pressure-sensitive adhesive layer exhibiting an adhesive force with respect to the mirror surface of the semiconductor wafer of 200 mN / 25 mm or less, when the semiconductor chip with the film adhesive is separated and picked up from the pressure-sensitive adhesive layer, the adhesive force of the pressure-sensitive adhesive
25 layer with respect to the film adhesive can be adjusted, so that the occurrence of process

abnormalities can be suppressed to facilitate the pickup process. Such effects of the present invention are exhibited in the film adhesives in general that are used in the field.

[0037]

The pressure-sensitive adhesive layer can be formed from a pressure-sensitive adhesive composition containing a pressure-sensitive adhesive. For example, a pressure-sensitive adhesive layer can be formed at an intended portion by applying a pressure-sensitive adhesive composition onto the surface on which the pressure-sensitive adhesive layer is to be formed, followed by drying if necessary. A more specific method of forming the pressure-sensitive adhesive layer will be described in detail later, together with a method of forming other layers. The ratio of the contents of the components that do not vaporize at normal temperature to each other in the pressure-sensitive adhesive composition is usually the same as the ratio of the contents of the aforementioned components of the pressure-sensitive adhesive layer to each other.

[0038]

The pressure-sensitive adhesive composition may be applied by a known method, and examples thereof include a method using various coaters such as an air knife coater, a blade coater, a bar coater, a gravure coater, a roll coater, a roll knife coater, a curtain coater, a die coater, a knife coater, a screen coater, a Meyer bar coater and a kiss coater.

[0039]

Although the drying conditions of the pressure-sensitive adhesive composition are not particularly limited, in the case where the pressure-sensitive adhesive composition contains a solvent to be described later, it is preferable to dry the pressure-sensitive adhesive composition by heating, and in this case, for example, it is preferable to dry under conditions of 70 to 130°C for 10 seconds to 5 minutes.

[0040]

[Pressure-sensitive adhesive composition]

The pressure-sensitive adhesive composition is preferably non-energy ray-curable.

- 5 As the non-energy ray-curable pressure-sensitive adhesive composition, for example, those containing an adhesive resin (hereinafter referred to as “adhesive resin (i)”) such as an acrylic resin, a urethane-based resin, a rubber-based resin, a silicone-based resin, an epoxy-based resin, a polyvinyl ether or a polycarbonate can be mentioned.

[0041]

- 10 (Adhesive resin (i))

The adhesive resin (i) is preferably the aforementioned acrylic resin.

As the acrylic resin in the adhesive resin (i), for example, an acrylic polymer having at least a structural unit derived from a (meth)acrylic acid alkyl ester can be mentioned.

- 15 The structural unit included in the acrylic resin may be composed of only one type or may be composed of two or more types, and when it is composed of two or more types, the combination and ratio thereof can be arbitrarily selected.

Here, the expression “derived” means that the chemical structure is changed due to polymerization.

- 20 [0042]

Examples of the (meth)acrylic acid alkyl ester include those in which the alkyl group constituting the alkyl ester has 1 to 20 carbon atoms, and the alkyl group is preferably linear or branched.

- 25 More specific examples of the (meth)acrylic acid alkyl ester include methyl (meth)acrylate, ethyl (meth)acrylate, n-propyl (meth)acrylate, isopropyl (meth)acrylate,

n-butyl (meth)acrylate, isobutyl (meth)acrylate, sec-butyl (meth)acrylate, tert-butyl (meth)acrylate, pentyl (meth)acrylate, hexyl (meth)acrylate, heptyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, isooctyl (meth)acrylate, n-octyl (meth)acrylate, n-nonyl (meth)acrylate, isononyl (meth)acrylate, decyl (meth)acrylate, undecyl (meth)acrylate, 5 dodecyl (meth)acrylate (also referred to as lauryl (meth)acrylate), tridecyl (meth)acrylate, tetradecyl (meth)acrylate (also referred to as myristyl (meth)acrylate), pentadecyl (meth)acrylate, hexadecyl (meth)acrylate (also referred to as palmityl (meth)acrylate), heptadecyl (meth)acrylate, octadecyl (meth)acrylate (also referred to as stearyl (meth)acrylate), nonadecyl (meth)acrylate and eicosyl (meth)acrylate.

10 Of the various possibilities described above, 2-ethylhexyl (meth)acrylate is preferable.

[0043]

From the viewpoint of improving the adhesive force of the pressure-sensitive adhesive layer, it is preferable that the acrylic polymer has a structural unit derived from 15 a (meth)acrylic acid alkyl ester in which the alkyl group has 4 or more carbon atoms. Further, from the viewpoint of further improving the adhesive force of the pressure-sensitive adhesive layer, the number of carbon atoms of the alkyl group is preferably from 4 to 12, and more preferably from 4 to 8. In addition, the (meth)acrylic acid alkyl ester in which the alkyl group has 4 or more carbon atoms is preferably an acrylic acid 20 alkyl ester.

[0044]

In addition to the structural unit derived from a (meth)acrylic acid alkyl ester, it is preferable that the acrylic polymer further has a structural unit derived from a functional group-containing monomer.

25 As the functional group-containing monomer, for example, those in which the

functional group reacts with a crosslinking agent to be described later to thereby become a starting point of crosslinking, and those in which the functional group reacts with an unsaturated group in an unsaturated group-containing compound to thereby enable introduction of an unsaturated group into the side chain of the acrylic polymer can be
 5 mentioned.

[0045]

Examples of the functional group in the functional group-containing monomer include a hydroxyl group, a carboxy group, an amino group and an epoxy group.

That is, examples of the functional group-containing monomer include a
 10 hydroxyl group-containing monomer, a carboxy group-containing monomer, an amino group-containing monomer and an epoxy group-containing monomer.

[0046]

Examples of the hydroxyl group-containing monomer include hydroxyalkyl (meth)acrylates such as hydroxymethyl (meth)acrylate, 2-hydroxyethyl (meth)acrylate, 2-
 15 hydroxypropyl (meth)acrylate, 3-hydroxypropyl (meth)acrylate, 2-hydroxybutyl (meth)acrylate, 3-hydroxybutyl (meth)acrylate and 4-hydroxybutyl (meth)acrylate; non-(meth)acrylic unsaturated alcohols (unsaturated alcohols having no (meth)acryloyl skeleton) such as vinyl alcohol and allyl alcohol, and the like.

Of the various possibilities described above, 2-hydroxyethyl (meth)acrylate, 4-
 20 hydroxybutyl (meth)acrylate and the like are preferable.

[0047]

Examples of the carboxy group-containing monomer include ethylenically unsaturated monocarboxylic acids (monocarboxylic acids having an ethylenically unsaturated bond) such as (meth)acrylic acid and crotonic acid; ethylenically unsaturated
 25 dicarboxylic acids (dicarboxylic acids having an ethylenically unsaturated bond) such as

fumaric acid, itaconic acid, maleic acid and citraconic acid; anhydrides of the ethylenically unsaturated dicarboxylic acids; (meth)acrylic acid carboxyalkyl esters such as 2-carboxyethyl methacrylate, and the like.

[0048]

- 5 The functional group-containing monomer is preferably a hydroxyl group-containing monomer or a carboxy group-containing monomer, and more preferably a hydroxyl group-containing monomer.

[0049]

- 10 The functional group-containing monomer constituting the acrylic polymer may be composed of only one type or may be composed of two or more types, and when it is composed of two or more types, the combination and ratio thereof can be arbitrarily selected.

[0050]

- 15 In the acrylic polymer, the content of the structural unit derived from the functional group-containing monomer is preferably from 1 to 35% by mass, more preferably from 3 to 32% by mass, and particularly preferably from 5 to 30% by mass with respect to the total amount (total mass) of the structural units constituting the acrylic polymer.

[0051]

- 20 In addition to the structural unit derived from the (meth)acrylic acid alkyl ester and the structural unit derived from the functional group-containing monomer, the acrylic polymer may further include a structural unit derived from another monomer.

The other monomer is not particularly limited as long as it is copolymerizable with a (meth)acrylic acid alkyl ester or the like.

- 25 Examples of the other monomer include styrene, α -methylstyrene, vinyltoluene,

vinyl formate, vinyl acetate, acrylonitrile and acrylamide.

[0052]

The other monomer constituting the acrylic polymer may be composed of only one type or may be composed of two or more types, and when it is composed of two or
5 more types, the combination and ratio thereof can be arbitrarily selected.

[0053]

Like the acrylic polymer, the aforementioned adhesive resin (i) other than the acrylic polymer also preferably has a structural unit derived from a functional group-containing monomer.

10 [0054]

The adhesive resin (i) contained in the pressure-sensitive adhesive composition may be composed of only one type or may be composed of two or more types, and when it is composed of two or more types, the combination and ratio thereof can be arbitrarily selected.

15 [0055]

The content of the adhesive resin (i) is preferably from 45 to 90% by mass, more preferably from 55 to 87% by mass, still more preferably from 65 to 84% by mass, and particularly preferably from 72 to 81% by mass with respect to the total mass of components constituting the pressure-sensitive adhesive composition other than the
20 solvent (that is, with respect to the total mass of the pressure-sensitive adhesive layer). By ensuring that the ratio of the content of the adhesive resin (i) is within such a range, the tackiness of the pressure-sensitive adhesive layer is further improved.

[0056]

(Crosslinking agent (ii))

25 The pressure-sensitive adhesive composition preferably contains a crosslinking

agent (ii).

For example, the crosslinking agent (ii) reacts with the functional group to crosslink the adhesive resins (i) with each other.

As the crosslinking agent (ii), for example, an isocyanate-based crosslinking agent (that is, a crosslinking agent having an isocyanate group) such as tolylene diisocyanate, hexamethylene diisocyanate, xylylene diisocyanate and adduct forms of these diisocyanates; an epoxy-based crosslinking agent (that is, a crosslinking agent having a glycidyl group) such as ethylene glycol glycidyl ethers; an aziridine-based crosslinking agent (that is, a crosslinking agent having an aziridiny group) such as hexa[1-(2-methyl)-aziridiny]triphosphatriazine; a metal chelate-based crosslinking agent (that is, a crosslinking agent having a metal chelate structure) such as aluminum chelates; an isocyanurate-based crosslinking agent (that is, a crosslinking agent having an isocyanuric acid skeleton), and the like can be mentioned.

It is preferable that the crosslinking agent (ii) is an isocyanate-based crosslinking agent from the viewpoints of improving the cohesive force of the pressure-sensitive adhesive to improve the adhesive force of the pressure-sensitive adhesive layer, easy availability, and the like, and examples thereof include a tolylene diisocyanate trimer adduct of trimethylolpropane and the like.

[0057]

The crosslinking agent (ii) contained in the pressure-sensitive adhesive composition may be composed of only one type or may be composed of two or more types, and when it is composed of two or more types, the combination and ratio thereof can be arbitrarily selected.

[0058]

When the pressure-sensitive adhesive composition contains the crosslinking

agent (ii), the content of the crosslinking agent (ii) in the pressure-sensitive adhesive composition is preferably from 5 to 50 parts by mass, more preferably from 10 to 45 parts by mass, and particularly preferably from 15 to 40 parts by mass, with respect to 100 parts by mass of the content of the adhesive resin (i). Further, as another aspect, the content of the crosslinking agent (ii) may be from 22 to 38 parts by mass, or may be from 22.62 to 37.70 parts by mass, with respect to 100 parts by mass of the content of the adhesive resin (i). By ensuring that the content of the crosslinking agent (ii) is equal to or more than the above lower limit value, the effects of using the crosslinking agent (ii) can be obtained more remarkably. Further, by ensuring that the content of the crosslinking agent (ii) is equal to or less than the above upper limit value, it becomes easier to control the adhesive force of the pressure-sensitive adhesive layer with respect to the film adhesive.

[0059]

(Other additives)

The pressure-sensitive adhesive composition may contain other additives that do not correspond to any of the above-mentioned components within a range that does not impair the effects of the present invention.

Examples of the other additives include known additives such as an antistatic agent, an antioxidant, a softener (a plasticizer), a filling material (a filler), a rust inhibitor, a colorant (a pigment or a dye), a sensitizer, a tackifier, a reaction retarder and a crosslinking accelerator (a catalyst).

It should be noted that the term “reaction retarder” means, for example, one that suppresses the unintended crosslinking reaction in the pressure-sensitive adhesive composition during storage by the action of the catalyst incorporated in the pressure-sensitive adhesive composition. As the reaction retarder, for example, a compound that

forms a chelate complex by chelating to the catalyst can be mentioned, and more specifically, a compound having two or more carbonyl groups (-C(=O)-) in one molecule can be mentioned.

[0060]

- 5 The other additive contained in the pressure-sensitive adhesive composition may be composed of only one type or may be composed of two or more types, and when it is composed of two or more types, the combination and ratio thereof can be arbitrarily selected.

[0061]

- 10 In the pressure-sensitive adhesive composition, the content of other additives is not particularly limited, and may be appropriately selected depending on the types thereof.

[0062]

(Solvent)

- 15 The pressure-sensitive adhesive composition may contain a solvent. Since the pressure-sensitive adhesive composition contains a solvent, the coatability to the surface to be coated is improved.

[0063]

- 20 The solvent is preferably an organic solvent. Examples of the organic solvent include ketones such as methyl ethyl ketone and acetone; esters (for example, carboxylic acid esters) such as ethyl acetate; ethers such as tetrahydrofuran and dioxane; aliphatic hydrocarbons such as cyclohexane and n-hexane; aromatic hydrocarbons such as toluene and xylene; and alcohols such as 1-propanol and 2-propanol.

[0064]

- 25 As the solvent, for example, the solvent used at the time of production of the

adhesive resin (i) may be used as it is in the pressure-sensitive adhesive composition without being removed from the adhesive resin (i), or a solvent of the same type as or different type from the solvent used at the time of production of the adhesive resin (i) may be added separately at the time of production of the pressure-sensitive adhesive composition.

[0065]

The solvent contained in the pressure-sensitive adhesive composition may be composed of only one type or may be composed of two or more types, and when it is composed of two or more types, the combination and ratio thereof can be arbitrarily selected.

[0066]

In the pressure-sensitive adhesive composition, the content of the solvent is not particularly limited and may be appropriately adjusted.

[0067]

[Method for producing pressure-sensitive adhesive composition]

The pressure-sensitive adhesive composition can be obtained by blending each component for constituting the composition.

The addition order at the time of blending each component is not particularly limited, and two or more types of components may be added at the same time.

In the case of using a solvent, the solvent may be mixed with any one of the blended components other than the solvent to dilute the blended components in advance, or the solvent may be mixed with these blended components without previously diluting any of the blended components other than the solvent.

[0068]

The method of mixing the respective components at the time of blending is not

particularly limited, and may be selected appropriately from known methods, such as a method of mixing by rotating a stirrer, a stirring blade or the like; a method of mixing by using a mixer; and a method of mixing by applying ultrasonic waves.

The temperature and time at the time of adding and mixing each component are
5 not particularly limited, as long as each blended component does not deteriorate, and may be adjusted appropriately, although the temperature is preferably from 15 to 30°C.

FIG. 1 is a cross-sectional view schematically showing an embodiment of the semiconductor processing sheet of the present invention. It should be noted that the drawings used in the following description are showing the main part in an enlarged
10 manner in some cases for the sake of convenience in order to make the features of the present invention easy to understand, and the dimensional ratios and the like of the respective constituents are not necessarily the same as the actual ratios.

[0069]

A semiconductor processing sheet 1 shown in FIG. 1 is a sheet in which a
15 pressure-sensitive adhesive layer 12 is provided on a base material 11. In the semiconductor processing sheet 1, the pressure-sensitive adhesive layer 12 is laminated on one surface 11a of the base material 11.

[0070]

It should be noted that the semiconductor processing sheet of the present
20 invention is not limited to the one shown in FIG. 1, but may be one shown in FIG. 1 in which a part of the configuration is modified, deleted or added within a range that does not impair the effects of the present invention.

[0071]

<< Method for producing semiconductor processing sheet >>

25 The semiconductor processing sheet of the present invention can be produced by

laminating a pressure-sensitive adhesive layer on a substrate. The method for forming the pressure-sensitive adhesive layer is as described above.

For example, a pressure-sensitive adhesive composition is applied onto a release film and dried as required, so that a pressure-sensitive adhesive layer is formed on the release film in advance, and the exposed surface in the formed pressure-sensitive adhesive layer on the side opposite to a side which is in contact with the release film is bonded to one surface of the base material to thereby obtain the semiconductor processing sheet. The release film may be removed at an arbitrary timing after obtaining the semiconductor processing sheet. It is preferable that the pressure-sensitive adhesive composition is applied to the release-treated surface of the release film.

[0072]

It should be noted that the semiconductor processing sheet is usually stored in a state where a release film is bonded to the surface of the outermost layer (that is, the pressure-sensitive adhesive layer) on the side opposite to the base material thereof. Therefore, after forming the pressure-sensitive adhesive layer on the release film by the above method, even after the pressure-sensitive adhesive layer is bonded to the base material, the release film may remain in a state of being bonded without being removed.

[0073]

<< Method for manufacturing semiconductor device >>

As a method for manufacturing a semiconductor device in the case of using the semiconductor processing sheet of the present invention, for example, a manufacturing method including: a step of forming a laminated structure in which a film adhesive is provided on a surface of a pressure-sensitive adhesive layer in the semiconductor processing sheet, and a plurality of already divided semiconductor chips are provided on a surface of the aforementioned film adhesive on a side opposite to a side where the

aforementioned pressure-sensitive adhesive layer is provided (hereinafter may be abbreviated as “laminated structure forming step”); a step of cutting the aforementioned film adhesive by expanding, while cooling, the aforementioned film adhesive in the aforementioned laminated structure in the surface direction of the aforementioned film adhesive (hereinafter may be abbreviated as “cutting step”); and a step of picking up (separating) the aforementioned semiconductor chip provided with the aforementioned film adhesive after cutting (that is, a semiconductor chip with a film adhesive) from the aforementioned pressure-sensitive adhesive layer (hereinafter may be abbreviated as “separating step”) can be mentioned.

10 [0074]

By using the semiconductor processing sheet of the present invention, in the cutting step, at the time of cutting the film adhesive by expanding the semiconductor processing sheet, in other words, by expanding the film adhesive, floating and scattering of the semiconductor chip with the film adhesive from the pressure-sensitive adhesive layer are suppressed. Further, in the separating step, it is possible to easily separate and pick up the semiconductor chip with the film adhesive from the pressure-sensitive adhesive layer without curing the pressure-sensitive adhesive layer through energy ray irradiation or the like. As described above, in the case of using the semiconductor processing sheet of the present invention, since the semiconductor chip with the film adhesive can be picked up without curing the pressure-sensitive adhesive layer, the manufacturing process of the semiconductor device can be simplified.

20 [0075]

Hereinafter, the above manufacturing method will be described with reference to FIG. 2. FIG. 2 is a cross-sectional view for schematically illustrating an embodiment of a method for manufacturing a semiconductor device in the case of using the

semiconductor processing sheet of the present invention. Here, a manufacturing method in the case of using the semiconductor processing sheet shown in FIG. 1 will be described. It should be noted that in FIG. 2, the same components as those shown in FIG. 1 are denoted by the same reference numerals as in FIG. 1, and a detailed description thereof will be omitted. Further, in FIG. 2, only the configurations related to the semiconductor processing sheet, the film adhesive, and the semiconductor chip are shown in cross section. The same applies to FIG. 3 and the subsequent drawings.

[0076]

<Laminated structure forming step>

10 A laminated structure 101 shown in FIG. 2(a) is a laminated structure in which a film adhesive 9 is provided on a surface 12a of the pressure-sensitive adhesive layer 12 of the semiconductor processing sheet 1 (the surface opposite to the side provided with the base material in the pressure-sensitive adhesive layer 12), and a plurality of already divided semiconductor chips 8 are provided on a surface 9a of the film adhesive 9 on the
15 side opposite to the side provided with the pressure-sensitive adhesive layer 12. It should be noted that the semiconductor processing sheet 1 is a semiconductor processing sheet of the present invention in which the pressure-sensitive adhesive layer 12 is laminated on the surface 11a of the base material 11.

In FIG. 2, gap portions between the plurality of semiconductor chips 8 (those
20 originating from the grooves) are highlighted.

[0077]

In the laminated structure forming step, for example, one sheet of film adhesive 9 is adhered to back surfaces 8b (the surfaces on the side opposite to the circuit forming surfaces of the semiconductor chips 8) of the plurality of already divided semiconductor
25 chips 8, and then the pressure-sensitive adhesive layer 12 in the semiconductor

processing sheet 1 of the present invention is adhered to a surface 9b of the film adhesive 9 on the side opposite to the side provided with the semiconductor chip 8, whereby the laminated structure 101 can be formed. Further, the laminated structure can also be formed by adhering the surface 9a of the film adhesive 9 on the side opposite to the side provided with the pressure-sensitive adhesive layer 12 to the back surfaces 8b of the plurality of already divided semiconductor chips 8, after adhering one sheet of film adhesive 9 to the surface 12a of the pressure-sensitive adhesive layer 12 in the semiconductor processing sheet 1 of the present invention.

[0078]

10 As described above, the plurality of already divided semiconductor chips 8 can be produced, for example, by forming grooves from a circuit forming surface (front surface) in the semiconductor wafer on the side opposite to the surface to which the film adhesive 9 is adhered (back surface), and grinding the back surface until reaching the grooves. Then, the grooves can be formed by methods such as blade dicing, laser
15 dicing and water dicing.

[0079]

FIG. 3 is a cross-sectional view for schematically illustrating an embodiment of a method for forming grooves in such a semiconductor wafer to obtain semiconductor chips.

20 In this method, as shown in FIG. 3(a), grooves 80' are formed in a semiconductor wafer 8' from one surface 8a' which is a circuit forming surface thereof by a method such as blade dicing, laser dicing and water dicing.

Subsequently, as shown in FIG. 3(b), a surface (the back surface) 8b' of the semiconductor wafer 8' on the opposite side of the aforementioned surface (the circuit forming surface) 8a' is ground. Grinding of the back surface 8b' can be carried out by a
25

known method by using, for example, a grinder 62. It is preferable that grinding of the back surface 8b' is performed by adhering a back grinding tape 63 to the surface 8a' of the semiconductor wafer 8', as shown here.

Then, by grinding the back surface 8b' until it reaches the grooves 80', a
5 plurality of semiconductor chips 8 are obtained from the semiconductor wafer 8' as shown in FIG. 3(c). The back surface 8b' of the semiconductor wafer 8' will become the back surface 8b of the semiconductor chip 8, that is, the surface for providing the film adhesive 9.

[0080]

10 However, in the aforementioned manufacturing method of a semiconductor device, as described above, it is preferable to adopt a method of forming a modified layer inside the semiconductor wafer, and dividing the semiconductor wafer at the portion where the modified layer is formed, instead of a method of scraping off a part of these semiconductor wafers.

15 [0081]

That is, in the method for manufacturing a semiconductor device, prior to the aforementioned laminated structure forming step, it is preferable to further include: a step of forming a modified layer inside the aforementioned semiconductor wafer by irradiating a laser beam in an infrared region so as to converge on a focal point set inside
20 the semiconductor wafer (hereinafter sometimes abbreviated as "modified layer forming step"); and a step of grinding a surface for providing the aforementioned film adhesive in the aforementioned semiconductor wafer in which the aforementioned modified layer has been formed, and applying a force at the time of grinding to the aforementioned semiconductor wafer, thereby dividing the aforementioned semiconductor wafer at a
25 portion of the aforementioned modified layer and obtaining a plurality of semiconductor

chips (hereinafter sometimes abbreviated as “dividing step”), and is preferable to use the plurality of semiconductor chips obtained in the aforementioned dividing step in the aforementioned laminated structure forming step.

FIG. 4 is a cross-sectional view for schematically illustrating an embodiment of a method for forming a modified layer in such a semiconductor wafer to obtain semiconductor chips.

[0082]

<Modified layer forming step>

In this method, in the modified layer forming step, as shown in FIG. 4(a), a laser beam in the infrared region is irradiated so as to converge on a focal point set inside the semiconductor wafer 8' to form modified layers 81' inside the semiconductor wafer 8'.

In the modified layer forming step, in order to form the modified layers 81' while minimizing the damage to the surface of the semiconductor wafer 8' and to the region in the vicinity of the surface by the irradiation of laser beam, for example, it is preferable to irradiate a laser beam with a large numerical aperture (NA).

[0083]

<Dividing step>

Subsequently, in the dividing step, as shown in FIG. 4(b), a surface (the back surface) 8b' of the semiconductor wafer 8' on the opposite side of the aforementioned surface (the circuit forming surface) 8a' is ground. Grinding at this time can be carried out in the same manner as in the grinding of the back surface of the semiconductor wafer on which grooves have been formed, as described above with reference to FIG. 3. For example, grinding of the back surface 8b' at this time is preferably performed by adhering a back grinding tape 63 to the surface 8a' of the semiconductor wafer 8'.

[0084]

Then, by grinding the back surface 8b' of the semiconductor wafer 8' and further applying a force at the time of grinding to the semiconductor wafer 8' during grinding, the semiconductor wafer 8' is divided at the portion where the modified layers 81' are formed, thereby obtaining a plurality of semiconductor chips 8 from the semiconductor wafer 8' as shown in FIG. 4(c). Also in this case, as in the case described with reference to FIG. 3, the back surface 8b' of the semiconductor wafer 8' will become the back surface 8b of the semiconductor chip 8, that is, the surface for providing the film adhesive 9.

[0085]

10 In any of the above methods, when the back grinding tape 63 is used, the obtained plurality of semiconductor chips 8 are held in an aligned state on the back grinding tape 63.

[0086]

15 The thickness of the semiconductor chip 8 is not particularly limited, but it is preferably from 5 to 60 μm , and more preferably from 10 to 55 μm . When such a thin semiconductor chip is used, the effects in the case of using the semiconductor processing sheet of the present invention can be obtained more remarkably.

[0087]

20 In the method for manufacturing a semiconductor device as described above, the film adhesive 9 may be a known one, for example, a film adhesive exhibiting curability, and a film adhesive having thermosetting properties is preferable, and a film adhesive having pressure-sensitive adhesive properties is preferable. In an uncured state, the film adhesive 9 having both thermosetting properties and pressure-sensitive adhesive properties can be adhered by lightly pressing it against various adherends. Further, the
25 film adhesive 9 may be one that can be adhered to various adherends by heating and

softening. The film adhesive 9 finally becomes a cured product having high impact resistance through curing, and this cured product can retain sufficient adhesive properties even under severe high temperature and high humidity conditions.

[0088]

5 The thickness of the film adhesive 9 is not particularly limited, but it is preferably from 1 to 50 μm , and more preferably from 3 to 40 μm . By ensuring that the thickness of the film adhesive 9 is equal to or more than the above-mentioned lower limit value, a higher adhesive force with respect to the adherend (semiconductor chip) can be obtained. In addition, by ensuring that the thickness of the film adhesive 9 is equal to or
10 less than the above upper limit value, the film adhesive 9 can be cut more easily by the expansion process described later.

[0089]

<Cutting step>

In the cutting step, after the laminated structure forming step, as shown in FIG. 2(b), while cooling the film adhesive 9 of the laminated structure 101, the film adhesive 9
15 is expanded in the direction of the surface 9a of the film adhesive 9 (a direction indicated by an arrow I in FIG. 2(b), that is, a direction horizontal to the surface of the film adhesive 9) to cut the film adhesive 9. The film adhesive 9 may be expanded together with the base material 11 and the pressure-sensitive adhesive layer 12 (that is, the
20 semiconductor processing sheet 1). Here, although the cut film adhesive is denoted by the reference numeral 9', this type of film adhesive 9' after cutting is simply referred to as "film adhesive 9" in some cases. Further, the expansion direction of the film adhesive 9 is indicated by an arrow I.

[0090]

25 The cooling temperature of the film adhesive 9 in the cutting step is not

particularly limited, but it is preferably from -15 to 3°C from the viewpoint that the film adhesive 9 can be cut more easily.

[0091]

In the cutting step, the expansion rate (expansion speed) of the film adhesive 9 is
5 not particularly limited as long as it does not impair the effects of the present invention,
but it is preferably from 0.5 to 100 mm/sec, more preferably from 0.5 to 60 mm/sec, and
may be, for example, from 1 to 50 mm/sec or the like. By ensuring that the expansion
rate is within such a range, the effects of the present invention can be obtained more
remarkably. Furthermore, by ensuring that the expansion rate is equal to or less than the
10 above upper limit value, the semiconductor chips 8 are less likely to be damaged at the
time of expanding the film adhesive 9.

[0092]

In the cutting step, since the semiconductor processing sheet 1 is used, floating
and scattering of the semiconductor chip 8 in a state in which the cut film adhesive 9' is
15 provided on the back surface 8b from the pressure-sensitive adhesive layer 12 are
suppressed.

[0093]

On the other hand, FIG. 5 is a cross-sectional view schematically showing the
state of a semiconductor chip at the time of expanding a film adhesive in the case of
20 using a conventional semiconductor processing sheet.

A pressure-sensitive adhesive layer 72 shown here has been conventionally used,
and in the case of using a semiconductor processing sheet 7 in which the pressure-
sensitive adhesive layer 72 is provided on the base material 11, the semiconductor chip 8
provided with the cut film adhesive 9' may float from the pressure-sensitive adhesive
25 layer 72 or may be peeled off from the pressure-sensitive adhesive layer 72 and scattered.

Such floating and scattering of the semiconductor chip with the film adhesive is typically seen, for example, when the storage elastic modulus at 0°C of the pressure-sensitive adhesive layer having a thickness of 200 μm as described above is less than 1,000 MPa.

In addition, such floating and scattering of the semiconductor chip with the film
5 adhesive tends to occur when the semiconductor chip 8 is thin.

[0094]

<Separating step>

In the separating step, after the cutting step, as shown in FIG. 2(c), the semiconductor chip 8 and the cut film adhesive 9' adhered thereto are separated and
10 picked up from the semiconductor processing sheet 1 (the pressure-sensitive adhesive layer 12).

[0095]

In the separating step, the semiconductor chip 8 is lifted up by a lifting portion 61 of the manufacturing apparatus of the semiconductor device, so that the cut film
15 adhesive 9' adhered to the back surface 8b of the semiconductor chip 8 is separated from the pressure-sensitive adhesive layer 12. A method for lifting up the semiconductor chip 8 may be a known method, and for example, a method in which the surface of the semiconductor chip 8 is sucked and lifted up by a vacuum collet, or the like can be mentioned. Here, the lifting direction of the semiconductor chip 8 is indicated by an
20 arrow II.

[0096]

In the separating step, since the semiconductor processing sheet 1 is used, it is possible to easily separate and pick up the semiconductor chip 8 together with the cut film adhesive 9' (the semiconductor chip with the film adhesive) from the pressure-
25 sensitive adhesive layer 12 even without curing the pressure-sensitive adhesive layer 12

through energy ray irradiation or the like.

[0097]

On the other hand, FIG. 6 is a cross-sectional view schematically showing a state when an attempt is made to pick up a semiconductor chip with a film adhesive in a case
5 where a conventional semiconductor processing sheet is used.

Among the drawings, in FIG. 6(a), as in the case of FIG. 2(c), a state is shown in which when the semiconductor chip 8 is lifted, the cut film adhesive 9' is peeled off from the semiconductor chip 8 and only the semiconductor chip 8 is lifted, while and the cut film adhesive 9' remains laminated on the pressure-sensitive adhesive layer 72.

10 On the other hand, in FIG. 6(b), as in the case of FIG. 2(c), a state is shown in which when an attempt is made to lift the semiconductor chip 8, the semiconductor chip 8 is laminated on the pressure-sensitive adhesive layer 72 through the cut film adhesive 9', and the semiconductor chip 8 cannot be lifted.

Both the process abnormalities as shown in FIG. 6(a) and FIG. 6(b) are typically
15 seen when the adhesive force of the pressure-sensitive adhesive layer 72 with respect to the semiconductor wafer is large so as to exceed 200 mN / 25 mm. Further, the state of FIG. 6(a) is likely to occur when the adhesive force of the film adhesive 9' with respect to the semiconductor wafer is relatively small, and the state of FIG. 6 (b) is likely to occur when the adhesive force of the film adhesive 9' with respect to the semiconductor wafer
20 is relatively large.

[0098]

In the above manufacturing method of a semiconductor device, a semiconductor device is manufactured using the semiconductor chip 8 separated (picked up) together with the cut film adhesive 9' (the semiconductor chip with the film adhesive), followed
25 by the same method as the conventional method. For example, the semiconductor chip

8 is die bonded to the circuit surface of the substrate with the film adhesive 9', and one or more semiconductor chips are further laminated on the semiconductor chip 8, if necessary, and after carrying out wire bonding, the entire constitution is sealed with a resin, thereby forming a semiconductor package (not shown). Then, by using this
5 semiconductor package, a desired semiconductor device may be fabricated.

[0099]

The method for manufacturing a semiconductor device using the semiconductor processing sheet of the present invention is not limited to the method described above with reference to FIG. 2, and some of the configurations in the above method may be
10 changed, deleted or added within a range that does not impair the effects of the present invention.

[0100]

It should be noted that the process abnormality described with reference to FIGS. 5 to 6 is merely an example, and in some cases, other process abnormality may occur.

15 On the other hand, in the case of using the semiconductor processing sheet according to the present invention, the occurrence of such process abnormality is suppressed, and as a result, the semiconductor device can be manufactured inexpensively by a more simplified method than the conventional method.

[0101]

20 As one aspect of the semiconductor processing sheet according to an embodiment of the present invention, a semiconductor processing sheet can be mentioned which is

a semiconductor processing sheet provided with a pressure-sensitive adhesive layer on a base material, wherein

25 the aforementioned pressure-sensitive adhesive layer is formed from a pressure-

sensitive adhesive composition containing an adhesive resin (i) and a crosslinking agent (ii);

the aforementioned adhesive resin (i) is an acrylic polymer having at least a structural unit derived from a (meth)acrylic acid alkyl ester, and is preferably an acrylic polymer having at least one structural unit selected from the group consisting of a structural unit derived from 2-ethylhexyl (meth)acrylate, a structural unit derived from 2-hydroxyethyl (meth)acrylate and a structural unit derived from 4-hydroxybutyl (meth)acrylate;

the aforementioned crosslinking agent (ii) is an isocyanate-based crosslinking agent, and preferably a tolylene diisocyanate trimer adduct of trimethylolpropane;

the content of the aforementioned adhesive resin (i) is from 45 to 90% by mass, preferably from 55 to 87% by mass, more preferably from 65 to 84% by mass, and particularly preferably from 72 to 81% by mass with respect to the total mass of the aforementioned pressure-sensitive adhesive layer;

the content of the aforementioned crosslinking agent (ii) is from 5 to 50 parts by mass, preferably from 10 to 45 parts by mass, more preferably from 15 to 40 parts by mass, and particularly preferably from 22 to 38 parts by mass with respect to 100 parts by mass of the content of the aforementioned adhesive resin (i);

when the thickness of the aforementioned pressure-sensitive adhesive layer is 200 μm , the storage elastic modulus of the aforementioned pressure-sensitive adhesive layer having a thickness of 200 μm at 0°C is from 100 MPa to 1000 MPa, preferably from 300 MPa to 1,000 MPa, more preferably from 500 MPa to 996 MPa, and particularly preferably from 533 MPa to 994 MPa; and

when the aforementioned semiconductor processing sheet is adhered to a mirror surface of a semiconductor wafer, the adhesive force of the aforementioned pressure-

sensitive adhesive layer with respect to the aforementioned mirror surface is from 10 to 200 mN / 25 mm, preferably from 30 to 200 mN / 25 mm, more preferably from 50 to 196 mN / 25 mm, and particularly preferably from 55 to 194 mN / 25 mm.

[0102]

5 As another aspect of the semiconductor processing sheet according to an embodiment of the present invention, a semiconductor processing sheet can be mentioned which is

a semiconductor processing sheet provided with a pressure-sensitive adhesive layer on a base material, wherein

10 the aforementioned pressure-sensitive adhesive layer is formed from a pressure-sensitive adhesive composition containing an adhesive resin (i) and a crosslinking agent (ii);

the aforementioned adhesive resin (i) is an acrylic polymer having at least one structural unit selected from the group consisting of a structural unit derived from 2-ethylhexyl (meth)acrylate and a structural unit derived from 2-hydroxyethyl (meth)acrylate;

15

the aforementioned crosslinking agent (ii) is a tolylene diisocyanate trimer adduct of trimethylolpropane;

the content of the aforementioned adhesive resin (i) is from 76 to 81% by mass;

20 the content of the aforementioned crosslinking agent (ii) is from 22 to 31 parts by mass with respect to 100 parts by mass of the content of the aforementioned adhesive resin (i);

when the thickness of the aforementioned pressure-sensitive adhesive layer is 200 μm , the storage elastic modulus of the aforementioned pressure-sensitive adhesive layer having a thickness of 200 μm at 0°C is from 533 MPa to 873 MPa; and

25

when the aforementioned semiconductor processing sheet is adhered to a mirror surface of a semiconductor wafer, the adhesive force of the aforementioned pressure-sensitive adhesive layer with respect to the aforementioned mirror surface is from 94 to 194 mN / 25 mm.

5 [0103]

As another aspect of the semiconductor processing sheet according to an embodiment of the present invention, a semiconductor processing sheet can be mentioned which is

a semiconductor processing sheet provided with a pressure-sensitive adhesive
10 layer on a base material, wherein

the aforementioned pressure-sensitive adhesive layer is formed from a pressure-sensitive adhesive composition containing an adhesive resin (i) and a crosslinking agent (ii);

the aforementioned adhesive resin (i) is an acrylic polymer having at least one
15 structural unit selected from the group consisting of a structural unit derived from 2-ethylhexyl (meth)acrylate and a structural unit derived from 4-hydroxybutyl (meth)acrylate;

the aforementioned crosslinking agent (ii) is a tolylene diisocyanate trimer adduct of trimethylolpropane;

20 the content of the aforementioned adhesive resin (i) is from 70 to 75% by mass;

the content of the aforementioned crosslinking agent (ii) is from 35 to 39 parts by mass with respect to 100 parts by mass of the content of the aforementioned adhesive resin (i);

when the thickness of the aforementioned pressure-sensitive adhesive layer is
25 200 μm , the storage elastic modulus of the aforementioned pressure-sensitive adhesive

layer having a thickness of 200 μm at 0°C is from 500 MPa to 994 MPa; and

when the aforementioned semiconductor processing sheet is adhered to a mirror surface of a semiconductor wafer, the adhesive force of the aforementioned pressure-sensitive adhesive layer with respect to the aforementioned mirror surface is from 50 to 5 60 mN / 25 mm.

[Examples]

[0104]

Hereinafter, the present invention will be described in more detail with reference 10 to specific examples. However, the present invention is not limited in any way by the following examples.

It should be noted that in the following description, “msec” means “milliseconds” which is a unit of time.

[0105]

15 The components used for producing a pressure-sensitive adhesive composition are shown below.

- Adhesive resin

Adhesive resin (i)-1: an acrylic polymer (weight average molecular weight: 860,000, glass transition temperature: -61°C) obtained by copolymerizing 2-ethylhexyl 20 acrylate (hereinafter abbreviated as “2EHA”) (80 parts by mass) and 2-hydroxyethyl acrylate (hereinafter abbreviated as “HEA”) (20 parts by mass).

Adhesive resin (i)-2: an acrylic polymer (weight average molecular weight: 430,000, glass transition temperature: -63°C) obtained by copolymerizing 2EHA (80 parts by mass) and 4-hydroxybutyl acrylate (hereinafter abbreviated as “4HBA”) (20 25 parts by mass).

Adhesive resin (i)-3: an acrylic polymer (weight average molecular weight: 430,000, glass transition temperature: -31°C) obtained by copolymerizing 2EHA (60 parts by mass), methyl methacrylate (hereinafter abbreviated as “MMA”) (30 parts by mass) and HEA (10 parts by mass).

- 5 Adhesive resin (i)-4: an acrylic polymer (weight average molecular weight: 720,000, glass transition temperature: -27°C) obtained by copolymerizing lauryl acrylate (hereinafter abbreviated as “LA”) (80 parts by mass) and HEA (20 parts by mass).

- Crosslinking agent

- 10 Crosslinking agent (ii)-1: a tolylene diisocyanate trimer adduct of trimethylolpropane (“Coronate L” manufactured by Tosoh Corporation).

- Photopolymerization initiator

Photopolymerization initiator (iii)-1: 1-hydroxycyclohexyl phenyl ketone (“Irgacure (registered trademark) 184” manufactured by BASF Corporation).

[0106]

- 15 [Example 1]

<Production of semiconductor processing sheet>

(Production of pressure-sensitive adhesive composition)

- 20 The crosslinking agent (ii)-1 (30.16 parts by mass) was added to the adhesive resin (i)-1 (100 parts by mass), and the resulting mixture was stirred at 23°C to obtain a non-energy ray-curable pressure-sensitive adhesive composition.

It should be noted that all the numbers of blended parts by mass shown here are values in terms of solid content.

The respective components and the added amounts thereof are shown in Table 1.

It should be noted that the description “-” in the section of blended components in Table

- 25 1 means that the component is not blended.

[0107]

(Production of semiconductor processing sheet)

The pressure-sensitive adhesive composition obtained as described above was applied to a release-treated surface of a release film (“SP-PET 381031” manufactured by Lintec Corporation, thickness: 38 μm) which was a polyethylene terephthalate film whose one side had been subjected to a release treatment through a silicone treatment, and heated and dried at 120°C for 2 minutes to form a pressure-sensitive adhesive layer having a thickness of 10 μm .

Subsequently, a low-density polyethylene (LDPE) film having a thickness of 110 μm was laminated onto the exposed surface of the pressure-sensitive adhesive layer as a base material to obtain a semiconductor processing sheet provided with a release film.

[0108]

<Evaluation of semiconductor processing sheet>

(Effect of suppressing floating / scattering of semiconductor chip with film adhesive)

Using a dicing apparatus (“DFD 6361” manufactured by DISCO Corporation), half-cut dicing was carried out to form grooves by making cuts from the surface to a depth of 80 μm with a dicing blade so as to draw a square having a size of 10 mm $\times$ 10 mm on a mirror surface of an 8-inch silicon wafer (thickness: 720 μm). At this time, “27 HECC” manufactured by DISCO Corporation was used as the dicing blade, the moving speed and the rotational speed of this dicing blade were set to 50 mm/sec and 40,000 rpm, respectively.

Subsequently, using a tape laminator (“RAD-3510” manufactured by Lintec Corporation), a back grinding tape (“ADWILL E-3125 KN” manufactured by Lintec Corporation) was adhered under normal temperature (23°C) through the adhesive layer

thereof to the mirror surface of the silicon wafer on which the above-mentioned grooves had been formed.

Then, using a grinder ("DFG 8760" manufactured by DISCO Corporation), the surface of the silicon wafer opposite to the mirror surface on which the grooves described above had been formed was ground. At this time, grinding was performed so that the thickness of the silicon wafer became 50 μm , and at the same time, the silicon wafer was divided into individual silicon chips. The obtained silicon chips were fixed on the back grinding tape with a space of about 30 μm from each other.

Subsequently, a film adhesive ("ADWILL LE 61-25*" manufactured by Lintec Corporation, thickness: 25 μm) heated to 60°C was adhered to the ground surface of the obtained silicon chip, and furthermore, the semiconductor processing sheet obtained as described above was adhered through the pressure-sensitive adhesive layer thereof to this film adhesive under normal temperature (23°C) to obtain a laminate.

Then, the obtained laminate was adhered and fixed to a ring frame for dicing through the exposed surface of the pressure-sensitive adhesive layer thereof, and the back grinding tape was peeled off from the silicon chip, thereby obtaining a test piece of a laminated structure in which an uncut film adhesive is laminated on a pressure-sensitive adhesive layer of the semiconductor processing sheet provided with the pressure-sensitive adhesive layer on a base material, and a plurality of semiconductor chips that had been divided into individual pieces in advance were are provided in an aligned state on the film adhesive.

[0109]

The test piece obtained as described above was set in an expansion unit of an expander ("ME-300B" manufactured by JCM Co., Ltd.), and the semiconductor processing sheet and the film adhesive were expanded in an environment of 0°C under

conditions of an expansion amount (expanding amount) of 10 mm, and an expansion rate (expansion speed) of 10 mm/sec to cut the film adhesive along the outer shape of the silicon chip. That is, here, the semiconductor processing sheet obtained as described above was used as an expansion sheet.

5 Then, the presence or absence of floating from the pressure-sensitive adhesive layer and the presence or absence of scattering were visually confirmed for the silicon chip provided with the already cut film adhesive (semiconductor chip with a film adhesive), and if these abnormalities were not observed at all, the effect of suppressing floatation / scattering was evaluated as satisfactory (A), and if any of these abnormalities
10 were observed even to a slight extent, the effect of suppressing floating / scattering was evaluated as unsatisfactory (B). The results are shown in the section of “suppression of floating / scattering of semiconductor chip” in Table 1.

[0110]

(Pick-up suitability of semiconductor chip with film adhesive)

15 Using a pickup/ die bonding apparatus (“BESTEM D02” manufactured by Canon Machinery Inc.), the semiconductor chip with the film adhesive in which no abnormality was observed after being evaluated for the “effect of suppressing floating / scattering of the semiconductor chip with the film adhesive” as described above was
20 picked up 30 times by a 1 pin thrusting method under the conditions of a push-up amount of 200 μm , a push-up rate of 20 mm/min and a lifting latency of 300 msec. Then, if the pickup processes were successful in all 30 attempts, the pick-up suitability was evaluated as satisfactory (A), and if the pickup process failed one or more times, the pick-up suitability was evaluated as unsatisfactory (B). The results are shown in the section of
25 “pick-up suitability” in Table 1.

[0111]

(Storage elastic modulus of laminate composed of pressure-sensitive adhesive layer)

Using the semiconductor processing sheet obtained as described above, a laminate was produced by laminating a plurality of pressure-sensitive adhesive layers from which the base material had been peeled off so that the total thickness was 200 μm .

- 5 Then, using a dynamic viscoelasticity measuring device (“DMA Q800” manufactured by TA Instruments, Inc.) under conditions of a rate of temperature increase of 10°C/min, a frequency of 11 Hz and a temperature of -50 to 50°C, the storage elastic modulus (MPa) of the laminate at 0°C was measured. The results are shown in the section of “storage elastic modulus” in Table 1.

10 [0112]

(Adhesive force of pressure-sensitive adhesive layer)

- The semiconductor processing sheet obtained as described above was cut to a size of 25 mm $\times$ 150 mm and adhered to a mirror surface of a silicon wafer under normal temperature (23°C) through the pressure-sensitive adhesive layer thereof. Then, while
- 15 the temperature conditions remained unchanged, the so-called 180° peeling was performed in which the semiconductor processing sheet was peeled off at a peeling rate of 300 mm/min, so that the surfaces of the pressure-sensitive adhesive layer and the silicon wafer that had been brought into contact with each other formed an angle of 180°, and the peel force at this time was measured, and the measured value was taken as the
- 20 adhesive force (mN / 25 mm). The results are shown in the section of “adhesive force” in Table 1.

[0113]

[Examples 2 to 4, Comparative Examples 1 to 3]

<Production and evaluation of semiconductor processing sheet>

- 25 A semiconductor processing sheet was produced and evaluated in the same

manner as in Example 1 except that the blended components and the added amounts thereof at the time of producing the pressure-sensitive adhesive composition were as shown in Table 1. The results are shown in Table 1.

It should be noted that although the pressure-sensitive adhesive layer in Comparative Example 3 is energy ray (ultraviolet)-curable as is apparent from the components contained in the pressure-sensitive adhesive composition, curing through energy ray irradiation is not carried out during a period from the formation of the pressure-sensitive adhesive layer to the evaluation of the semiconductor processing sheet as described above.

10 [0114]

[Table 1]

			Ex. 1	Ex. 2	Ex. 3	Ex. 4	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3
Blended components of pressure-sensitive adhesive composition (parts by mass)	Adhesive resin	(i)-1	100	100	-	100	-	100	-
		(i)-2	-	-	100	-	-	-	-
		(i)-3	-	-	-	-	100	-	-
		(i)-4	-	-	-	-	-	-	100
	Crosslinking agent	(ii)-1	30.16	26.39	37.70	22.62	18.85	37.70	7.00
	Photopolymerization initiator	(iii)-1	-	-	-	-	-	-	3
Evaluation results	Suppression of floating / scattering of semiconductor chip		A	A	A	A	B	B	A
	Pick-up suitability		A	A	A	A	A	A	B
	Storage elastic modulus (MPa)		873	692	994	533	1,634	1,218	1
	Adhesive force (mN / 25 mm)		94	120	55	194	95	68	534

[0115]

As is apparent from the above results, in Examples 1 to 4, the storage elastic modulus of the laminate at 0°C was 994 MPa or less, and at the time of cutting the film adhesive by expansion, floating and scattering of the semiconductor chip with the film adhesive from the pressure-sensitive adhesive layer were completely suppressed. In addition, the adhesive force of the pressure-sensitive adhesive layer with respect to the semiconductor wafer was 194 mN / 25 mm or less, and the semiconductor chip with the

film adhesive was excellent in pick-up suitability without curing through energy ray irradiation or the like.

[0116]

On the other hand, in Comparative Examples 1 and 2, the storage elastic
5 modulus of the laminate at 0°C was 1,218 MPa or more, and floating and scattering of the semiconductor chip with the film adhesive were not suppressed.

Further, in Comparative Example 3, the adhesive force of the pressure-sensitive adhesive layer with respect to the semiconductor wafer was as large as 534 mN / 25 mm, and the pick-up suitability of the semiconductor chip with the film adhesive was poor.

10 [0117]

It should be noted that in this case, at the time of evaluating the floating / scattering suppression effect as described above, a silicon chip obtained by performing half-cut dicing of a silicon wafer using a dicing blade is used. However, similar evaluation results are obtained even when a silicon chip is used which is obtained by
15 adopting, for example, the method of forming a modified layer inside the semiconductor wafer (silicon wafer) as described above, instead of such a method of forming grooves in a silicon wafer. This is because, if there is no abnormality in the semiconductor chip used for evaluation, the method of manufacturing a semiconductor chip (the method of dividing a semiconductor wafer) does not affect the above evaluation process.

20

[Industrial Applicability]

[0118]

The present invention is extremely useful industrially because it can be used for manufacturing a semiconductor device.

25

[Reference Signs List]

[0119]

1: Semiconductor processing sheet; 11: Base material; 11a: Surface of base
material; 12: Pressure-sensitive adhesive layer; 12a: Surface of pressure-sensitive
5 adhesive layer; 8: Semiconductor chip; 8b: Back surface of semiconductor chip

[CLAIMS]

[Claim 1]

- A semiconductor processing sheet comprising a pressure-sensitive adhesive
- 5 layer on a base material and having the following characteristics:
- when a thickness of said pressure-sensitive adhesive layer is 200 μm , a storage elastic modulus of said pressure-sensitive adhesive layer having a thickness of 200 μm at 0°C is equal to or less than 1,000 MPa; and
- when said semiconductor processing sheet is adhered to a mirror surface of a
- 10 semiconductor wafer, an adhesive force of said pressure-sensitive adhesive layer with respect to said mirror surface is equal to or less than 200 mN / 25 mm.

[Claim 2]

- The semiconductor processing sheet according to Claim 1, wherein said
- 15 pressure-sensitive adhesive layer is non-energy ray-curable.

[Claim 3]

- The semiconductor processing sheet according to Claim 1 or 2, further comprising a film adhesive on said pressure-sensitive adhesive layer.