

DESCRIPTION

Title of Invention

DICING SHEET

5

Technical Field

[0001]

The present invention relates to a dicing sheet which can be used in dicing, particularly, Stealth Dicing (registered trademark: the same hereinafter) of a workpiece

10 such as a semiconductor wafer.

Priority is claimed on Japanese Patent Application No. 2014-120034, filed June 10, 2014, the content of which is incorporated herein by reference.

Background Art

15 [0002]

In the past, in the manufacturing of a machined product formed of a flaky body such as a semiconductor chip from a workpiece such as a semiconductor wafer, blade dicing for obtaining a flaky body by cutting the workpiece with a rotary blade while spraying a liquid for washing or the like onto the workpiece has been generally

20 performed. However, in recent years, Stealth Dicing enabling dry division into flaky bodies has been employed (PTL 1).

[0003]

For example, PTL 2 discloses a Stealth Dicing method in which a laminated adhesive sheet (a laminate of two adhesive sheets each formed of a base material and an

25 adhesive layer) is adhered to an extremely thin semiconductor wafer, the semiconductor

wafer is irradiated with laser light from the laminated adhesive sheet side through the laminated adhesive sheet to form a modified portion inside the semiconductor wafer, and then the adhesive sheet is expanded to divide the semiconductor wafer along a dicing line, thereby producing a semiconductor chip.

5 Citation List

Patent Literature

[0004]

[PTL 1] Japanese Patent No. 3762409

[PTL 2] Japanese Unexamined Patent Application, First Publication No.

10 2007-123404

Summary of Invention

Technical Problem

[0005]

15 As described above, in a case in which the workpiece is irradiated with laser light, it is necessary for the laser light to pass through the adhesive sheet and reach the workpiece, and thus the adhesive sheet is required to have laser light transparency.

[0006]

In many cases, a release sheet is laminated on the adhesive layer on the side
20 opposite to the base material in a dicing sheet in order to protect the adhesive layer. When such a dicing sheet is unwound from a rolled state, a surface of the base material on the side opposite to the adhesive layer in the wound dicing sheet may be tightly adhered to a surface of the release sheet on the side opposite to the adhesive layer, and thus blocking may occur and failure may thus occur in the unwinding from the roll, or the
25 base material may be transferred onto the wound release sheet, and thus the workpiece

may not be adhered.

[0007]

The invention is contrived in view of the above-described situation, and an object thereof is to provide a dicing sheet in which it is possible to suppress the
5 occurrence of blocking when the dicing sheet is unwound from a state of being wound in a roll shape, and excellent laser light transparency is thus exhibited when laser light irradiation is performed.

Solution to Problem

[0008]

10 In order to achieve the object, first, the invention provides a dicing sheet including a base material, an adhesive layer which is laminated on the first surface side of the base material, and a release sheet which is laminated on the adhesive layer on the side opposite to the base material, in which an arithmetic mean roughness (Ra1) of a second surface of the base material is 0.2 μm or greater, and an arithmetic mean
15 roughness (Ra2) of the second surface of the base material after the dicing sheet is heated for 2 hours at 130°C is 0.25 μm or less (Invention 1). In this description, the term “sheet” includes, for example, the concept of a long tape.

[0009]

According to the invention (Invention 1), when the dicing sheet is wound in a
20 roll shape, the second surface of the base material is unlikely to be tightly adhered to the release sheet coming into contact with the second surface of the base material, and blocking rarely occurs when the dicing sheet wound in a roll shape is unwound. In addition, when laser light irradiation is performed from the second surface side of the base material after heating of the dicing sheet, laser light passes through the dicing sheet
25 without being scattered by irregularities of the second surface of the base material, and

efficiently reaches the workpiece (semiconductor wafer), and excellent laser light transparency is exhibited.

[0010]

In the invention (Invention 1), the arithmetic mean roughness (Ra2) of the
5 second surface of the base material after the heating is preferably less than the arithmetic mean roughness (Ra1) (Invention 2).

[0011]

In the invention (Inventions 1 and 2), the base material preferably has a melting point of 90°C to 180°C (Invention 3).

10 [0012]

In the invention (Inventions 1 to 3), the base material preferably has a storage elastic modulus of 1 to 100 MPa at 130°C (Invention 4).

[0013]

In the invention (Inventions 1 to 4), the light transmittance of the base material
15 at a wavelength of 1064 nm after the heating is preferably 40% or greater (Invention 5).

[0014]

In the invention (Inventions 1 to 5), the base material is preferably a film formed of a copolymer of ethylene and propylene (Invention 6).

[0015]

20 In the invention (Inventions 1 to 6), the dicing sheet preferably further includes an adhesive layer for a tool which is laminated on a peripheral portion of the adhesive layer on the side opposite to the base material (Invention 7).

Advantageous Effects of Invention

[0016]

25 According to a dicing sheet of the invention, it is possible to suppress the

occurrence of blocking when the dicing sheet is unwound from a state of being wound in a roll shape, and thus excellent laser light transparency is exhibited when laser light irradiation is performed.

5 Brief Description of Drawings

[0017]

FIG. 1 is a cross-sectional view of a dicing sheet according to an embodiment of the invention.

FIG. 2 is a cross-sectional view illustrating an example of use of a dicing sheet
10 according to an embodiment of the invention, specifically a laminate structure.

FIG. 3 is a cross-sectional view of a dicing sheet according to another embodiment of the invention.

FIG. 4 is a plan view of a dicing sheet produced in an example.

15 Description of Embodiments

[0018]

Hereinafter, embodiments of the invention will be described.

FIG. 1 is a cross-sectional view of a dicing sheet according to an embodiment of the invention. As illustrated in FIG. 1, a dicing sheet 1 according to this embodiment is
20 provided with a base material 2, an adhesive layer 3 laminated on the first surface side (upper side in FIG. 1) of the base material 2, and a release sheet 6 laminated on the adhesive layer 3. The release sheet 6 is removed by being released when using the dicing sheet 1, and serves to protect the adhesive layer 3 until being removed. Here, a surface of the base material 2 on the side of the adhesive layer 3 is referred to as “first
25 surface”, and a surface on the opposite side (lower surface in FIG. 1) is referred to as

“second surface”.

[0019]

For example, the dicing sheet 1 according to this embodiment is used to hold a semiconductor wafer when subjecting the semiconductor wafer as a workpiece to dicing,
5 but the use thereof is not limited thereto.

[0020]

Usually, the dicing sheet 1 according to this embodiment is formed to be long and wound in a roll shape to be used in a roll-to-roll manner.

[0021]

10 1. Base Material

The second surface of the base material 2 (hereinafter, may be referred to as “rear surface of the base material 2”) has an arithmetic mean roughness (Ra1) of 0.2 μm or greater. After the dicing sheet 1 is heated for 2 hours at 130°C and cooled to room temperature (hereinafter, may be simply referred to as “after heating”), the rear surface of
15 the base material 2 has an arithmetic mean roughness (Ra2) of 0.25 μm or less. The arithmetic mean roughness (Ra1) of the rear surface of the base material 2 is an arithmetic mean roughness of the rear surface of the base material 2 before heating for 2 hours at 130°C, and hereinafter, may be referred to as “arithmetic mean roughness (Ra1) before heating”. The arithmetic mean roughness (Ra1) before heating and the
20 arithmetic mean roughness (Ra2) after heating are measured based on JIS B0601: 2001, and details of the measuring method are as shown in test examples to be described later.

[0022]

The dicing sheet 1 wound in a roll shape is unwound before heating, and laser light irradiation of Stealth Dicing is performed after heating.

[0023]

When the arithmetic mean roughness (Ra1) of the rear surface of the base material 2 before heating is 0.2 μm or greater, the rear surface of the base material 2 is unlikely to be tightly adhered to a surface of the release sheet 6 on the side opposite to the adhesive layer 3. Accordingly, when the dicing sheet 1 wound in a roll shape is unwound, blocking rarely occurs. Accordingly, it is possible to suppress the occurrence of failure in the unwinding due to the blocking, or failure in the adhesion of the workpiece due to the transfer of the base material 2 onto the wound release sheet 6.

[0024]

From the above-described viewpoint, the arithmetic mean roughness (Ra1) of the rear surface of the base material 2 before heating is preferably 0.25 μm or greater, and particularly preferably 0.30 μm or greater.

[0025]

Here, the upper limit of the arithmetic mean roughness (Ra1) of the rear surface of the base material 2 before heating is preferably 1.0 μm or less, particularly preferably 0.8 μm or less, and even more preferably 0.7 μm or less. When the arithmetic mean roughness (Ra1) before heating is greater than 1.0 μm , there is a concern that it may be difficult to satisfy the above-described arithmetic mean roughness (Ra2) after heating.

That is, the arithmetic mean roughness (Ra1) of the rear surface of the base material 2 before heating is preferably in a range of 0.25 to 1.0 μm , and more preferably in a range of 0.30 to 0.7 μm .

[0026]

When the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating depending on the conditions is 0.25 μm or less, laser light passes

through the dicing sheet 1 without being scattered by irregularities of the rear surface of the base material 2, and efficiently reaches the workpiece (semiconductor wafer) when laser light irradiation is performed from the rear surface side of the base material 2 after heating of the dicing sheet 1, and excellent laser light transparency is exhibited.

5 Accordingly, excellent workpiece divisibility by Stealth Dicing is exhibited.

[0027]

From the above-described viewpoint, the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating is preferably 0.20 μm or less, and particularly preferably 0.10 μm or less.

10 [0028]

Here, the lower limit of the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating is not particularly limited as long as the arithmetic mean roughness (Ra1) before heating is satisfied. The lower limit is usually 0.001 μm or greater, and preferably 0.01 μm or greater.

15 That is, the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating is preferably in a range of 0.001 to 0.20 μm , and more preferably in a range of 0.01 to 0.10 μm .

[0029]

In addition, in the base material 2, the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating depending on the conditions is preferably less than the arithmetic mean roughness (Ra1) before heating. Due to such a setting, it is possible to improve both of the effect of suppressing the blocking before heating and the laser light transparency after heating.

[0030]

The method of adjusting the arithmetic mean roughness (Ra1) of the rear surface of the base material 2 before heating is not particularly limited. In general, the adjustment can be performed by changing the surface roughness of the surface of the roll which is used in the preparation of the resin film constituting the base material 2, or by
 5 blending a filler which becomes flat by sandblasting or melting through heating.

[0031]

As a method of adjusting the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating, the base material 2 is preferably formed of a resin film (a film containing a resin-based material as a main material) having a melting
 10 point in a predetermined range, and particularly preferably formed of a resin film having a melting point in a predetermined range and a storage elastic modulus at 130°C in a predetermined range.

[0032]

The melting point of the base material 2 is preferably 90°C to 180°C,
 15 particularly preferably 100°C to 160°C, and even more preferably 110°C to 150°C.

When the melting point of the base material 2 is in the above range, the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating is easily adjusted in the above range. When the melting point of the base material 2 is lower than 90°C, there is a concern that the base material 2 may be completely melted during heating.

20 When the melting point of the base material 2 is higher than 180°C, there is a concern that the arithmetic mean roughness of the rear surface of the base material 2 may not be changed by heating for 2 hours at 130°C. The melting point is measured based on JIS K7121 (ISO3146), and details of the measuring method are as shown in test examples to be described later.

[0033]

The method of adjusting the melting point of the base material 2 is not particularly limited. In general, the melting point can be adjusted according to a melting point of the resin material to be used. In addition, the melting point of the base
5 material 2 can be adjusted to an arbitrary melting point by mixing a plurality of resin materials having different melting points or by copolymerizing a plurality of monomers.

[0034]

The storage elastic modulus of the base material 2 at 130°C is preferably 1 to 100 MPa, particularly preferably 2 to 80 MPa, and even more preferably 5 to 50 MPa.
10 When the storage elastic modulus of the base material 2 at 130°C is in the above range, the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating is easily adjusted in the above range. When the storage elastic modulus of the base material 2 at 130°C is less than 1 MPa, there is a concern that the base material 2 may be greatly deformed during the heating treatment, and thus the workpiece may not
15 be held. When the storage elastic modulus of the base material 2 at 130°C is greater than 100 MPa, there is a concern that the arithmetic mean roughness of the rear surface of the base material 2 may not be changed even by heating for 2 hours at 130°C. The method of measuring the storage elastic modulus is as shown in test examples to be described later.

20 [0035]

The method of adjusting the storage elastic modulus of the base material 2 at 130°C is not particularly limited. In general, the storage elastic modulus can be adjusted mainly according to a storage elastic modulus of the resin material to be used. In addition, in general, the storage elastic modulus tends to increase when the molecular

weight is high even with the same chemical structure, and the storage elastic modulus also tends to increase by crosslinking or a narrow molecular weight distribution. Based on these tendencies, the storage elastic modulus of the base material 2 can be adjusted to an arbitrary storage elastic modulus.

5 [0036]

In a case in which laser light with a wavelength of 1064 nm is used in Stealth Dicing or the like, the light transmittance of the base material 2 at a wavelength of 1064 nm after heating is preferably 40% or greater, particularly preferably 50% or greater, and even more preferably 60% or greater. When the light transmittance of the base material
10 2 at a wavelength of 1064 nm after heating is in the above range, excellent workpiece divisibility by Stealth Dicing is exhibited. In this embodiment, the above-described light transmittance can be realized by adjusting the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating in the above range. As for the light transmittance of the base material 2 at a wavelength of 1064 nm after heating, the higher,
15 the better. The maximum feasible light transmittance is about 99%.

[0037]

Specific example of the resin film constituting the base material 2 include polyethylene films such as low-density polyethylene (LDPE) films, linear low-density polyethylene (LLDPE) films, and high-density polyethylene (HDPE) films,
20 polyolefin-based films such as polypropylene films, ethylene-propylene copolymer films, polybutene films, polybutadiene films, polymethylpentene films, ethylene-norbornene copolymer films, and norbornene resin films; ethylene-based copolymer films such as ethylene-vinyl acetate copolymer films, ethylene-(meth)acrylic acid copolymer films, and ethylene-(meth)acrylic acid ester copolymer films; polyvinyl chloride-based films
25 such as polyvinyl chloride films and vinyl chloride copolymer films; polyester-based

films such as polyethylene terephthalate films and polybutylene terephthalate films; polyurethane films; polyimide films; polystyrene films; polycarbonate films; and fluoro resin films. Modified films such as crosslinked films and ionomer films thereof are also used. Laminated films in which the films are laminated may also be used. In this description, the term “(meth)acrylic acid” means both of an acrylic acid and a methacrylic acid. The same applies to other similar terms.

[0038]

In the case of a laminated film, for example, a film in which the arithmetic mean roughness is changed before or after heating is preferably disposed on the rear surface side of the base material 2, and a heat-resistant film which is not deformed even at a high temperature is preferably disposed on the base material 2 on the side of the adhesive layer 3.

[0039]

Among the films, polyolefin-based films are preferred, polyethylene films, polypropylene films, and ethylene-propylene copolymer films are particularly preferred, and ethylene-propylene copolymer films are even more preferred. According to these resin films, the above-described physical properties are easily satisfied, and particularly, in the case of ethylene-propylene copolymer films, the above-described physical properties are easily satisfied by adjusting a copolymerization ratio between an ethylene monomer and a propylene monomer. In addition, these resin films are also preferred from the viewpoint of workpiece adhesiveness and chip releasability.

[0040]

If desired, one or both surfaces of the resin film can be subjected to a surface treatment by an oxidation method, a roughening method, or the like, or a primer treatment in order to improve adhesion to the adhesive layer 3 to be laminated on a

surface of the resin film. Examples of the oxidation method include a corona discharge treatment, a plasma discharge treatment, a chromium oxidation treatment (wet type), a flame treatment, a hot air treatment, ozone treatment, and an ultraviolet irradiation treatment. Examples of the roughening method include a sandblasting method and a spray treatment method.

[0041]

The base material 2 may contain various additives such as a colorant, a flame retardant, a plasticizer, an antistatic agent, a lubricant, and a filler in the resin film.

[0042]

The thickness of the base material 2 is not particularly limited as long as the dicing sheet 1 can appropriately function in each process in which the dicing sheet 1 is used. The thickness is preferably 20 to 450 μm , particularly preferably 25 to 400 μm , and even more preferably 50 to 350 μm .

[0043]

2. Adhesive Layer

The adhesive layer 3 included in the dicing sheet 1 according to this embodiment may be formed of a non-energy ray-curable adhesive or an energy ray-curable adhesive. The non-energy ray-curable adhesive preferably has desired adhesive power and re-releasability, and for example, acrylic adhesives, rubber-based adhesives, silicone-based adhesives, urethane-based adhesives, polyester-based adhesives, polyvinyl ether-based adhesives, and the like can be used. Among these, acrylic adhesives are preferred which can effectively suppress falling of the workpiece or the machined product in a dicing process and the like.

[0044]

Regarding the energy ray-curable adhesive, the adhesive power thereof is

reduced by energy ray irradiation, and thus when the dicing sheet 1 is separated from the workpiece or the machined product, these can be easily separated from each other by energy ray irradiation.

[0045]

5 The energy ray-curable adhesive constituting the adhesive layer 3 may mainly contain an energy ray-curable polymer, or a mixture of a polymer which is not energy ray-curable and an energy ray-curable polyfunctional monomer and/or oligomer.

[0046]

 A case in which the energy ray-curable adhesive mainly contains an energy
10 ray-curable polymer will be described below.

[0047]

 The energy ray-curable polymer is preferably a (meth)acrylic acid ester (co)polymer (A) (hereinafter, may be referred to as “energy ray-curable polymer (A)”) with an energy ray-curable functional group (energy ray-curable group) introduced to a
15 side chain thereof. This energy ray-curable polymer (A) is preferably obtained by reacting a (meth)acrylic copolymer (a1) having a functional group-containing monomer unit with an unsaturated group-containing compound (a2) having a substituent which is bonded to the functional group of the (meth)acrylic copolymer (a1).

[0048]

20 The acrylic copolymer (a1) includes a constituent unit derived from a functional group-containing monomer and a constituent unit derived from a (meth)acrylic acid ester monomer or a derivative thereof.

[0049]

 The functional group-containing monomer as a constituent unit of the acrylic
25 copolymer (a1) preferably has a polymerizable double bond and a functional group such

as a hydroxyl group, an amino group, a substituted amino group, or an epoxy group in a molecule.

[0050]

Specific examples of the functional group-containing monomer include

- 5 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 3-hydroxypropyl (meth)acrylate, and 4-hydroxybutyl (meth)acrylate. These are used alone or in combination of two or more types thereof.

[0051]

- As the (meth)acrylic acid ester monomer constituting the acrylic copolymer (a1),
10 alkyl (meth)acrylate with an alkyl group having 1 to 20 carbon atoms, cycloalkyl (meth)acrylate, and benzyl (meth)acrylate are used. Among these, alkyl (meth)acrylate with an alkyl group having 1 to 18 carbon atoms, such as methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, n-butyl (meth)acrylate, and 2-ethylhexyl (meth)acrylate, is particularly preferably used.

15 [0052]

- The acrylic copolymer (a1) contains the constituent unit derived from a functional group-containing monomer at a ratio of usually 3% to 100% by mass, preferably 4% to 80% by mass, and more preferably 5% to 40% by mass with respect to the total mass of the acrylic copolymer (a1), and contains the constituent unit derived
20 from a (meth)acrylic acid ester monomer or a derivative thereof at a ratio of usually 0% to 97% by mass, and preferably 60% to 95% by mass with respect to the total mass of the acrylic copolymer (a1).

[0053]

- The acrylic copolymer (a1) is obtained by copolymerizing the functional
25 group-containing monomer and the (meth)acrylic acid ester monomer or a derivative

thereof in the usual way as described above. Other than these monomers, dimethylacrylamide, vinyl formate, vinyl acetate, styrene, and the like may be copolymerized.

[0054]

5 The energy ray-curable polymer (A) is obtained by reacting the acrylic copolymer (a1) having a functional group-containing monomer unit with the unsaturated group-containing compound (a2) having a substituent which is bonded to the functional group of the acrylic copolymer (a1).

[0055]

10 The substituent of the unsaturated group-containing compound (a2) can be appropriately selected according to the type of the functional group of the functional group-containing monomer unit of the acrylic copolymer (a1). For example, in a case in which the functional group is a hydroxyl group, an amino group, or a substituted amino group, the substituent is preferably an isocyanate group or an epoxy group, and in
15 a case in which the functional group is an epoxy group, the substituent is preferably an amino group, a carboxyl group, or an aziridinyll group.

[0056]

 The number of energy ray-polymerizable carbon-carbon double bonds contained in the unsaturated group-containing compound (a2) is 1 to 5, and preferably 1 or 2 per
20 molecule. Specific examples of such an unsaturated group-containing compound (a2) include 2-methacryloyloxyethyl isocyanate, m-isopropenyl- α,α -dimethylbenzyl isocyanate, methacryloyl isocyanate, allyl isocyanate, 1,1-(bisacryloyloxymethyl)ethyl isocyanate; acryloyl monoisocyanate compounds each obtained by reacting a diisocyanate compound or a polyisocyanate compound with hydroxyethyl
25 (meth)acrylate; acryloyl monoisocyanate compounds each obtained by reacting a

diisocyanate compound or a polyisocyanate compound, a polyol compound, and hydroxyethyl (meth)acrylate; glycidyl (meth)acrylate; (meth)acrylic acid, 2-(1-aziridiny)ethyl (meth)acrylate, 2-vinyl-2-oxazoline, and 2-isopropenyl-2-oxazoline.

[0057]

5 The unsaturated group-containing compound (a2) is used usually in a proportion of 10 to 100 equivalents, and preferably 20 to 95 equivalents per 100 equivalents of the functional group-containing monomer of the acrylic copolymer (a1).

[0058]

 In the reaction of the acrylic copolymer (a1) with the unsaturated
10 group-containing compound (a2), the temperature, pressure, solvent, and time of the reaction, the presence or absence of a catalyst, and the type of the catalyst can be appropriately selected according to a combination of the functional group and the substituent. Accordingly, the functional group present in the acrylic copolymer (a1) reacts with the substituent in the unsaturated group-containing compound (a2), the
15 unsaturated group is introduced to a side chain in the acrylic copolymer (a1), and thus the energy ray-curable polymer (A) is obtained.

[0059]

 The weight-average molecular weight of the energy ray-curable polymer (A) obtained in this manner is preferably 10,000 or greater, particularly preferably 150,000 to
20 1,500,000, and even more preferably 200,000 to 1,000,000. In this description, the weight-average molecular weight (Mw) is a value measured by gel permeation chromatography (GPC) in terms of polystyrene.

[0060]

 Even in a case in which the energy ray-curable adhesive mainly contains an
25 energy ray-curable polymer, the energy ray-curable adhesive may further contain an

energy ray-curable monomer and/or oligomer (B).

[0061]

As the energy ray-curable monomer and/or oligomer (B), for example, an ester of a polyhydric alcohol and a (meth)acrylic acid can be used.

5 [0062]

Examples of the energy ray-curable monomer and/or oligomer (B) include monofunctional acrylic acid esters such as cyclohexyl (meth)acrylate and isobornyl (meth)acrylate, polyfunctional acrylic acid esters such as trimethylolpropane tri(meth)acrylate, pentaerythritol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, 10 dipentaerythritol hexa(meth)acrylate, 1,4-butanediol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, polyethylene glycol di(meth)acrylate, and dimethylol tricyclodecane di(meth)acrylate, polyester oligo(meth)acrylates, and polyurethane oligo(meth)acrylates.

[0063]

In a case in which the energy ray-curable monomer and/or oligomer (B) is 15 blended, the content of the energy ray-curable monomer and/or oligomer (B) in the energy ray-curable adhesive is preferably 5% to 80% by mass, and particularly preferably 20% to 60% by mass with respect to the total mass of the energy ray-curable adhesive.

[0064]

Here, in a case in which ultraviolet rays are used as the energy rays for curing 20 the energy ray-curable resin composition, it is preferable to add a photopolymerization initiator (C), and by the use of this photopolymerization initiator (C), it is possible to reduce the polymerization curing time and the amount of light irradiation.

[0065]

Specific examples of the photopolymerization initiator (C) include 25 benzophenone, acetophenone, benzoin, benzoin methyl ether, benzoin ethyl ether,

benzoin isopropyl ether, benzoin isobutyl ether, benzoin benzoate, benzoin methyl benzoate, benzoin dimethyl ketal, 2,4-diethylthioxanthone, 1-hydroxy cyclohexyl phenyl ketone, benzyl diphenyl sulfide, tetramethylthiuram monosulfide, azobisisobutyronitrile, benzyl, dibenzyl, diacetyl, β -chloroanthraquinone, (2,4,6-trimethylbenzyl
 5 diphenyl)phosphine oxide, 2-benzothiazole-N,N-diethyldithiocarbamate, oligo{2-hydroxy-2-methyl-1-[4-(1-propenyl)phenyl]propanone}, and 2,2-dimethoxy-1,2-diphenylethan-1-one. These may be used alone or in combination of two or more types thereof.

[0066]

10 The photopolymerization initiator (C) is preferably used in an amount within a range of 0.1 to 10 parts by mass, and particularly preferably 0.5 to 6 parts by mass with respect to 100 parts by mass of the energy ray-curable copolymer (A) (with respect to 100 parts by mass of the total amount of the energy ray-curable copolymer (A) and the energy ray-curable monomer and/or oligomer (B) in a case in which the energy
 15 ray-curable monomer and/or oligomer (B) is blended).

[0067]

In the energy ray-curable adhesive, other components may be appropriately blended other than the above-described components. Examples of other components include a polymer component or oligomer component (D) which is not energy
 20 ray-curable, and a crosslinking agent (E).

[0068]

Examples of the polymer component or oligomer component (D) which is not energy ray-curable include polyacrylic esters, polyesters, polyurethanes, polycarbonates, and polyolefins, and a polymer or oligomer having a weight-average molecular weight
 25 (Mw) of 3,000 to 2,500,000 is preferred.

[0069]

As the crosslinking agent (E), a polyfunctional compound which is reactive with the functional group of the energy ray-curable copolymer (A) or the like can be used.

Examples of such a polyfunctional compound include isocyanate compounds, epoxy

5 compounds, amine compounds, melamine compounds, aziridine compounds, hydrazine compounds, aldehyde compounds, oxazoline compounds, metal alkoxide compounds, metal chelate compounds, metal salts, ammonium salts, and reactive phenolic resins.

[0070]

By blending these other components (D) and (E) in the energy ray-curable

10 adhesive, the adhesive properties and releasability before curing, the strength after curing, the adhesiveness to other layers, the storage stability, and the like can be improved in the adhesive layer 3. The amount of these other components to be blended is not particularly limited, and is appropriately determined in a range of 0 to 40 parts by mass with respect to 100 parts by mass of the energy ray-curable copolymer (A).

15 [0071]

Next, a case in which the energy ray-curable adhesive mainly contains a mixture of a polymer component which is not energy ray-curable and an energy ray-curable polyfunctional monomer and/or oligomer will be described below.

[0072]

20 As the polymer component which is not energy ray-curable, for example, the same components as those of the above-described acrylic copolymer (a1) can be used.

The content of the polymer component which is not energy ray-curable in the energy ray-curable resin composition is preferably 20% to 99.9% by mass, and particularly preferably 30% to 80% by mass with respect to the total mass of the energy ray-curable

25 resin composition.

[0073]

As the energy ray-curable polyfunctional monomer and/or oligomer, the same material as the above-described component (B) is selected. Regarding the blending ratio between the polymer component which is not energy ray-curable and the energy ray-curable polyfunctional monomer and/or oligomer, the polyfunctional monomer and/or oligomer is preferably 10 to 150 parts by mass, and particularly preferably 25 to 100 parts by mass with respect to 100 parts by mass of the polymer component.

[0074]

Also in this case, as described above, the photopolymerization initiator (C) and the crosslinking agent (E) can be appropriately blended.

[0075]

The thickness of the adhesive layer 3 is not particularly limited as long as the dicing sheet 1 can appropriately function in each process in which the dicing sheet 1 is used. Specifically, the thickness of the adhesive layer 3 is preferably 1 to 50 μm , particularly preferably 2 to 30 μm , and even more preferably 3 to 20 μm .

[0076]

3. Release Sheet

In this embodiment, the release sheet 6 protects the adhesive layer 3 until the dicing sheet 1 is used. In this embodiment, the release sheet 6 is directly laminated on the adhesive layer 3, but the configuration is not limited thereto. Other layers (die bonding film and the like) may be laminated on the adhesive layer 3, and the release sheet 6 may be laminated on the above-described other layers.

[0077]

The configuration of the release sheet 6 is optional, and one obtained by subjecting a plastic film to a release treatment using a release agent or the like is

exemplified. Specific examples of the plastic film include polyester films such as polyethylene terephthalate, polybutylene terephthalate, and polyethylene naphthalate, and polyolefin films such as polypropylene and polyethylene. As the release agent, silicone-based agents, fluorine-based agents, long chain alkyl-based agents, and the like
5 can be used. Among these, silicone-based agents with which stabilized performance is obtained at a low cost are preferred. The thickness of the release sheet 6 is not particularly limited, and is usually about 20 to 250 μm .

[0078]

4. Method of Manufacturing Dicing Sheet

10 In order to manufacture the dicing sheet 1, for example, a coating agent for an adhesive layer containing an adhesive constituting the adhesive layer 3 and if desired, a solvent is coated and dried on a release surface of the release sheet 6 to form the adhesive layer 3. Then, the base material 2 is pressure-bonded to the exposed surface of the adhesive layer 3 to obtain the dicing sheet 1 formed of the base material 2, the adhesive
15 layer 3, and the release sheet 6.

[0079]

In this embodiment, the adhesive layer 3 can be preferably adhered to a tool such as a ring frame. In this case, when the adhesive layer 3 is formed of an energy ray-curable adhesive, the energy ray-curable adhesive is preferably not cured.
20 Accordingly, a high adhesive force to a tool such as a ring frame can be maintained.

[0080]

If desired, the laminate of the base material 2 and the adhesive layer 3 may be subjected to cutting by a cutting blade or half-cutting by laser irradiation from the side of the first release sheet or the second release sheet so as to be formed into a desired shape
25 such as a circle corresponding to a workpiece (semiconductor wafer). In this case, extra

portions produced by half-cutting may be appropriately removed.

[0081]

5. Method of Using Dicing Sheet

As an example using the dicing sheet 1 according to this embodiment, a method
5 of manufacturing a chip from a semiconductor wafer as a workpiece will be described
below.

[0082]

First, a dicing sheet 1 wound in a roll shape is unwound to adhere the adhesive
layer 3 of the dicing sheet 1 to a semiconductor wafer 7 and to a ring frame 8 as
10 illustrated in FIG. 2.

[0083]

In the dicing sheet 1 according to this embodiment, when the arithmetic mean
roughness (Ra1) of the rear surface of the base material 2 before heating is 0.2 μm or
greater, blocking rarely occurs at the time of unwinding, and thus failure in the
15 unwinding or failure in the adhesion of the workpiece is suppressed.

[0084]

After that, a laminate structure (hereinafter, may be referred to as “laminate
structure L”) with a configuration in which the semiconductor wafer 7 is laminated on
the surface of the expandable dicing sheet 1 on the side of the adhesive layer 3 is
20 obtained. The laminate structure L illustrated in FIG. 2 is further provided with the ring
frame 8.

[0085]

The dicing sheet 1 is subjected to a heating treatment. In this case, the heating
temperature is preferably 50°C to 200°C, and particularly preferably 90°C to 150°C, and
25 the heating time is preferably 0.1 to 10 hours, and particularly preferably 1 to 3 hours.

In the dicing sheet 1 according to this embodiment, the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 is 0.25 μm or less through such a heating treatment.

[0086]

5 Next, the laminate structure L is subjected to a Stealth Dicing process. Specifically, the laminate structure L is installed in a laser irradiation apparatus for division, and a position of a surface of the semiconductor wafer 7 is detected. Then, the semiconductor wafer 7 is irradiated with laser light through the dicing sheet 1 to form a modified layer inside the semiconductor wafer 7. Thereafter, an expanding process is
10 performed to expand the dicing sheet 1, and thus a force (tension in a principal plane direction) is applied to the semiconductor wafer 7. As a result, the semiconductor wafer 7 adhered to the dicing sheet 1 is divided, and thus a chip is obtained. Then, the chip is picked up from the dicing sheet 1 using a pick-up device.

[0087]

15 The dicing sheet 1 according to this embodiment is excellent in laser light transparency since the arithmetic mean roughness (Ra2) of the rear surface of the base material 2 after heating is 0.25 μm or less. Accordingly, in the Stealth Dicing process, the dicing sheet is excellent in workpiece divisibility by Stealth Dicing.

[0088]

20 6. Another Embodiment of Dicing Sheet

FIG. 3 is a cross-sectional view of a dicing sheet according to another embodiment of the invention. As illustrated in FIG. 3, a dicing sheet 1A according to this embodiment is provided with a base material 2, an adhesive layer 3 laminated on one surface (upper side in FIG. 1) of the base material 2, an adhesive layer 5 for a tool
25 laminated on a peripheral portion of the adhesive layer 3 on the side opposite to the base

material 2, and a release sheet 6 laminated on the adhesive layer 3 and the adhesive layer 5 for a tool. The adhesive layer 5 for a tool is a layer for adhering the dicing sheet 1 to a tool such as a ring frame. The release sheet 6 protects the adhesive layer 3 and the adhesive layer 5 for a tool until the dicing sheet 1A is used. That is, when the adhesive layer 5 for a tool is applied to the dicing sheet 1 illustrated in FIG. 1, the dicing sheet 1A illustrated in FIG. 3 is provided.

[0089]

The adhesive constituting the adhesive layer 5 for a tool preferably has desired adhesive power and re-releasability, and for example, acrylic adhesives, rubber-based adhesives, silicone-based adhesives, urethane-based adhesives, polyester-based adhesives, polyvinyl ether-based adhesives, and the like can be used. Among these, acrylic adhesives which have high adhesion to a tool such as a ring frame and can effectively suppress falling of the dicing sheet 1A from a ring frame or the like in a dicing process or the like are preferably used as the adhesive layer 5 for a tool. A base material as a core may be interposed inside the adhesive layer 5 for a tool in a thickness direction. In addition, a base material may be present on the adhesive layer 5 for a tool on the side of the adhesive layer 3.

[0090]

The thickness of the adhesive layer 5 for a tool is preferably 5 to 200 μm , and particularly preferably 10 to 100 μm from the viewpoint of adhesiveness to a tool such as a ring frame.

[0091]

The materials and the thicknesses of the members other than the adhesive layer 5 for a tool in the dicing sheet 1A according to this embodiment are the same as those of the members of the above-described dicing sheet 1.

[0092]

As an example of the manufacturing of the dicing sheet 1A, first, a coating agent for an adhesive layer containing an adhesive constituting the adhesive layer 3 and if desired, a solvent is coated and dried on a release surface of the release sheet to form the adhesive layer 3. Then, the base material 2 is pressure-bonded to the exposed surface of the adhesive layer 3 to obtain a laminate formed of the base material 2, the adhesive layer 3, and the release sheet.

[0093]

Here, in a case in which the adhesive layer 3 is formed of an energy ray-curable adhesive, the adhesive layer 3 may be cured by irradiating the adhesive layer 3 with energy rays in this step. In a case in which other layers are laminated, the adhesive layer 3 may be cured after lamination with other layers. In addition, in a case in which the adhesive layer 3 is cured after lamination with other layers, the adhesive layer 3 may be cured before or after the dicing process.

[0094]

As the energy rays, typically, ultraviolet rays, electron rays, and the like are used. The amount of irradiation of energy rays varies depending on the type of energy rays. In a case in which the energy rays are ultraviolet rays, the amount of irradiation of the energy rays is preferably 50 to 1,000 mJ/cm², and particularly preferably 100 to 500 mJ/cm² in terms of light quantity. In a case in which the energy rays are electron rays, the amount of irradiation of the energy rays is about preferably 10 to 1,000 krad.

[0095]

If desired, the laminate of the base material 2 and the adhesive layer 3 may be subjected to half-cutting so as to be formed into a desired shape such as a circle corresponding to a workpiece (semiconductor wafer). In this case, extra portions

produced by half-cutting may be appropriately removed.

[0096]

Next, the release sheet is released from the adhesive layer 3, and the adhesive layer 5 for a tool is formed on the exposed peripheral portion of the adhesive layer 3.

5 The adhesive layer 5 for a tool can also be formed by coating through the same method as that for the adhesive layer 3. Finally, the release sheet 6 is laminated on the exposed surfaces of the adhesive layer 3 and the adhesive layer 5 for a tool to obtain the dicing sheet 1A.

[0097]

10 One method of manufacturing the dicing sheet 1A has been shown as above, but the manufacturing method is not limited thereto. For example, in a case in which the adhesive layer 5 for a tool has a base material, a laminate constituting the adhesive layer 5 for a tool may be formed on the release sheet, and then subjected to half-cutting so as to be formed into a shape such as an annular shape corresponding to a tool, and this
15 laminate may be laminated on the adhesive layer 3.

[0098]

The embodiments described above are described not to limit the invention but to facilitate the understanding of the invention. Accordingly, the respective elements disclosed in the above-described embodiments are intended to include all design
20 modifications or equivalents belonging to the technical scope of the invention.

[0099]

For example, other layers may be interposed between the base material 2 and the adhesive layer 3 in the dicing sheet 1 or 1A. Other layers may be interposed between the adhesive layer 3 and the release sheet 6 in the dicing sheet 1 or 1A. Examples of
25 other layers include a die bonding film. In this case, the dicing sheets 1 and 1A can be

used as a dicing die bonding sheet.

[0100]

In the dicing sheet according to the invention, when the arithmetic mean roughness (Ra1) of the rear surface of the base material 2 before heating is about 0.51 to 0.65 μm , the arithmetic mean roughness (Ra2) after heating for 2 hours at 130°C is about 0.08 to 0.22 μm , and the storage elastic modulus of the base material 2 at 130°C is about 13 to 20 MPa, the composite sheet for forming a protective film has further excellent blocking resistance and dicing divisibility.

Examples

10 [0101]

Hereinafter, the invention will be described in more detail using examples and the like, but the scope of the invention is not limited to these examples and the like.

[0102]

[Example 1]

15 In Example 1, a dicing sheet 1 was manufactured as follows as illustrated in FIGS. 1 and 4.

[0103]

(1) Production of Laminate

The following components (A) and (B) were mixed and diluted with methyl ethyl ketone such that the solid content concentration was 30% by mass, thereby preparing a coating agent for an adhesive layer.

(A) Main adhesive: 100 parts by mass of a (meth)acrylic acid ester copolymer (a copolymer obtained by copolymerizing 40 parts by mass of butyl acrylate, 55 parts by mass of 2-ethylhexyl acrylate, and 5 parts by mass of 2-hydroxyethyl acrylate, weight-average molecular weight: 600,000).

25

(B) Crosslinking agent: 10 parts by mass of an aromatic polyisocyanate compound (manufactured by Mitsui Chemicals, Inc., TAKENATE D110N).

[0104]

Next, an ethylene-propylene copolymer film with one surface (corresponding to
5 a rear surface of a base material: second surface of the base material) with an arithmetic mean roughness (Ra1) before heating, an arithmetic mean roughness (Ra2) after heating (130°C for 2 hours), a melting point, and a storage elastic modulus at 130°C adjusted as in the following Table 1 was produced, and the other surface of the film was subjected to a corona treatment to use the film as a base material. The arithmetic mean roughness
10 (Ra1) before heating was adjusted by changing, in the preparation of the base material, an arithmetic mean roughness of a surface of the metal roll in which the rear surface side was wound. In addition, the arithmetic mean roughness (Ra2) after heating was adjusted by changing the copolymerization ratio between the ethylene and the propylene constituting the ethylene-propylene copolymer of the base material.

15 [0105]

A release sheet (manufactured by Lintec Corporation, SP-PET 381031) in which a silicone-based release agent layer was formed on one surface of a PET film having a thickness of 38 μm was prepared, a release surface of the release sheet was coated with the above-described coating agent for an adhesive layer using a knife coater and dried
20 such that an adhesive layer obtained finally had a thickness of 10 μm , and thus an adhesive layer was formed. Thereafter, the above-described corona-treated surface of the base material was superposed on the adhesive layer to adhere them to each other, and thus a laminate formed of the base material (base material 2 in FIG. 1), the adhesive layer (adhesive layer 3 in FIG. 1), and the release sheet was obtained. This laminate was long,
25 and after the laminate became a roll by being wound in a roll shape, it was cut to be 300

mm in a width direction (shown by w_1 in FIG. 4).

[0106]

(2) Production of Dicing Sheet

The laminate obtained in the above-described (1) was subjected to half-cutting
5 from the base material side so as to cut the laminate of the base material and the adhesive
layer. Specifically, as illustrated in FIG. 4, a circle (diameter d_1 : 270 mm; reference
numeral 401 in FIG. 4; circular dicing sheet main body) was formed, and arcs (reference
numeral 402 in FIG. 4) with an interval (shown by w_2 in FIG. 4) of 20 mm therebetween
were formed on the outside of the circle. Two straight lines (reference numeral 403 in
10 FIG. 4) parallel to an end portion in the width direction of the laminate were formed
between the circles adjacent to each other, and the arcs adjacent to each other were
connected by the straight lines.

[0107]

Thereafter, the portion between the circular dicing sheet main body and the arc
15 and the portion sandwiched between the two straight lines were removed, and thus a
dicing sheet illustrated in FIGS. 1 and 4 was obtained.

[0108]

[Examples 2 to 5 and Comparative Examples 1 to 3]

Dicing sheets of Examples 2 to 5 and Comparative Examples 1 to 3 were
20 manufactured in the same manner as in Example 1, except that the arithmetic mean
roughness (Ra_1) before heating and the arithmetic mean roughness (Ra_2) after heating in
the rear surface of the base material, the melting point, and the storage elastic modulus at
130°C were changed as shown in the following Table 1.

[0109]

25 [Test Example 1]

< Measurement of Arithmetic Mean Roughness of Base Material >

The arithmetic mean roughness (Ra1: μm) before heating and the arithmetic mean roughness (Ra2: μm) after heating in the rear surface of the base material used in each of the examples and the comparative examples were measured based on JIS B0601: 2001 with a cut off value λ_c of 0.8 mm and an evaluation length L_n of 4 mm using a contact-type surface roughness meter (manufactured by Mitutoyo Corporation, SURFTEST SV-3000). The results thereof are shown in the following Table 1.

[0110]

Here, regarding the arithmetic mean roughness (Ra2) after heating, in a state in which the dicing sheet provided with the base material in each of the examples and the comparative examples was fixed to a ring frame, a value after the dicing sheet was heated for 2 hours at 130°C under an air atmosphere in an oven and then left to cool to room temperature was measured. In this heating treatment, the measurement surface (the rear surface of the base material) was prevented from coming into contact with an inner wall or a bottom portion in the oven.

[0111]

[Test Example 2]

< Measurement of Melting Point of Base Material >

Regarding the base material used in each of the examples and the comparative examples, a melt peak temperature was obtained based on JIS K7121 (ISO3146) using a differential scanning calorimeter (manufactured by TA Instruments, Q2000). Specifically, the base material was heated from 23°C to 200°C at 10°C/min to draw a DSC curve. A melt peak temperature (°C) was obtained from the obtained DSC curve during the temperature increase. The results thereof are shown in the following Table 1.

[0112]

[Test Example 3]

<Measurement of Storage Elastic Modulus of Base Material>

Regarding the base material used in each of the examples and the comparative
 5 examples, the storage elastic modulus at 130°C was measured using the following
 apparatus under the following conditions. The results thereof are shown in the
 following Table 1.

Measuring Apparatus: manufactured by TA Instruments, dynamic modulus
 measuring apparatus “DMA Q800”

10 Test Start Temperature: 0°C

Test End Temperature: 200°C

Rate of Temperature Increase: 3°C/min

Frequency: 11 Hz

Amplitude: 20 μm

15 [0113]

[Test Example 4]

<Measurement of Light Transmittance>

The base material used in each of the examples and the comparative examples
 was heated for 2 hours at 130°C as in Test Example 1. Then, the light transmittance of
 20 the base material after heating at a wavelength of 200 to 1200 nm was measured using an
 ultraviolet visible light spectrophotometer (manufactured by Shimadzu Corporation,
 UV-3101PC, not using integrating spheres), and a measurement value at a wavelength of
 1064 nm was read. The results thereof are shown in the following Table 1.

[0114]

[Test Example 5]

<Blocking Resistance Evaluation>

The dicing sheet manufactured in each of the examples and the comparative examples was set in an adhering apparatus (manufactured by Lintec Corporation, RAD-2700 F/12) to adhere the dicing sheet main body to a silicon wafer (outside diameter: 8 inches, thickness: 100 μ m) and a ring frame (made of stainless-steel) under an environment at 70°C in a roll-to-roll manner. In that case, 10 sheets were continuously subjected to the adhesion operation to evaluate blocking resistance based on the following standards. The results thereof are shown in the following Table 1.

10 A: Adhesion was possible without problems (without the occurrence of blocking).

 B: Adhesion was possible, but the base material and the release sheet on the rear surface side of the base material were partially tightly adhered to each other, and thus the release sheet was partially released from the adhesive layer when the dicing
15 sheet was unwound.

 C: Adhesion failure occurred such as transfer of even one dicing sheet main body onto the release sheet on the rear surface side of the base material or failure in the unwinding of the dicing sheet (blocking occurred).

[0115]

20 [Test Example 6]

<Evaluation of Dicing Divisibility>

The dicing sheet manufactured in each of the examples and the comparative examples was set in an adhering apparatus (manufactured by Lintec Corporation, RAD-2700 F/12) to adhere the dicing sheet main body to a silicon wafer (outside
25 diameter: 8 inches, thickness: 100 μ m) and a ring frame (made of stainless-steel) under

an environment at 70°C. After that, a heating treatment was performed for 2 hours at 130°C.

[0116]

Next, using a laser saw (manufactured by DISCO Corporation, DFL7360), the silicon wafer on the dicing sheet was divided through Stealth Dicing including the following processes.

(Process 1) The silicon wafer and the ring frame to which the dicing sheet of each of the examples and the comparative examples is adhered are installed at a predetermined position in a laser saw so as to be irradiated with laser light from the rear surface side of the base material.

(Process 2) The position of the surface of the silicon wafer is detected, and then a focal position of laser light of the laser saw is set, and along a scheduled cutting line set such that a chip body of 9 mm × 9 mm is formed on the silicon wafer, irradiation of laser light with a wavelength of 1064 nm from the laser saw is performed 10 times from the rear surface side of the base material to form a modified layer in the silicon wafer.

(Process 3) The silicon wafer and the ring frame to which the dicing sheet is adhered are installed in a die separator (manufactured by DISCO Corporation, DDS2300) to perform expanding with an expansion amount of 10 mm at a pulling-down rate of 100 mm/sec.

[0117]

Through the above processes, at least a part of the silicon wafer having the modified layer formed therein was divided along a scheduled division line, and a plurality of chips was obtained. Based on the division ratio (= (number of chips actually obtained by division/scheduled number of divided chips) × 100) (%) at that time,

dicing divisibility was evaluated according to the following standards. The results thereof are shown in the following Table 1.

A: Chip division ratio: 100% (good divisibility)

B: Chip division ratio: 90% to less than 100% (acceptable divisibility)

5 C: Chip division ratio: 80% to less than 90% (acceptable divisibility)

D: Chip division ratio: less than 80% (unacceptable divisibility)

[0118]

[Table 1]

	Base Material					Dicing Sheet	
	Arithmetic Mean Roughness		Melting Point	Storage Elastic Modulus at 130°C	Light Transmittance after Heating (1064 nm)	Evaluation of Blocking Resistance	Evaluation of Dicing Divisibility
	Before Heating (Ra1)	After Heating (Ra2)					
	μm	μm					
Example 1	0.58	0.15	117	20	79	A	B
Example 2	0.51	0.08	119	20	91	A	A
Example 3	0.47	0.22	121	22	68	A	C
Example 4	0.65	0.17	131	13	77	A	B
Example 5	0.53	0.22	112	37	68	A	C
Example 6	0.51	0.08	119	20	89	A	A
Comparative Example 1	0.53	0.52	181	19	32	A	D
Comparative Example 2	0.33	0.32	175	52	39	B	D
Comparative Example 3	0.08	0.08	181	19	91	C	A

[0119]

10 As seen from Table 1, the dicing sheet of each of the examples in which the arithmetic mean roughness (Ra1) of the rear surface of the base material before heating was 0.2 μm or greater, the arithmetic mean roughness (Ra2) of the rear surface of the

base material after heating for 2 hours at 130°C was 0.25 μm or less had excellent blocking resistance and dicing divisibility.

Industrial Applicability

[0120]

- 5 A dicing sheet according to the invention is preferably used in a case in which a process of performing laser light irradiation so as to allow laser light to pass through a base material, such as Stealth Dicing, is included.

Reference Signs List

[0121]

- 10 1, 1A: DICING SHEET
- 2: BASE MATERIAL
- 3: ADHESIVE LAYER
- 401: CIRCLE
- 402: ARC
- 15 403: STRAIGHT LINE
- 5: ADHESIVE LAYER FOR TOOL
- 6: RELEASE SHEET
- 7: SEMICONDUCTOR WAFER
- 8: RING FRAME

CLAIMS

1. A dicing sheet, comprising:

a base material;

5 an adhesive layer which is laminated on the first surface side of the base material; and

a release sheet which is laminated on the adhesive layer on the side opposite to the base material,

wherein an arithmetic mean roughness (Ra1) of a second surface of the base material is 0.2 μm or greater, and

10 an arithmetic mean roughness (Ra2) of the second surface of the base material after the dicing sheet is heated for 2 hours at 130°C is 0.25 μm or less.

2. The dicing sheet according to Claim 1,

15 wherein the arithmetic mean roughness (Ra2) of the second surface of the base material after the heating is less than the arithmetic mean roughness (Ra1).

3. The dicing sheet according to Claim 1 or 2,

wherein the base material has a melting point of 90°C to 180°C.

20

4. The dicing sheet according to any one of Claims 1 to 3,

wherein the base material has a storage elastic modulus of 1 to 100 MPa at 130°C.

5. The dicing sheet according to any one of Claims 1 to 4,

wherein the light transmittance of the base material at a wavelength of 1064 nm after the heating is 40% or greater.

5 6. The dicing sheet according to any one of Claims 1 to 5,

wherein the base material is a film formed of a copolymer of ethylene and propylene.

7. The dicing sheet according to any one of Claims 1 to 6, further comprising:

10 an adhesive layer for a tool which is laminated on a peripheral portion of the adhesive layer on the side opposite to the base material.