

DESCRIPTION

TITLE OF INVENTION:

SEMICONDUCTOR-PROCESSING TEMPORARY-ADHESIVE TAPE

5

TECHNICAL FIELD

{0001}

The present invention relates to a semiconductor-processing temporary-adhesive tape, for more detail, relates to a semiconductor-processing temporary-adhesive tape to be used at the time of a semiconductor wafer-processing, and, for furthermore detail, relates to a surface protective temporary-adhesive tape of processing a semiconductor, that is preferably used in a method of producing a semiconductor chip, which comprises: grinding the backing-face side of the semiconductor wafer, thereby to singulate the semiconductor wafer into individual chips.

15

BACKGROUND ART

{0002}

In the step of processing the semiconductor wafer (hereinafter, also referred to as a wafer), after forming a pattern on the wafer surface, a so-called backgrinding and/or polishing by which the backing-face side of the wafer is background and/or polished until a predetermined thickness would be carried out. At that time, in order to protect the wafer surface, a surface protective temporary-adhesive tape is laminated on the wafer surface and the backing-face side of the wafer is ground in that state. As for the surface protective temporary-adhesive tape, those tapes have been proposed (see, for example, Patent Literature 1), in which a temporary-adhesive layer containing an acrylic polymer as a main component is provided on a plastic film, such as polyolefin.

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{0003}

On the other hand, much further thinning is required in the chip, due to popularization of IC cards, a response to a rapid capacity increase of the semiconductor memories represented by USB memories, and popularization of a small device, such as a smartphone and a tablet. For example, for chips whose thickness is from about 200 μm to about 350 μm in the past, the thinning is required to a thickness of from 50 μm to 100 μm , or of less than 50 μm .

{0004}

Ordinarily, a wafer having a circuit pattern formed thereon is processed thinly at the backgrinding step. In the thin film wafer after grinding, curvedness (hereinafter, referred to as warpage) of the wafer tends to occur, due to a difference in shrinkage factor between silicon and a circuit or a protective layer and also due to shrinkage of the temporary-adhesive tape. As the chip becomes thinner, stiffness (rigidity) of the wafer itself would lower, and therefore a problem may arise such that a warpage occurs that makes the wafer transfer or processing in the equipment impossible.

{0005}

Further, in the wafer after backgrinding, when the finish thickness would become 100 μm or less, the mechanical strength of the wafer is lowered and cracks occur starting from a slight impact or a defect, so that there is a possibility that the yield may lower. Further, even if the crack does not occur in backgrinding, since the wafer is cut mechanically by a diamond blade in the subsequent chip singulation (hereinafter, referred to as dicing) step, the chip sometimes may be broken resulting from chips (hereinafter, referred to as chipping) generating from the cutting line.

{0006}

With respect to the thin film wafer processing as described above, for example, Patent Literature 2 proposes a method of dividing a wafer, which

includes: forming a groove which is deeper than a thickness of a wafer to be finished but is shallower than the original thickness of the wafer, by dicing at the predetermined position (position of scheduled chip division) from the wafer circuit side before backgrinding; and then thinning the wafer so as to get to more than
 5 the depth of the groove by backgrinding, thereby to carry out the backgrinding and singulation into individual chips at the same time.

{0007}

Further, as a method similar to the above, for example, Patent Literature 3 proposes a laser processing which includes: performing laser irradiation to the
 10 position of scheduled chip division, thereby to form a modifying layer inside the wafer instead of a groove; and then performing division and singulation into individual chips starting from the modifying layer at the time of backgrinding. When this method is used, since there is no groove which would be conventionally provided, the distance between chips can be cut down to almost 0
 15 (zero), so that more chips can be obtained from a sheet of wafer. Further, since there is no impact of cutting by a diamond blade, elimination of chipping also becomes possible.

CITATION LIST

20 PATENT LITERATURES

{0008}

Patent Literature 1: JP-A-2001-240842

Patent Literature 2: JP-A-1999 (H11)-40520

Patent Literature 3: JP-A-2002-192370

25

SUMMARY OF INVENTION

TECHNICAL PROBLEM

{0009}

On the other hand, in the method described in Patent Literature 3, since a modifying layer is formed by laser, the distance between chips is almost 0 (zero), and therefore a problem arises such that when misalignment of chips is caused by external factors, such as a change in shape of the surface protective tape and
 5 a shearing force at the time of backgrinding, adjacent chips easily have a contact with each other, so that cracks are likely to occur from that part.

Further, as a result of intensive consideration, the inventors of the present invention have gotten to know that, in a case where a base having a multilayered structure including a specific layer is used as a base of the tape, adhesion
 10 between the layers that constitute the multilayered structure would become important, and when the interlayer adhesion is not sufficient, a peelability would be lowered or an interlayer peeling would occur in a processing of the semiconductor wafer that is an adherend, which resulted in damage of the wafer.
 {0010}

15 In view of the above, the present invention is contemplated for solving the above-described problems, and for providing a semiconductor-processing temporary-adhesive tape that has excellent peelability and excellent interlayer adhesion and further that allows well-suppressed occurrence of a defective chip, even when ground to a thin film, especially in the backgrinding step of the silicon
 20 wafer and the like, in the semiconductor-wafer processing.

SOLUTION TO PROBLEM

{0011}

That is, the present invention is to provide the following means:

25 (1)

A semiconductor-processing temporary-adhesive tape, comprising: a base; and a temporary-adhesive layer provided on one side of the base, wherein the base is composed of a multilayer structure, at least one of which is a layer A

containing a cyclic olefin polymer with a proportion of 80% by mass or more, and separately from the layer A, said multilayer structure has a layer B containing a linear low-density polyethylene or a high-density polyethylene.

(2)

5 The semiconductor-processing temporary-adhesive tape described in the above item (1), wherein the density of the linear low-density polyethylene is 0.95 g/cm³ or less.

(3)

10 The semiconductor-processing temporary-adhesive tape described in the above item (1) or (2), wherein the melt-flow rate of the linear low-density polyethylene is 4.0 g/10-min or less.

(4)

15 The semiconductor-processing temporary-adhesive tape described in any one of the above items (1) to (3), wherein the linear low-density polyethylene is metallocene polyethylene.

(5)

20 The semiconductor-processing temporary-adhesive tape described in any one of the above items (1) to (4), which is employed in a method of producing a semiconductor chip, which comprises: singulating a semiconductor wafer having a modifying layer formed inside of the semiconductor wafer by subjecting to a laser irradiation along a scheduled singulation area of each chip; or a semiconductor wafer having a groove formed by a mechanical means along a scheduled singulation area of each chip, into individual chips by backgrinding of said semiconductor wafer.

25

EFFECTS OF INVENTION

{0012}

The semiconductor-processing temporary-adhesive tape of the present

invention has excellent peelability and excellent interlayer adhesion and further allows well-suppressed occurrence of a defective chip, even when ground to a thin film, especially in the backgrinding step of the silicon wafer and the like, in semiconductor-wafer processing.

5 Further, the semiconductor-processing temporary-adhesive tape of the present invention has excellent peelability and excellent interlayer adhesion and further allows well-suppressed occurrence of a defective chip, even when ground to a thin film, by employing it in a method of producing a semiconductor chip, which includes: performing chip singulation by backgrinding of the semiconductor
10 wafer.

Other and further features and advantages of the invention will appear more fully from the following description, appropriately referring to the accompanying drawings.

15 BRIEF DESCRIPTION OF THE DRAWINGS

{0013}

{Fig. 1}

Fig. 1 is an outlined cross-sectional view schematically showing one embodiment of the semiconductor-processing temporary-adhesive tape of the
20 present invention.

{Figs. 2(a) to 2(c)}

Figs. 2(a) to 2(c) each are an outlined cross-sectional view explaining steps of processing a semiconductor wafer, using the semiconductor-processing temporary-adhesive tape of the present invention. Fig. 2(a) shows a step of
25 peeling a release film from the semiconductor-processing temporary-adhesive tape, thereby to expose an adhesive layer. Fig. 2(b) shows a state in which the semiconductor-processing temporary-adhesive tape is laminated on the protrusion (convex part) side of the semiconductor wafer. Fig. 2(c) shows a step

of grinding the backing-face side of the semiconductor wafer.

MODE FOR CARRYING OUT THE INVENTION

{0014}

5 [Semiconductor-processing temporary-adhesive tape]

The semiconductor-processing temporary-adhesive tape of the present invention comprises: a base; and a temporary-adhesive layer provided on one side of the base. The base is composed of a multilayer structure, at least one of which is a layer A containing a cyclic olefin polymer with a content of 80% by
 10 mass or more, and separately from the layer A, said multilayer structure has a layer B containing a linear low-density polyethylene or a high-density polyethylene.

Hereinafter, preferable embodiments of the semiconductor-processing temporary-adhesive tape of the present invention are explained.

15 {0015}

The semiconductor-processing temporary-adhesive tape 1 of the present invention is a tape in which a temporary-adhesive layer 3 is laminated on a base 2 and both layers are integrated, as shown in Fig. 1. Further, in the semiconductor-processing temporary-adhesive tape 1, a release film 4 for
 20 protecting the temporary-adhesive layer 3 may be provided on said temporary-adhesive layer 3. The semiconductor-processing temporary-adhesive tape 1 of the present invention may be formed as a rolled laminated body composed of the base 2, the temporary-adhesive layer 3 and the release film 4.

{0016}

25 (Base 2)

The base 2 of the semiconductor-processing temporary-adhesive tape 1 of the present invention is composed of a multilayer structure. At least one of this multilayer structure is a layer A containing a cyclic olefin polymer (hereinafter,

referred to as "COP"), and, separately from the layer A, the base 2 has a layer B containing a linear low-density polyethylene or a high-density polyethylene, as at least one layer of said multilayer structure.

{0017}

5 In the present specification, COP means a ring-opening polymer of the cyclic olefin, a hydrogen adduct of the ring-opening polymer, and an addition polymer of the cyclic olefin, and also includes an addition copolymer of the cyclic olefin and a linear olefin, which is called as a cyclic olefin copolymer (hereinafter, referred to as "COC").

10 The cyclic olefin as a monomer is good if it is a cyclic alkene or alkyne which is a compound capable of forming a polymer by a ring-opening polymerization or an addition polymerization. The cyclic olefin having 4 to 12 carbon atoms is preferred. The cyclic olefin is good if it comprises a bicyclic olefin, and further may comprise a monocyclic olefin and/or tricyclic or more
15 polycyclic olefin. Examples of the monocyclic olefin include cyclic cycloolefins having 4 to 12 carbon atoms, such as cyclobutene, cyclopentene, cycloheptene, and cyclooctene. Examples of the bicyclic olefin or the tricyclic or more polycyclic olefin include: dicyclopentadiene; derivatives, such as 2,3-dihydrodicyclopentadiene, methanooctahydrofluorene,
20 dimetanooctahydronaphtharene, dimetanocyclopentadienonaphtharene, and methanooctahydrocyclopentadienonaphtharene; derivatives having a substituent, such as 6-ethyl-octahydronaphtharene; a cyclopentadiene-tetrahydroindene adduct and the like, a cyclopentadiene trimer or tetramer, norbornene, tetracyclododecene, and like. Among those, norbornene and
25 tetracyclododecene are preferred.

Further, the linear olefin is good if it is a linear alkene or alkyne which is a compound capable of forming a polymer by an addition polymerization with a cyclic olefin. The carbon atoms thereof are preferably from 2 to 10, more

preferably from 2 to 8, and still more preferably from 2 to 4. Specifically, examples of the linear olefin include linear olefins having 2 to 10 carbon atoms, such as ethylene, propylene, 1-butene, isobutene, 1-pentene, 3-methyl-1-pentene, 4-methyl-1-pentene, 1-hexene, 1-octene, and the like. These linear olefins may
 5 be used solely or in combination of 2 or more kinds. In particular, ethylene is preferred.

The content of COP in the above-described layer A is 80% by mass or more, and preferably 90% by mass or more. The upper limit is not limited in particular and is 100% by mass or less. Note that in a case where COP is COC,
 10 the content of COP means the content of COC.

Specifically, examples of the above-described COP include “ZEONOR”, trade name, manufactured by Zeon Corporation, “Topas”, trade name, manufactured by Polyplastics Co., Ltd. and the like.

{0018}

15 Since a homopolymer of the cyclic olefin of COP is an amorphous resin and has a rigid and brittle property, the homopolymer also needs a high temperature processing when forming a sheet or a film.

On the other hand, since COC is a copolymer of the cyclic olefin and ethylene, COC has flexibility and ductility. Further, by adjusting a polymerization
 20 ratio (content ratio), COC having various characteristics is obtained.

Of the constituents of COC, the content of ethylene constituent is preferably from 30 to 40% by mass, and more preferably from 35 to 40% by mass. If the content of ethylene constituent is too low, there is a possibility that the base is so brittle that the semiconductor-processing temporary-adhesive tape fractures.
 25 On the other hand, if the content of ethylene constituent is too high, there is a possibility that a nature of the ethylene constituent becomes too strong to obtain a sufficient stiffness (rigidity).

{0019}

As a separate layer from the layer A containing COP, the above-described base 2 has a layer B containing a linear low-density polyethylene (hereinafter, referred to as "LLDPE") or a high-density polyethylene (hereinafter, referred to as "HDPE"), each of which has a good adhesion to the layer A. Note
5 that a low-density polyethylene (hereinafter, referred to as "LDPE") is not preferred, from the viewpoint that a sufficient interlayer adhesion to the layer A is not obtained. If the interlayer adhesion to the layer A is insufficient, there is a possibility that peelability becomes insufficient, or the peeling occurs between layers in a processing of the semiconductor wafer that is an adherent, which
10 results in a damage of the wafer.

{0020}

LLDPE and HDPE may be a copolymer of ethylene and α -olefin. The α -olefin whose carbon atoms are within a range of 3 to 10 is preferred. Examples thereof include propylene, butene-1, pentene-1, hexene-1, 4-methylpentene-1,
15 heptene-1, octane-1, and the like.

In a case where LLDPE and HDPE are each a copolymer of ethylene and α -olefin, the content of an ethylene constituent of the total constituents of the copolymer is preferably from 95 to 99% by mass, and more preferably from 96 to 98% by mass.

20 {0021}

The content of LLDPE and HDPE in the above-described layer B is preferably 50% by mass or more, and more preferably 80% by mass or more. The upper limit is not limited in particular and is 100% by mass or less. Note that in a case where LLDPE and HDPE are each a copolymer of ethylene and α -olefin, the content of LLDPE and HDPE means the content of a copolymer of
25 ethylene and α -olefin.

{0022}

The density of LLDPE is preferably 0.95 g/cm^3 or less, more preferably

0.94 g/cm³ or less, and still more preferably 0.93 g/cm³ or less. The lower limit is practically 0.89 g/cm³ or more.

The melt flow rate (MFR) of LLDPE is preferably 4.0 g/10-min or less, more preferably 2.0 g/10-min or less, and still more preferably 1.0 g/10-min or less. The lower limit is practically 0.5 g/10-min or more.

Further, the density of HDPE is preferably 0.97 g/cm³ or less, and more preferably 0.96 g/cm³ or less. The lower limit is practically 0.5 g/cm³ or more.

MFR (melt flow rate) of HDPE is preferably 6.0 g/10-min or less, and more preferably 5.0 g/10-min or less. The lower limit is practically 0.5 g/10-min or more.

MFR is a value under the conditions of: temperature: 190°C; and load: 21.18 N, and the density and MFR can be measured by a method described in Example.

{0023}

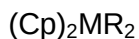
As for LLDPE, in particular, metallocene polyethylene is preferred from the viewpoint of adhesion to the layer A containing COC.

In the present specification, the term "metallocene polyethylene" means an ethylene-based polyolefin obtained by using a metallocene catalyst (hereinafter, sometimes referred to as "metallocene catalyst ethylene-based polyolefin"), and the metallocene polyethylene is obtained by polymerizing ethylene, or a mixed monomer of ethylene and α -olefin, in the presence of a metallocene catalyst. Thus, the ethylene-based polyolefin obtained by using a metallocene catalyst contains polyethylene and a copolymer of ethylene and α -olefin, each of which is obtained by polymerization reaction in the presence of a metallocene catalyst.

{0024}

The metallocene catalyst is a collective term of the catalyst composed of a transition metal constituent comprising metallocene, that is, a complex that is

constituted by 2 rings of a substituted or unsubstituted cyclopentadienyl ring and a variety of transition metal; and an organoaluminum constituent, in particular aluminoxane. Examples of the transition metal constituent include a Group IVb, Group Vb, or Group VIb metal of the periodic table, in particular, zirconium or hafnium. As for the transition metal constituent of the catalyst, a compound represented by the following formula is typically used.



In the formula, Cp represents a substituted or unsubstituted cyclopentadienyl ring, M represents a transition metal, and R represents a halogen atom or an alkyl group.

{0025}

The aluminoxane is a compound obtained by allowing reaction of an organoaluminum compound with water, and includes a linear aluminoxane and a cyclic aluminoxane. These aluminoxanes may be used solely or in combination with other organoaluminum.

{0026}

The polymerization method of ethylene, or ethylene and α -olefin using a metallocene catalyst is publicly known by a number of publications. Synthesis thereof is performed by polymerization in an organic solvent or liquid monomer (s) or by gas phase polymerization in the presence of the above-described metallocene catalyst. Any of these known methods may be used for the purpose of the present invention, as long as it satisfies the above-described conditions.

{0027}

In a case of the copolymer of ethylene and α -olefin, the descriptions of the copolymer of ethylene and α -olefin in the above-described LLDPE may be preferably applied to the specific α -olefin and the content of an ethylene constituent in the total constituents of the copolymer.

{0028}

The metallocene catalyst ethylene-based polyolefin is characterized by a narrow molecular weight distribution. In the present invention, the use is made of a metallocene catalyst ethylene-based polyolefin whose polydispersity that is
5 an index of the molecular weight distribution (mass-average molecular weight M_w /number-average molecular weight M_n) is preferably 4.0 or less, more preferably 3.5 or less, and still more preferably 3.2 or less. Meanwhile, for the purpose of improving formability, a polymer to which a branch having a relatively long chain has been introduced is preferably used at the step of polymerization or
10 a later step. Further, as for the metallocene catalyst ethylene-based polyolefin, the density is generally 0.89 to 0.95 g/cm³ and preferably from about 0.91 to about 0.93 g/cm³, and MFR is generally 0.1 to 10 g/10-min and preferably from about 0.3 to about 5 g/10-min.

{0029}

15 The presence of the metallocene catalyst ethylene-based polyolefin in the layer B can be confirmed by the following method. That is, the layer B is cut to 100- μ m thick with glass, to prepare a sample. The sample is placed in a scanning electronic microscope SEM, to measure generated X-ray fluorescence with an energy-distribution analyzer, and thereby to confirm the presence of the
20 peak corresponding to the energy of Zr (zirconium) or Hf (hafnium).

{0030}

The metallocene catalyst ethylene-based polyolefin, although synthetic compounds may be used, can be also selected and used from among commercially available products. Examples of the commercially available
25 products include YUMERITE (registered trademark) manufactured by Ube-Maruzen Polyethylene Co., Ltd., EXELLEN (registered trademark) manufactured by Sumitomo Chemical Co. Ltd., HARMOLEX (registered trademark) and KARNEL (registered trademark), each manufactured by Japan polyethylene

Corporation.

{0031}

Since the above-described LLDPE and HDPE are flexible, they have good cushioning properties at the time of wafer grinding. Further, the melting
5 point of the resin is preferably 60°C or more from the viewpoint of heat resistance.

Each resin may be used solely as a layer that constitutes a base 2, or may be used by blending resins in combination thereof. Further, the layer that constitutes a base 2 may contain, in addition to the above-described resins, additives such as a colorant, an antioxidant, and an antistatic agent as needed
10 within the range that does not affect the physical properties.

{0032}

The thickness of the above-described base 2, although there is no limitation in particular, is preferably from 50 to 200 μm , and more preferably from 80 to 180 μm .

15 The thickness of the above-described layer A is preferably from 20 to 100 μm , and more preferably from 30 to 60 μm from the viewpoint of stiffness. Further, the thickness of the above-described layer B is preferably from 10 to 100 μm , and more preferably from 20 to 80 μm from the viewpoint of flexibility.

In a case where the base 2 has the layer A composed of 2 or more layers and the layer B composed of 2 or more layers, “the thickness of the above-
20 described layer A” and “the thickness of the above-described layer B” each mean a total thickness of individual layers.

{0033}

The layer constitution of the base 2 is not particularly limited as long as it
25 is a multilayer structure containing at least one layer A and at least one layer B. However, a layer constitution in which the layer A and the layer B are laminated next to each other is preferred. The layer constitution of 3 or more layers: in which a layer B₁/a layer A/a layer B₂ are laminated in this order is more preferred.

The layer constitution of 3 layers: in which a layer B₁/a layer A/a layer B₂ are laminated in this order is still more preferred. Herein, the layer B₁ and the layer B₂ each mean the layer B and may be the same or different from each other.

{0034}

5 On the surface of the base 2 where a temporary-adhesive layer 3 is provided, a treatment such as a corona treatment or provision of a primary layer may be appropriately applied in order to improve adhesion to the temporary-adhesive layer 3.

{0035}

10 The method of producing the above-described base 2 is not particularly limited. The base 2 can be prepared by an ordinary method such as extrusion, inflation, cast or the like. Further, a film and another film each of which has been independently formed can be also bonded with an adhesive or the like to prepare the base 2.

15 {0036}
(Temporary-adhesive layer 3)

 The temporary-adhesive layer 3 of the semiconductor-processing temporary-adhesive tape according to the present invention is good as long as it is a layer containing a temporary-adhesive. For example, the temporary-

20 adhesive layer is formed using a temporary-adhesive composition. The temporary-adhesive composition is not particularly limited and includes a composition containing a temporary-adhesive such as an ordinary acrylic, rubber or silicone. From the viewpoints of weather resistance, costs and the like, acrylic temporary-adhesives are preferably used.

25 {0037}

 Examples of the acrylic temporary-adhesives include a copolymer having a (meth)acrylic acid ester as a constituent (hereinafter, referred to as “(meth)acrylate copolymer”). Further, in addition to the (meth)acrylate

copolymer, a curing agent described below may be contained therein.

Further, in the present invention, the (meth)acrylic monomer is defined as including both acrylic monomers and methacrylic monomers.

{0038}

5 Examples of a (meth)acrylate as a constituent of the (meth)acrylate copolymer include alkyl acrylates or alkyl methacrylates each having a linear or branched alkyl group having 30 or less carbon atoms, preferably 4 to 18 carbon atoms, such as methyl, ethyl, n-propyl, isopropyl, n-butyl, t-butyl, isobutyl, amyl, isoamyl, hexyl, heptyl, cyclohexyl, 2-ethylhexyl, octyl, isooctyl, nonyl, isononyl,
10 decyl, isodecyl, undecyl, lauryl, tridecyl, tetradecyl, stearyl, octadecyl, dodecyl groups and the like. These (meth)acrylates may be used solely or in combination of 2 or more kinds.

 Among constituents of the (meth)acrylic copolymer, the content of the above-described (meth)acrylate constituent is preferably 80% by mass or more,
15 more preferably 90% by mass or more, and still more preferably from 95% by mass to 99.9% by mass.

{0039}

 The above-described (meth)acrylate copolymer may contain constituents other than the above-described (meth)acrylate.

20 Examples of the other constituents include: a carboxyl group-containing monomer, such as (meth)acrylic acid, carboxyethyl (meth)acrylate, carboxypentyl (meth)acrylate, itaconic acid, maleic acid, fumaric acid, and crotonic acid; an acid anhydride monomer, such as maleic acid anhydride and itaconic acid anhydride; a hydroxyl group-containing monomer, such as a hydroxyalkyl (meth)acrylate
25 (preferably a compound in which the above-described alkyl (meth)acrylate has been substituted with a hydroxyl group); a sulfonic acid group-containing monomer, such as a styrene sulfonic acid, an allyl sulfonic acid, 2-(meth)acrylamide-2-methylpropane sulfonic acid, (meth)acrylamide propane

sulfonic acid, sulfopropyl (meth)acrylate, and a (meth)acryloyloxynaphtharene sulfonic acid; a phosphoric acid group-containing monomer, such as 2-hydroxyethyl acryloyl phosphate; (meth)acrylamide, (meth)acrylic acid N-hydroxymethylamide, an alkylaminoalkyl (meth)acrylic acid ester (for example, 5 dimethylaminoethyl methacrylate, t-butylaminoethyl methacrylate and the like), N-vinylpyrrolidone, acryloyl morpholine, vinyl acetate, styrene, and acrylonitrile. These constituents may be used solely or in combination thereof.

{0040}

Of the solid constituents in the temporary-adhesive layer 3, the content of 10 the (meth)acrylic copolymer (the converted content in the condition before reacting with a curing agent or a photopolymerizable compound described below) is preferably 80% by mass or more, more preferably 90% by mass or more, and still more preferably 95 to 99.9% by mass.

{0041}

15 As for the curing agent, those curing agents described in JP-A-2007-146104 may be used. Examples thereof include: an epoxy compound having 2 or more epoxy groups in the molecule, such as 1,3-bis (N,N-diglycidylaminomethyl)cyclohexane, 1,3-bis(N,N-diglycidylaminomethyl)toluene, 1,3-bis(N,N-diglycidylaminomethyl)benzene, and N,N,N,N'-tetraglycidyl-m- 20 xylenediamine; an isocyanate-based compound having 2 or more isocyanate groups in the molecule, such as 2,4-tolylene diisocyanate, 2,6-tolylene diisocyanate, 1,3-xylene diisocyanate, 1,4-xylene diisocyanate, and diphenylmethane-4,4'-diisocyanate; an aziridine-based compound having 2 or more aziridinyl groups in the molecule, such as tetramethylol-tri- β -aziridinyl 25 propionate, trimethylol-tri- β -aziridinyl propionate, trimethylolpropane-tri- β -aziridinyl propionate, trimethylolpropane-tri- β -(2-methyl aziridine) propionate. The content of the curing agent may be adjusted according to the desired temporary-adhesive force, and is preferably 0.01 to 10 parts by mass and more

preferably 0.1 to 5 parts by mass with respect to 100 parts by mass of the above-described (meth)acrylate copolymer.

{0042}

The temporary-adhesive layer 3 is also preferably composed of a
 5 radiation-curable temporary-adhesive containing a photopolymerizable compound and a photopolymerization initiator in addition to the above-described temporary-adhesive. By containing therein the temporary-adhesive, the photopolymerizable compound and the photopolymerization initiator, the temporary-adhesive layer 3 is cured due to exposure to radiation (preferably
 10 ultraviolet ray), whereby the temporary-adhesive force thereof can be lowered. As such photopolymerizable compounds, the use can be made of a low-molecular compound having at least 2 photopolymerizable carbon-carbon double bonds in the molecule that can be three-dimensionally reticulated by exposure to light and an oligomers formed by polymerizing these low-molecular compounds,
 15 as described in, for example, JP-A-1985 (S60)-196956 and JP-A-1985 (S60)-223139.

{0043}

As for the above-described photopolymerizable compound, specifically, the use can be made of: trimethylol propane tri(meth)acrylate, pentaerythritol
 20 di(meth)acrylate, pentaerythritol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol monohydroxy penta(meth)acrylate, dipentaerythritol hexa(meth)acrylate, neopentyl glycol di(meth)acrylate or 1,4-butylene glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, (poly)ethyleneglycol di(meth)acrylate, (poly)propyleneglycol di(meth)acrylate,
 25 epoxy(meth)acrylate ((meth)acrylic acid adduct of epoxy compound), polyester (meth)acrylate ((meth)acrylic acid adduct of polyester), urethane-(meth)acrylate ((meth)acrylic acid adduct of urethane), and the like.

{0044}

As for the above-described photopolymerization initiator, use may be made of: the photopolymerization initiator described in JP-A-2007-146104 or JP-A-2004-186429. Specifically, the use can be made of isopropyl benzoin ether, isobutyl benzoin ether, benzophenone, Michler's ketone, chlorothioxanthone, benzylmethylketal, α -hydroxycyclohexyl phenyl ketone, 2-hydroxymethyl phenyl propane, and the like.

{0045}

As for the above-described radiation-curable temporary-adhesive, other than a combination of the above-described (meth)acrylate copolymer and a low molecular compound having at least 2 radiation-polymerizable carbon-carbon double bonds in the molecule, it is also preferable to use a copolymer having a (meth)acrylate as a constituent, that is a (meth)acrylic copolymer whose repeating unit that constitutes said copolymer has a radiation-polymerizable carbon-carbon double bond (hereinafter, referred to as "radiation-polymerizable (meth)acrylate copolymer").

The radiation-polymerizable (meth)acrylate copolymer is a copolymer having, in the molecule thereof, a reactive group that is capable of polymerization reaction by exposure to radiation, ultraviolet ray in particular.

Such a reactive group is an ethylenically unsaturated group, that is, a group having a carbon-carbon double bond (ethylenically unsaturated bond); and examples thereof include a vinyl group, an allyl group, a styryl group, a (meth)acryloyloxy group, and a (meth)acryloylamino group.

{0046}

The above-described radiation-polymerizable (meth)acrylate copolymer is not particularly limited. Examples thereof include a (meth)acrylate copolymer obtained by reacting a (meth)acrylate copolymer having a functional group a, with a compound having a functional group b that is able to react with said functional group a; and a radiation-polymerizable carbon-carbon double bond (hereinafter,

referred to as “a radiation-polymerizable compound having a functional group b”).
{0047}

Examples of the above-described (meth)acrylate copolymer having a carbon-carbon double bond include the same materials as described in
5 paragraphs [0036] to [0055] of JP-A-2014-192204.
{0048}

With respect to the above-described radiation-polymerizable compound having a functional group b, examples of the functional group b include a carboxyl group, a hydroxyl group, an amino group, a cyclic acid anhydride group, an epoxy
10 group, and an isocyanate group. Examples of specific radiation-polymerizable compound having a functional group b include acrylic acid, methacrylic acid, cinnamic acid, itaconic acid, fumaric acid, phthalic acid, 2-hydroxyalkylacrylates, 2-hydroxyalkylmethacrylates, glycol monoacrylates, glycol monomethacrylates, N-methylol acrylamide, N-methylol methacrylamide, allyl alcohol, N-
15 alkylaminoethylacrylates, N-alkylaminoethylmethacrylates, acrylamides, methacrylamides, maleic acid anhydride, itaconic acid anhydride, fumaric acid anhydride, phthalic acid anhydride, glycidyl acrylate, glycidyl methacrylate, allyl glycidyl ether, and derivatives of the polyisocyanate compound in which a part of the isocyanate group has been urethanated with a hydroxyl group or a carboxyl
20 group and a monomer having a radiation-polymerizable carbon-carbon double bond.
{0049}

An acid value, a hydroxyl group value, and the like, can be appropriately determined, by remaining unreacted functional groups in the reaction of the
25 above-described (meth)acrylic copolymer having a functional group a with the above-described radiation-polymerizable compound having a functional group b.

The above-described radiation-polymerizable (meth)acrylate copolymer can be obtained, by solution polymerization in a variety of solvents. As for the

organic solvent in a case of the solution polymerization, use may be made of: a ketones solvent, an esters solvent, an alcohols solvent, or an aromatic solvent. In general, use is preferably made of: a solvent that is good for an acrylic polymer and has a boiling point of 60 to 120°C. For example, the use can be made of:

5 toluene, ethyl acetate, isopropyl alcohol, benzene, methyl cellosolve, ethyl cellosolve, acetone, methyl ethyl ketone, and the like. As for the polymerization initiator, the use can be made of azobis-radical generator, such as α,α' -azobis isobutyl nitrile, and an organic peroxide-radical generator, such as benzoyl peroxide. At this time, a catalyst or a polymerization inhibitor may be used with

10 the polymerization initiator as needed. Copolymers having a desired molecular weight can be obtained by controlling a polymerization temperature and a polymerization time. Meanwhile, a synthetic method is not limited to a solution polymerization, but other methods, such as bulk polymerization, use may be made of: suspension polymerization, and the like.

15 {0050}

As for the rest, in the temporary-adhesive composition that constitutes the temporary-adhesive layer 3, a release agent, a tackifier, a temporary-adhesive conditioner, a surfactant or other modifiers may be contained as needed. Further, inorganic compound fillers may be contained therein.

20 {0051}

The temporary-adhesive layer 3 can be formed by coating and drying a temporary-adhesive composition on a release film 4 and then transferring the temporary-adhesive composition to a base 2. In the present invention, the thickness of the temporary-adhesive layer 3 is preferably 10 to 60 μm and more

25 preferably 20 to 50 μm . If the thickness is too thick, there is a possibility that by an excessive adhesion to a surface of the semiconductor wafer 5 (refer to Fig. 2(b)) or embedding a protrusion 51 (refer to Fig. 2(c)) of the semiconductor wafer 5 surface, an adhesive deposit to the surface of the semiconductor wafer 5

occurs after peeling the semiconductor-processing temporary-adhesive tape 1. By setting the thickness to the above upper limit or less, the excessive adhesion of the temporary-adhesive can be suppressed. If the thickness is too thin, there is a possibility that the temporary-adhesive layer 3 cannot follow the protrusion 51 of the semiconductor wafer 5 surface, so that a grinding water containing a grinding dust gets in through the gap between the semiconductor-processing temporary-adhesive tape 1 and the semiconductor wafer 5 to thereby become a factor for a so-called seepage or the like that contaminates a circuit surface of the semiconductor wafer 5.

10 {0052}

(Release film 4)

The release film 4 is also called as a separator, a peeling layer, or a release liner and may be provided as needed for the purpose of protecting a radiation-curable temporary-adhesive layer, or smoothing the radiation-curable temporary-adhesive layer. Examples of the material that constitutes the release film 4 include a synthetic resin film such as polyethylene, polypropylene, polyethylene terephthalate, and the like, and a paper. In order to increase peelability from the temporary-adhesive layer 3, the surface of the release film 4 may be subjected to a release treatment such as a silicone treatment, a long-chain alkyl treatment, a fluorine treatment and the like, as needed. Further, in order to prevent the temporary-adhesive layer 3 from reaction to outdoor ultraviolet rays, the surface may be subjected to an ultraviolet-preventing treatment as needed. The thickness of the release film 4 is ordinarily 10 to 50 μm and preferably 25 to 38 μm .

25 {0053}

[Method of producing semiconductor device]

The semiconductor-processing temporary-adhesive tape of the present invention is preferably used for a production of the semiconductor chip which

comprises singulating (dividing) a semiconductor wafer (hereinafter, referred to as semiconductor wafer A) having a modifying layer formed inside the semiconductor wafer by subjecting to a laser irradiation along a scheduled singulation area of each chip, or a semiconductor wafer (hereinafter, referred to as semiconductor wafer B) having a groove formed by a mechanical means along a scheduled singulation area of each chip, into individual chips through a backing-face side grinding of said semiconductor wafer.

Herein, the term "backing-face side of said semiconductor wafer" means a surface of said semiconductor wafer opposite to the patterned surface of the semiconductor wafer on which a circuit or the like of the semiconductor device has been formed. To be more precise, the term "patterned surface" means a modifying layer-forming surface in the semiconductor wafer A or a groove-forming surface in the semiconductor wafer B.

The term "scheduled singulation area of each chip" means a scribe line of the wafer.

Further, the expression "singulation into individual chips" means the state of the semiconductor chips singulated from the semiconductor wafer, which includes the state in which the singulated semiconductor chips have been laminated on the semiconductor-processing temporary-adhesive tape of the present invention.

{0054}

The semiconductor wafer A is a semiconductor wafer having a modifying layer formed inside said semiconductor wafer by subjecting to laser irradiation along a scheduled singulation area of each chip. Both film thinning of the semiconductor wafer 5 and singulation into individual chips can be performed together by forming a modified layer having a thickness T_A on the semiconductor wafer 5 with laser irradiation thereto and further by grinding the semiconductor wafer 5 so that the semiconductor wafer 5 is thinned to the same as the above-

described thickness T_A or gets thinner than the thickness T_A at a subsequent backing-side face grinding processing of the semiconductor wafer. The thickness T_A is not particularly limited as long as it is less than the thickness of the semiconductor wafer before the backgrinding. It is practical to be larger by
 5 about 20 to about 30 μm than a final thickness of the wafer.

This method is a combined method of stealth dicing and 'Dicing Before Grinding', and is also called as a chip singulation method to deal with a narrow scribe width (scribe line). According to this method, since a modified layer of silicon (semiconductor wafer) is cleaved and singulated by a stress during a
 10 backing-side surface grinding processing of the wafer, the kerf width is 0 (zero), the chip yield is high, and the transverse strength (or deflective strength) is also improved.

The semiconductor wafer B is a semiconductor wafer having a groove formed by a mechanical means along a scheduled singulation area of each chip.
 15 Both film thinning of the semiconductor wafer 5 and singulation into individual chips can be performed together by forming a groove having a thickness T_B on the semiconductor wafer 5 by mechanical means (for example, a dicing blade) and further by grinding the semiconductor wafer 5 so that the semiconductor wafer 5 is thinned to the same as the above-described thickness T_B or gets
 20 thinner than the thickness T_B at a subsequent back-side face grinding processing of the semiconductor wafer. The thickness T_B is not particularly limited as long as it is less than the thickness of the semiconductor wafer before the backgrinding. It is practical to be larger by about 20 to about 30 μm than a final thickness of the wafer.

25 This method is called as a DBG (Dicing Before Grinding) method. According to this method, although it has a limitation in narrowing of the kerf (also referred to as a scribe line or a street) width that is a distance between chips, the transverse strength (or deflective strength) of the chip is increased, so that

damage of the chip can be suppressed.

{0055}

The above-described method of producing a semiconductor chip (the method of processing a semiconductor wafer) employing the semiconductor-
5 processing temporary-adhesive tape of the present invention is explained with reference to Figs. 2(a) to 2(c).

In the semiconductor-processing temporary-adhesive tape 1 of the present invention, in a case of having a release film 4 on a temporary-adhesive layer 3, after peeling the release film 4 to expose the temporary-adhesive layer 3
10 on top, the semiconductor-processing temporary-adhesive tape 1 composed of a laminate of a base 2 and the temporary-adhesive layer 3 is used (refer to Fig. 2(a)).

The semiconductor-processing temporary-adhesive tape 1 of the present invention is laminated on a semiconductor wafer 5 so that a protrusion 51 of the
15 semiconductor wafer 5 have a contact with the temporary-adhesive layer 3, thereby to obtain the semiconductor wafer 5 in which the protrusion 51 has been covered with the semiconductor-processing temporary-adhesive tape 1 of the present invention (refer to Fig. 2(b)). Herein, the protrusion 51 means a part that is able to constitute a semiconductor chip when the semiconductor wafer is
20 singulated. Ordinarily, the protrusion 51 has a patterned surface on which a circuit or the like of the semiconductor device has been formed.

{0056}

By grinding the backing-side face of the semiconductor wafer 5 with a grinder 7, the semiconductor wafer 5 is thinned (refer to Fig. 2(c)), and finally is
25 singulated into individual chips having a patterned surface.

The singulated semiconductor chip is picked up from the semiconductor-processing temporary-adhesive tape 1 of the present invention according to a conventional method such as peeling by a release tape in the state of being

adsorbed on the chuck table. On this occasion, in a case where the temporary-adhesive layer 3 is ultraviolet-curable, by reducing the temporary-adhesive strength of the temporary-adhesive layer 3 due to ultraviolet irradiation, it becomes possible to easily peel said temporary-adhesive layer 3 from the
5 singulated semiconductor chip.

EXAMPLES

{0057}

The present invention will be described in more detail based on examples
10 given below, but the invention is not meant to be limited by these.

Meanwhile, the density of the resins used hereinafter was measured in conformity to JIS K7112, and MFR of the resin was measured in conformity to JIS K7210, under the conditions of temperature: 190°C and load: 21.18 N.

{0058}

15 <Example 1>

1. Preparation of temporary-adhesive composition

80 parts by mass of 2-ethylhexyl acrylate as an acrylate monomer, 20 parts by mass of 2-hydroxyethyl acrylate as an acrylate monomer having a functional group, and 3 parts by mass of 2-isocyanatoethyl methacrylate having
20 an ultraviolet-polymerizable carbon-carbon double bond and an isocyanate group that reacts with a hydroxyl group in the molecule, with respect to a (meth)acrylic copolymer containing 1 part by mass of methyl methacrylate as a constituent, were allowed to react, to obtain a (meth)acrylic copolymer having an ultraviolet-polymerizable carbon-carbon double bond. With respect to 100 parts by mass
25 of this (meth)acrylic copolymer, 0.9 parts by mass of isocyanate compound (trade name: CORONATE L, manufactured by Nippon Polyurethane Industry Co., Ltd.) as a cross-linking agent, and 5.0 parts by mass of a photopolymerization initiator (trade name: IRUGACURE 184, manufactured by BASF), were mixed, to obtain

an ultraviolet-curable temporary-adhesive composition.

2. Preparation of base

A total thick-100 μm base was obtained by preparing so that 25 μm of LLDPE (linear low polyethylene, metallocene-catalyzed polymer), 50 μm of COP (cyclic olefin polymer), and 25 μm of LLDPE were laminated in this order, according to an extrusion method. Herein, the ethylene content of COP was 30% by mass, and MFR of COP was 0.8 g/10-min. Further, MFR of LLDPE was 2.5 g/10-min, and the density of LLDPE was 0.925 g/cm³.

3. Preparation of semiconductor-processing temporary-adhesive tape

On a PET film (thickness: 25 μm) subjected to a release treatment, the above-described temporary-adhesive composition was coated so that the thickness after drying would be 30 μm , and was dried to evaporate ethyl acetate as a solvent. After that, the coated temporary-adhesive composition was laminated with the base to transfer it to the base side, thereby to obtain a semiconductor-processing temporary-adhesive tape related to in Example 1. This semiconductor-processing temporary-adhesive tape 1 has a structure in which a base film 2, a temporary-adhesive layer 3, and a release film 4 have been laminated in this order, as shown in Fig. 1. Further, the base film 2 has a structure, in which a layer B₁, a layer A, and a layer B₂ have been laminated in this order, from the temporary-adhesive layer 3 side.

{0059}

<Example 2>

A semiconductor-processing temporary-adhesive tape related to in Example 2 was obtained in the same manner as in Example 1, except for replacing LLDPE with LLDPE (metallocene-catalyzed polymer) whose MFR is 4 g/10-min.

{0060}

<Example 3>

A semiconductor-processing temporary-adhesive tape related to in Example 3 was obtained in the same manner as in Example 2, except for replacing the thickness of the base with a total thickness of 150 μ m consisting of 35 μ m-thick LLDPE, 80 μ m-thick COP and 35 μ m-thick LLDPE.

5 {0061}

<Example 4>

A semiconductor-processing temporary-adhesive tape related to in Example 4 was obtained in the same manner as in Example 1, except for replacing LLDPE with HDPE having 7.0g/10-min of MFR and 0.964g/cm³ of density, and also replacing COP with COP having 35 mass% of ethylene content and 2.0g/10min of MFR.

{0062}

<Example 5>

A semiconductor-processing temporary-adhesive tape related to in Example 5 was obtained in the same manner as in Example 1, except for replacing LLDPE with LLDPE (metallocene-catalyzed polymer) having 2.0 g/10-min of MFR and 0.918g/cm³ of density.

{0063}

<Example 6>

20 A semiconductor-processing temporary-adhesive tape related to in Example 6 was obtained in the same manner as in Example 1, except for replacing LLDPE with LLDPE having 4.0 g/10-min of MFR and 0.944 g/cm³ of density and further replacing the thickness of the base with a total thickness of 80 μ m consisting of 16 μ m-thick LLDPE, 48 μ m-thick COP and 16 μ m-thick LLDPE.

25 {0064}

<Comparative Example 1>

A semiconductor-processing temporary-adhesive tape related to in Comparative Example 1 was obtained in the same manner as in Example 1,

except for replacing LLDPE with LLDPE having 3.1g/10-min of MFR and 0.925 g/cm³ of density.

{0065}

<Comparative Example 2>

- 5 A semiconductor-processing temporary-adhesive tape related to in Comparative Example 2 was obtained in the same manner as in Comparative Example 1, except for replacing COP with COP having 35% by mass of ethylene content and 2.0 g/10-min of MFR.

{0066}

- 10 <Comparative Example 3>

 A semiconductor-processing temporary-adhesive tape related to in Comparative Example 3 was obtained in the same manner as in Comparative Example 1, except for replacing LLDPE with an ethylene vinyl acetate copolymer having 2.5 g/10-min of MFR and 0.928 g/cm³ of density.

- 15 {0067}

 With the obtained semiconductor-processing temporary-adhesive tapes, the following evaluations were conducted.

{0068}

[1. Interlayer adhesion]

- 20 Each of 1300 mm-long, 25 mm-wide, and 100 μm-thick films was prepared, by using resins that constitute the layer B₁ and the layer B₂, and a resin that constitutes the layer A. The 25 mm×10 mm regions of 2 kinds of films produced were overlaid and heat-pressed at 220°C for 5 seconds, to form a junction. The release strength when peeled at a speed of 300 mm/min and a
25 peeling angle of 180° was measured by a strograph (manufactured by Toyoseiki Co., Ltd.). The case of taking the release strength of 5 N or more was evaluated as “○” (excellent), whereas the case of taking the release strength of less than 5 N was evaluated as “×” (poor).

{0069}

[2. Heat resistance]

On an 8-inch dummy wafer with a smooth surface, each of the semiconductor-processing temporary-adhesive tapes related to in Examples and Comparative Examples was laminated at the temporary-adhesive layer side, and the wafer was ground to a thickness of 50 μ m using a grinder DGP8760 (trade name) manufactured by Disco Corporation. After grinding, the wafer was heated up to 70°C by a hot plate so that the tape side had contact with the hot plate. Then, the case where no change in outer appearance was observed was evaluated as “o” (excellent), whereas the case where a change in outer appearance was observed was evaluated as “x” (poor).

{0070}

[3. Peelability]

On an 8-inch dummy wafer, the semiconductor-processing temporary-adhesive tape (hereinafter, referred to as the temporary-adhesive tape) prepared as described above was laminated, and the wafer was ground to a thickness of 50 μ m, using a grinder DGP8760 (trade name) manufactured by Disco Corporation. After grinding, the wafer was irradiated with an ultraviolet ray of integrated irradiation dose of 500 mJ/cm² from the temporary-adhesive tape side, using a high-pressure mercury lamp, to cure the temporary-adhesive layer, whereby a temporary-adhesive force was lowered. After that, with the temporary-adhesive tape side up, the wafer was adsorbed on a chuck table, and then the temporary-adhesive tape was peeled, using a release tape (manufactured by Nitto Denko Corporation). The case where peeling was observed at the interface between the wafer and the temporary-adhesive layer was evaluated as “o” (excellent), whereas the case where no peeling was observed at the interface or peeling was observed at the other position was evaluated as “x” (poor).

{0071}

[4.Crack]

On an 8-inch dummy wafer (thickness: 725 μm) having 75 μm -deep grooves formed along the singulation-scheduled area of 10 mm-by-12 mm in size of chip, the semiconductor-processing temporary-adhesive tape (hereinafter, referred to as the temporary-adhesive tape) prepared as described above was laminated on the side where grooves were formed, and the wafer was ground to a thickness of 50 μm using a grinder DGP8760 (trade name) manufactured by Disco Corporation, whereby chip singulation was performed. After grinding, irradiating the wafer with an ultraviolet ray of integrated irradiation dose of 500 mJ/cm^2 from the temporary-adhesive tape side, using a high-pressure mercury lamp, the temporary-adhesive layer was cured, to lower a temporary-adhesive force. After that, each chip was peeled from the temporary-adhesive tape, and then a crack at the end of the chip was observed by a microscope. The case where the number of cracked chips was 10 or less was evaluated as “○” (excellent). The case where the number of cracked chips was more than 10 and 20 or less was evaluated as “△” (good). The case where the number of cracked chips was more than 20 was evaluated as “×” (poor).

{0072}

Table 1

	Ex 1	Ex 2	Ex 3	Ex 4	Ex 5	Ex 6
Base	Layer B ₁ (μm)	25	25	25	25	16
	Layer A (μm)	50	50	50	50	48
	Layer B ₂ (μm)	25	25	25	25	16
	Total thickness (μm)	100	100	100	100	80
COP for constituting the layer A	Ethylene amount (mass%)	30	30	35	30	30
	MFR (g/10-min)	0.8	0.8	1	0.8	0.8
	Tg (°C)	110	110	80	110	110
	Resin	LLDPE	LLDPE	HDPE	LLDPE	LLDPE
Resin for constituting the layers B ₁ and B ₂	MFR (g/10-min)	2.5	4	7	2	4
	Density (g/cm ³)	0.925	0.925	0.925	0.918	0.944
Evaluation	Heat resistance	○	○	○	○	○
	Peelability	○	○	○	○	○
	Interlayer adhesion	○	○	○	○	○
	Crack	○	○	○	○	○

Note: 'Ex' means Example according to this invention.

Table 1 (continued)

		C Ex 1	C Ex 2	C Ex 3
Base	Layer B ₁ (μm)	25	25	25
	Layer A (μm)	50	50	50
	Layer B ₂ (μm)	25	25	25
	Total thickness (μm)	100	100	100
COP for constituting the layer A	Ethylene amount (mass%)	30	35	30
	MFR (g/10-min)	0.8	2	0.8
	Tg (°C)	110	80	110
Resin for constituting the layers B ₁ and B ₂	Resin	LDPE	LDPE	EVA
	MFR (g/10-min)	3.1	3.1	2.5
	Density (g/cm ³)	0.925	0.925	0.928
Evaluation	Heat resistance	○	○	○
	Peelability	×	×	○
	Interlayer adhesion	×	×	×
	Crack	○	○	○

Note: 'C Ex' means Comparative Example.

{0073}

From the above Table 1, Examples 1 to 6 of the semiconductor-processing temporary-adhesive tape each stipulated by the present invention each showed good results in any of heat resistance, peelability, interlayer
 5 adhesion, and suppression of crack occurrence. In contrast, the semiconductor-processing temporary-adhesive tape of Comparative Examples 1 and 2 each were poor in terms of peelability and interlayer adhesion, and the semiconductor-processing temporary-adhesive tape of Comparative Example 3 was poor in terms of interlayer adhesion, as compared to Examples 1 to 6.

10 {0074}

Having described our invention as related to the present embodiments, it is our intention that the invention not be limited by any of the details of the description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

15 {0075}

This application claims priority on Patent Application No. 2017-046435 filed in Japan on March 10, 2017, which is entirely herein incorporated by reference.

20 REFERENCE SIGNS LIST

{0076}

- 1 Semiconductor-processing temporary-adhesive tape
- 2 Base
- 3 Temporary-adhesive layer
- 25 4 Release film
- 5 Semiconductor wafer
- 7 Grinder
- 51 Protrusion (convex part)

CLAIMS

{Claim 1}

A semiconductor-processing temporary-adhesive tape, comprising: a
5 base; and a temporary-adhesive layer provided on one side of the base, wherein
the base is composed of a multilayer structure, at least one of which is a layer A
containing a cyclic olefin polymer with a proportion of 80% by mass or more, and
separately from the layer A, said multilayer structure has a layer B containing a
linear low-density polyethylene or a high-density polyethylene.

10

{Claim 2}

The semiconductor-processing temporary-adhesive tape according to
claim 1, wherein the density of the linear low-density polyethylene is 0.95 g/cm^3 or
less.

15

{Claim 3}

The semiconductor-processing temporary-adhesive tape according to
claim 1 or 2, wherein the melt-flow rate of the linear low-density polyethylene is
4.0 g/10-min or less.

20

{Claim 4}

The semiconductor-processing temporary-adhesive tape according to any
one of claims 1 to 3, wherein the linear low-density polyethylene is metallocene
polyethylene.

25

{Claim 5}

The semiconductor-processing temporary-adhesive tape according to any
one of claims 1 to 4, which is employed in a method of producing a

semiconductor chip, which comprises: singulating a semiconductor wafer having a modifying layer formed inside of the semiconductor wafer by subjecting to a laser irradiation along a scheduled singulation area of each chip; or a semiconductor wafer having a groove formed by a mechanical means along a scheduled singulation area of each chip, into individual chips by backgrinding of said semiconductor wafer.