

DESCRIPTION

Title of Invention

TAPE FOR SEMICONDUCTOR PROCESSING

5 Technical Field

[0001] The present invention relates to a tape for semiconductor processing.

Background Art

10 [0002] Recently, a demand for a reduction in the size, a reduction in the weight, and high functionality of an electronic device has increased. In accordance with such a demand, a reduction in the size, a reduction in the thickness, and high-density mounting have been required for a semiconductor device configuring the electronic device.

15 The semiconductor device is manufactured through a sealing step of sealing a semiconductor chip that is fixed onto a substrate, glass, or a temporary fixing material with a resin, a dicing step of dicing the sealed semiconductor chip, as necessary, and the like. There is also a case where a step of grinding a wafer is provided in the manufacturing procedure.

20 Such steps are generally performed in a state where the chip, the substrate, or the like is covered with a protective tape. The protective tape, in general, is pasted onto a surface to be protected, before a specific processing step, and is peeled off after the processing step.

25 [0003] Patent Literature 1 discloses a heat resistance pressure-sensitive adhesive sheet for manufacturing a semiconductor that is used for manufacturing a substrateless semiconductor package not using a metal

lead frame, a pressure-sensitive adhesive agent that is used in the sheet, and a manufacturing method of a semiconductor device using the sheet.

Citation List

Patent Literature

- 5 [0004] Patent Literature 1: Japanese Unexamined Patent Publication No. 2011-129649

Summary of Invention

Technical Problem

10 [0005] The present inventors have studied the use of a dicing die bonding tape that is used in the related art as a tape for temporary fixing that is necessary in various steps in a manufacturing procedure of a semiconductor device. In a case where one type of tape can be applied to both of the dicing die bonding tape and the tape for temporary fixing, general versatility of the tape increases, and thus, it is possible to
15 effectively manufacture a semiconductor device.

[0006] Heat resistance is exemplified as one of the properties of a tape that can be applied to various steps in the manufacturing procedure of the semiconductor device (hereinafter, referred to as a "tape for semiconductor processing"). According to the studies of the present
20 inventors, the pressure-sensitive adhesive agent layer of the pressure-sensitive adhesive sheet described in Patent Literature 1 contains a rubber component as a main component, and thus, there is a room for improvement in that the heat resistance is not sufficient.

[0007] Excellent peeling properties are exemplified as other properties
25 of the tape for semiconductor processing. In the related art, the tape that is used for temporary fixing is designed such that the

pressure-sensitive adhesive agent layer has suitable flexibility from the viewpoint of ensuring suitable peeling properties.

5 However, it is not possible to necessarily attain excellent peeling properties by only simply imparting the flexibility to the pressure-sensitive adhesive agent layer. Specifically, there are problems such as the occurrence of an adhesive residue in a peeling step.

10 [0008] The present invention has been made in consideration of the problems described above, and an object thereof is to provide a tape for semiconductor processing having excellent general versatility in a semiconductor manufacturing procedure.

Solution to Problem

15 [0009] In a tape for semiconductor processing according to the present invention, a base material layer, a pressure-sensitive adhesive layer, and an adhesive layer having thermosetting properties are laminated in this order, and a contraction ratio of the adhesive layer is less than 2%, and a thermal elastic modulus of the adhesive layer is less than 5 MPa, after a curing treatment is performed at 130°C for 1 hour. The adhesive layer after being subjected to the curing treatment at 130°C for 1 hour satisfies such a condition, and thus, the tape for semiconductor processing can be applied to various processing steps in a manufacturing procedure of a semiconductor device. Specifically, it is possible to impart heat resistance and peeling properties that are required in the various processing steps described above to the adhesive layer.

25 [0010] It is preferable that a peeling force of the adhesive layer with

respect to a wafer is greater than or equal to 15 N/m, after the curing treatment is performed at 130°C for 1 hour. The adhesive layer satisfies such a condition, and thus, it is possible to sufficiently ensure cohesiveness with respect to the wafer.

5 [0011] The tape for semiconductor processing according to the present invention is used for temporarily fixing a substrate and a wafer in addition to the dicing die bonding tape. That is, in the manufacturing procedure of the semiconductor device, the tape for semiconductor processing according to the present invention can be used for temporarily fixing the substrate onto one surface of the adhesive layer, and for temporarily fixing the wafer onto the other surface of the adhesive layer, after the base material layer and the adhesive layer are peeled off. For example, as described above, in a case where the tape for semiconductor processing is used for temporary fixing, none of the base material layer, the pressure-sensitive adhesive layer, and the adhesive layer remain in a semiconductor device that is finally manufactured.

15 [0012] It is preferable that the adhesive layer contains a thermoplastic resin, a thermosetting resin, a curing accelerator, and a filler. In this case, it is preferable that when a content of the thermoplastic resin in the adhesive layer is set to 100 parts by mass, a content of the thermosetting resin in the adhesive layer is 1 part by mass to 40 parts by mass. In addition, it is preferable that when the content of the thermoplastic resin in the adhesive layer is set to 100 parts by mass, a content of the filler in the adhesive layer is 1 part by mass to 330 parts by mass.

The adhesive layer satisfying such a condition is capable of

more stably improving the heat resistance and the peeling properties, in various processing steps in the manufacturing procedure of the semiconductor device.

5 [0013] The pressure-sensitive adhesive layer described above may be an UV type pressure-sensitive adhesive layer or a non-UV type pressure-sensitive adhesive layer.

Advantageous Effects of Invention

10 [0014] According to the present invention, a tape for semiconductor processing having excellent general versatility in a semiconductor manufacturing procedure is provided.

Brief Description of Drawings

[0015] FIG. 1 is a sectional view schematically illustrating one embodiment of tape for semiconductor processing of the present invention.

15 FIGS. 2(a) to 2(f) are sectional views schematically illustrating a step of manufacturing a semiconductor device by using the tape for semiconductor processing illustrated in FIG. 1 as a dicing die bonding tape.

20 FIG. 3 is a sectional view schematically illustrating an example of the semiconductor device that is manufactured by using the tape for semiconductor processing illustrated in FIG. 1.

25 FIGS. 4(a) to 4(f) are sectional views schematically illustrating a step of manufacturing a semiconductor device by using the tape for semiconductor processing illustrated in FIG. 1 as a tape for temporary fixing.

Description of Embodiments

[0016] Hereinafter, embodiments of the present invention will be described while suitably referring to the drawings. Furthermore, the present invention is not limited to the following embodiments. Herein, (meth)acryl indicates acryl or methacryl.

5 [0017] <Tape for Semiconductor Processing>

FIG. 1 is a sectional view schematically illustrating a tape for semiconductor processing according to this embodiment. In a tape 10 for semiconductor processing illustrated in the drawing, a base material layer 1, a pressure-sensitive adhesive layer 2, and an adhesive layer 3 having thermosetting properties are laminated in this order. The tape 10 for semiconductor processing can be applied to both of a dicing die bonding tape and a tape for temporary fixing, in a manufacturing procedure of a semiconductor device. In order to realize this, in the tape 10 for semiconductor processing, a contraction ratio of the adhesive layer 3 is less than 2%, and a thermal elastic modulus of the adhesive layer 3 is less than 5 MPa, after a curing treatment is performed at 130°C for 1 hour. The adhesive layer 3 after being subjected to the curing treatment at 130°C for 1 hour satisfies such a condition, and thus, the tape 10 for semiconductor processing is capable of imparting heat resistance and peeling properties that are required in various processing steps in the manufacturing procedure of the semiconductor device to the adhesive layer 3.

[0018] As described above, the contraction ratio of the adhesive layer 3 is less than 2%, after the curing treatment is performed at 130°C for 1 hour. The value is preferably less than or equal to 1.8%, and is more preferably less than or equal to 1.6%. The value is less than 2%, and

thus, in the manufacturing procedure of the semiconductor device, even in a case where the adhesive layer 3 is heated in a state where a wafer or a substrate is temporarily fixed to the adhesive layer 3, it is possible to sufficiently suppress positional displacement.

5 [0019] The contraction ratio of the adhesive layer 3 can be obtained as follows. The tape 10 for semiconductor processing is cut to have a predetermined size (for example, 100 mm × 100 mm), and the base material layer 1 and the pressure-sensitive adhesive layer 2 are peeled off from the tape 10 for semiconductor processing, and thus, a sample
10 only including the adhesive layer 3 is prepared. The sample is cured by being heated at 130°C for 1 hour, and the size of the sample after the curing treatment is measured. A sample area before thermal curing and a sample area after thermal curing are substituted into the following expression, and thus, the contraction ratio is calculated.

15
$$\text{Contraction ratio (\%)} = (\text{Sample area after curing}) / (\text{Sample area before curing}) \times 100$$

[0020] As described above, the thermal elastic modulus of the adhesive layer 3 is less than 5 MPa, after the curing treatment is performed at 130°C for 1 hour. The value is preferably less than or equal to 4.5
20 MPa, and is more preferably less than or equal to 4 MPa. The value is less than 5 MPa, and thus, in the manufacturing procedure of the semiconductor device, even in a case where the adhesive layer 3 is heated in a state where the wafer or the substrate is temporarily fixed to the adhesive layer 3, the adhesive layer 3 has suitable flexibility, and
25 thus, it is possible to realize excellent peeling properties. Furthermore, a lower limit value of the thermal elastic modulus of the adhesive layer

3, for example, is 1 MPa.

[0021] The thermal elastic modulus of the adhesive layer 3 can be obtained as follows. The tape 10 for semiconductor processing is cut to have a predetermined size, and the base material layer 1 and the pressure-sensitive adhesive layer 2 are peeled off from the tape 10 for semiconductor processing, and thus, a sample only including the adhesive layer 3 is prepared. The sample is cured by being heated at 130°C for 1 hour. The adhesive layer 3 after the curing treatment that is obtained as described above is cut to have a predetermined size (for example, 4 mm × 30 mm), and thus, a sample is obtained. A thermal elastic modulus of the sample is measured by using a dynamic viscoelasticity measurement device. That is, a tensile load is applied to the sample, and the thermal elastic modulus of the sample is measured from -50°C to 300°C in a condition of a frequency of 10 Hz and a temperature rising rate of 10°C/minute. An elastic modulus at a temperature of 100°C is set to the thermal elastic modulus.

[0022] From the viewpoint of sufficiently ensuring the cohesiveness of the adhesive layer 3 with respect to the wafer, a peeling force of the adhesive layer 3 with respect to the wafer after the curing treatment is performed at 130°C for 1 hour is preferably greater than or equal to 15 N/m, is more preferably 20 N/m to 200 N/m, and is even more preferably 25 N/m to 150 N/m.

[0023] It is preferable that the adhesive layer 3 contains a thermoplastic resin, a thermosetting resin, a curing accelerator, and a filler. In a case where the content of the thermoplastic resin in the adhesive layer 3 is set to 100 parts by mass, the content of the thermosetting resin in the

adhesive layer 3 is preferably 1 part by mass to 40 parts by mass, is more preferably 5 parts by mass to 39 parts by mass, and is even more preferably 10 parts by mass to 38 parts by mass. The content of the curing accelerator in the adhesive layer 3 is preferably 0.01 part by mass to 3 parts by mass, is more preferably 0.02 part by mass to 2 parts by mass, and is even more preferably 0.03 part by mass to 1 part by mass. The content of the filler in the adhesive layer 3 is preferably 1 part by mass to 330 parts by mass, is more preferably 1 part by mass to 300 parts by mass, is even more preferably 5 parts by mass to 200 parts by mass, and is particularly preferably 10 parts by mass to 100 parts by mass. The adhesive layer 3 satisfying such a condition is capable of more stably improving the heat resistance and the peeling properties that are required in various processing steps in the manufacturing procedure of the semiconductor device.

[0024] It is preferable that the adhesive layer 3 and the pressure-sensitive adhesive layer 2 sufficiently cohere with each other such that peeling does not occur during a processing step. A cohesive force between the adhesive layer 3 and the pressure-sensitive adhesive layer 2 can be evaluated by a T-shaped peeling strength of both of the adhesive layer 3 and the pressure-sensitive adhesive layer 2. The T-shaped peeling strength of the adhesive layer 3 and the pressure-sensitive adhesive layer 2 (Peeling Rate: 50 mm/minute) is preferably greater than or equal to 15 N/m, and is more preferably 16 N/m to 100 N/m. The T-shaped peeling strength is measured by the following method. The adhesive layer 3 and the pressure-sensitive adhesive layer 2 are bonded to each other by a laminator, and then, a

notch having a width of 25 mm is cut, and thus, a measurement sample is prepared. At this time, in the case of using an UV irradiation type pressure-sensitive adhesive agent, UV irradiation is suitably performed. The T-shaped peeling strength is measured at a peeling rate of 50 mm/minute.

[0025] Hereinafter, the adhesive layer 3, the pressure-sensitive adhesive layer 2, and the base material layer 1 configuring the tape 10 for semiconductor processing will be described.

[0026] [Adhesive Layer]

As described above, it is preferable that the adhesive layer 3 contains the thermoplastic resin, the thermosetting resin, the curing accelerator, and the filler.

[0027] (Thermoplastic Resin)

A resin having thermoplastic properties, or a resin that has thermoplastic properties at least in an uncured state and forms a cross-linked structure after being heated can be used as the thermoplastic resin. From the viewpoint of excellent contractility, excellent heat resistance, and excellent peeling properties as the tape for semiconductor processing, a (meth)acrylic copolymer having a reactive group (hereinafter, may be referred to as a "reactive group-containing (meth)acrylic copolymer") is preferable as the thermoplastic resin.

In a case where the reactive group-containing (meth)acrylic copolymer is contained as the thermoplastic resin, the adhesive layer 3 may not contain the thermosetting resin. That is, the adhesive layer 3 may contain the reactive group-containing (meth)acrylic copolymer, the curing accelerator, and the filler.

Only one type of such thermoplastic resins can be used, or two or more types thereof can be used by being combined.

[0028] Examples of the (meth)acrylic copolymer include a (meth)acrylic acid ester copolymer such as acrylic glass and acrylic rubber, and the like, and the acrylic rubber is preferable. It is preferable that the acrylic rubber contains acrylic acid ester as a main component, and is formed by the copolymerization of a monomer to be selected from (meth)acrylic acid ester and acrylonitrile.

[0029] Examples of the (meth)acrylic acid ester include methyl acrylate, ethyl acrylate, propyl acrylate, isopropyl acrylate, butyl acrylate, isobutyl acrylate, hexyl acrylate, cyclohexyl acrylate, 2-ethyl hexyl acrylate, lauryl acrylate, methyl methacrylate, ethyl methacrylate, propyl methacrylate, isopropyl acrylate, butyl methacrylate, isobutyl methacrylate, hexyl methacrylate, cyclohexyl methacrylate, 2-ethyl hexyl methacrylate, lauryl methacrylate, and the like.

A copolymer containing butyl acrylate and acrylonitrile as a copolymerization component, and a copolymer containing ethyl acrylate and acrylonitrile as a copolymerization component are preferable as the (meth)acrylic acid ester copolymer.

[0030] It is preferable that the reactive group-containing (meth)acrylic copolymer is a reactive group-containing (meth)acrylic copolymer that contains a (meth)acrylic monomer having a reactive group as a copolymerization component. Such a reactive group-containing (meth)acrylic copolymer can be obtained by copolymerizing a monomer composition that contains a (meth)acrylic monomer having a reactive group and the monomers described above.

[0031] From the viewpoint of improving the heat resistance, an epoxy group, a carboxyl group, an acryloyl group, a methacryloyl group, a hydroxyl group, and an episulfide group are preferable as the reactive group, and among them, from the viewpoint of cross-linking properties,
5 the epoxy group and the carboxyl group are more preferable as the reactive group.

[0032] In this embodiment, it is preferable that the reactive group-containing (meth)acrylic copolymer is an epoxy group-containing (meth)acrylic copolymer that contains a (meth)acrylic monomer having
10 an epoxy group as a copolymerization component. In this case, examples of the (meth)acrylic monomer having an epoxy group include glycidyl acrylate, 4-hydroxy butyl acrylate glycidyl ether, 3,4-epoxy cyclohexyl methyl acrylate, glycidyl methacrylate, 4-hydroxy butyl methacrylate glycidyl ether, 3,4-epoxy cyclohexyl methyl methacrylate,
15 and the like. From the viewpoint of the heat resistance, the glycidyl acrylate and the glycidyl methacrylate are preferable as the (meth)acrylic monomer having a reactive group.

[0033] It is preferable that Tg of the thermoplastic resin is -50°C to 50°C. In a case where the Tg of the thermoplastic resin is lower than
20 or equal to 50°C, it is easy to ensure the flexibility of the adhesive layer 3. In addition, in a case where there is irregularity when the adhesive layer 3 is pasted to an adherend, it is easy for the adhesive layer 3 to follow the irregularity, and thus, suitable adhesiveness is obtained. On the other hand, in a case where Tg of the thermoplastic resin is higher
25 than or equal to -50°C, it is easy to suppress an excessive increase in the flexibility of the adhesive layer 3, and thus, excellent handling

properties, excellent adhesiveness, and excellent peeling properties can be attained.

[0034] Tg of the thermoplastic resin is a midpoint glass transition temperature value that is obtained by differential scanning calorimetry (DSC). Specifically, Tg of the thermoplastic resin is a midpoint glass transition temperature that is calculated by measuring a calorimetric change in a condition of a temperature rising rate of 10°C/minute and a measurement temperature of -80°C to 80°C, in accordance with a method based on JIS K 7121:1987.

[0035] It is preferable that a weight average molecular weight of the thermoplastic resin is greater than or equal to 100000 and less than or equal to 2000000. In a case where the weight average molecular weight is greater than or equal to 100000, it is easy to ensure the heat resistance in the use of temporary fixing. On the other hand, in a case where the weight average molecular weight is less than or equal to 2000000, it is easy to suppress a decrease in the flow and a decrease in the pasting properties in the use of temporary fixing. From the viewpoint described above, the weight average molecular weight of the thermoplastic resin is more preferably greater than or equal to 500000 and less than or equal to 2000000, and is even more preferably greater than or equal to 1000000 and less than or equal to 2000000. Furthermore, the weight average molecular weight is a value in terms of polystyrene using a standard curve of standard polystyrene in a gel permeation chromatography (GPC).

[0036] In a case where the (meth)acrylic copolymer having a reactive group contains glycidyl acrylate or glycidyl methacrylate as a

copolymerization component, the total content thereof is preferably 0.1 mass% to 20 mass%, is more preferably 0.5 mass% to 15 mass%, and is even more preferably 1.0 mass% to 10 mass%, on the basis of the total amount of the copolymerization components. In a case where the content is within the range described above, it is possible to make the flexibility, the adhesiveness, and the peeling properties of the adhesive layer 3 compatible at a higher level.

[0037] A (meth)acrylic copolymer having a reactive group that is obtained by a polymerization method such as a pearl polymerization and a solution polymerization may be used as the (meth)acrylic copolymer having a reactive group as described above. Alternatively, a commercially available product such as HTR-860P-3CSP (Product Name, manufactured by Nagase ChemteX Corporation) may be used.

[0038] (Thermosetting Resin)

A resin that is cured by heat can be used as the thermosetting resin without any particular limitation. Examples of the thermosetting resin include an epoxy resin, an acrylic resin, a silicone resin, a phenolic resin, a thermal curable polyimide resin, a polyurethane resin, a melamine resin, an urea resin, and the like. Only one type of such thermosetting resins can be used, or two or more types thereof can be used by being combined.

[0039] The epoxy resin is not particularly limited insofar as the epoxy resin has a heat-resistant function by being cured. A difunctional epoxy resin such as bisphenol A type epoxy, a novolac type epoxy resin such as a phenol novolac type epoxy resin and a cresol novolac type epoxy resin, and the like can be used as the epoxy resin. In addition,

known epoxy resins of the related art, such as a polyfunctional epoxy resin, a glycidyl amine type epoxy resin, a heterocyclic ring-containing epoxy resin, and an alicyclic epoxy resin, can be used as the epoxy resin.

5 [0040] Examples of the bisphenol A type epoxy resin include EPIKOTE 807, EPIKOTE 815, EPIKOTE 825, EPIKOTE 827, EPIKOTE 828, EPIKOTE 834, EPIKOTE 1001, EPIKOTE 1004, EPIKOTE 1007, and EPIKOTE 1009 (all are manufactured by Mitsubishi Chemical Corporation), DER-330, DER-301, and DER-361 (all are manufactured
10 by The Dow Chemical Company), YD8125 and YDF8170 (all are manufactured by Tohto Kasei Co., Ltd.), and the like.

Examples of the phenol novolac type epoxy resin include EPIKOTE 152 and EPIKOTE 154 (all are manufactured by Mitsubishi Chemical Corporation), EPPN-201 (manufactured by Nippon Kayaku
15 Co., Ltd.), DEN-438 (manufactured by The Dow Chemical Company), and the like.

Examples of the o-cresol novolac type epoxy resin include YDCN-700-10 (manufactured by Nippon Steel & Sumikin Chemical Co., Ltd.), EOCN-102S, EOCN-103S, EOCN-104S, EOCN-1012,
20 EOCN-1025, and EOCN-1027 (all are manufactured by Nippon Kayaku Co., Ltd.), YDCN701, YDCN702, YDCN703, and YDCN704 (all are manufactured by Tohto Kasei Co., Ltd.), and the like.

Examples of the polyfunctional epoxy resin include Epon 1031S (manufactured by Mitsubishi Chemical Corporation), Araldite 0163
25 (manufactured by BASF Japan Ltd.), DENACOL EX-611, EX-614, EX-614B, EX-622, EX-512, EX-521, EX-421, EX-411, and EX-321

(all are manufactured by Nagase ChemteX Corporation), and the like.

Examples of the amine type epoxy resin include EPIKOTE 604 (manufactured by Mitsubishi Chemical Corporation), YH-434 (manufactured by Tohto Kasei Co., Ltd.), TETRAD-X and TETRAD-C (all are manufactured by MITSUBISHI GAS CHEMICAL COMPANY, INC.), ELM-120 (manufactured by Sumitomo Chemical Company, Limited), and the like.

Examples of the heterocyclic ring-containing epoxy resin include Araldite PT810 (manufactured by BASF Japan Ltd.), ERL4234, ERL4299, ERL4221, and ERL4206 (all are manufactured by Union Carbide Corporation), and the like. Only one type of such epoxy resins can be used, or two or more types thereof can be used by being combined.

[0041] Known resins that are generally used can be used as an epoxy resin curing agent that is a part of the thermosetting resin component. Specifically, examples of the epoxy resin curing agent include amines, polyamide, an acid anhydride, polysulfide, borontrifluoride, bisphenols having two or more phenolic hydroxyl groups in one molecule, such as bisphenol A, bisphenol F, and bisphenol S, a phenolic resin such as a phenol novolac resin, a bisphenol A novolac resin, and a cresol novolac resin, and the like. In particular, the phenolic resin such as the phenol novolac resin, the bisphenol A novolac resin, and the cresol novolac resin is preferable as the epoxy resin curing agent, from the viewpoint of excellent corrosion resistance at the time of absorbing moisture.

Furthermore, an epoxy curing agent may be used along with the epoxy resin, or may be independently used.

[0042] Among the phenolic resin curing agents described above, PHENOLITE LF2882, PHENOLITE LF2822, PHENOLITE TD-2090, PHENOLITE TD-2149, PHENOLITE VH-4150, and PHENOLITE VH4170 (all are manufactured by DIC Corporation, Product Name),
5 H-1 (manufactured by Meiwa Plastic Industries, Ltd., Product Name), and Epicure MP402FPY, Epicure YL6065, Epicure YLH129B65, Milex XL, Milex XLC, Milex XLC-LL, Milex RN, Milex RS, and Milex VR (all are manufactured by Mitsubishi Chemical Corporation, Product Name) are preferably used.

10 [0043] (Curing Accelerator)

Examples of the curing accelerator include imidazoles, a dicyandiamide derivative, dicarboxylic acid dihydrazide, triphenyl phosphine, tetraphenyl phosphonium tetraphenyl borate, 2-ethyl-4-methyl imidazole-tetraphenyl borate,
15 1,8-diazabicyclo[5,4,0]undecene-7-tetraphenyl borate, and the like. Only one type of such curing accelerators can be used, or two or more types thereof can be used by being combined.

[0044] In a case where the adhesive layer 3 contains a (meth)acrylic copolymer having an epoxy group, it is preferable to contain a curing
20 accelerator for accelerating the curing of the epoxy group contained in such an acrylic copolymer. Examples of the curing accelerator for accelerating the curing of the epoxy group include a phenol-based curing agent, an acid anhydride-based curing agent, an amine-based curing agent, an imidazole-based curing agent, an imidazoline-based
25 curing agent, a triazine-based curing agent, and a phosphine-based curing agent. Among them, the imidazole-based curing agent that can

be expected to reduce a process time and to improve workability is preferable as the curing accelerator, from the viewpoint of fast curing properties, heat resistance, and peeling properties. Only one type of such compounds can be used, or two or more types thereof can be used by being combined.

[0045] The content of the curing accelerator in the adhesive layer 3 is preferably 0.02 part by mass to 20 parts by mass, is more preferably 0.025 part by mass to 10 parts by mass, is even more preferably 0.025 part by mass to 3 parts by mass, and is particularly preferably 0.025 part by mass to 0.05 part by mass, with respect to 100 parts by mass of the thermoplastic resin. In a case where the content of the curing accelerator is within the range described above, the curing accelerator tends to be capable of sufficiently suppressing a decrease in preservation stability while improving curing properties of the adhesive layer 3.

[0046] (Inorganic Filler)

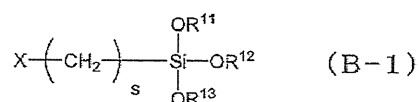
The adhesive layer 3 can be compounded with an inorganic filler. Examples of the inorganic filler include a metal filler such as a silver powder, a gold powder, and a copper powder, a non-metal inorganic filler such as silica, alumina, boron nitride, titania, glass, iron oxide, and ceramic, and the like. The inorganic filler can be selected in accordance with a desired function.

[0047] It is preferable that the inorganic filler described above has an organic group on a surface. The surface of the inorganic filler is modified with the organic group, and thus, dispersibility with respect to an organic solvent at the time of preparing varnish for forming the

adhesive layer 3, and the contractility of the adhesive layer 3 are readily suppressed, the elastic modulus is readily improved, and the peeling properties are readily improved.

[0048] The inorganic filler having an organic group on the surface, for example, can be obtained by mixing a silane coupling agent represented by Formula (B-1) described below and an inorganic filler, and by stirring the mixture at a temperature of higher than or equal to 30°C. It is possible to confirm that the surface of the inorganic filler is modified with the organic group by UV measurement, IR measurement, XPS measurement, and the like.

[0049] [Chemical Formula 1]



[0050] In Formula (B-1), X represents an organic group selected from the group consisting of a phenyl group, a glycidoxy group, an acryloyl group, a methacryloyl group, a mercapto group, an amino group, a vinyl group, an isocyanate group, and a methacryloxy group, s represents an integer of 0 or 1 to 10, and R¹¹, R¹², and R¹³ each independently represents an alkyl group having 1 to 10 carbon atoms.

Examples of the alkyl group having 1 to 10 carbon atoms include a methyl group, an ethyl group, a propyl group, a butyl group, a pentyl group, a hexyl group, a heptyl group, an octyl group, a nonyl group, a decyl group, an isopropyl group, an isobutyl group, and the like.

The methyl group, the ethyl group, and the pentyl group are preferable as the alkyl group having 1 to 10 carbon atoms, from the

viewpoint of commercial availability. X is preferably the amino group, the glycidoxy group, the mercapto group, and the isocyanate group, and is more preferably the glycidoxy group and the mercapto group, from the viewpoint of the heat resistance. In Formula (B-1), s is preferably 0 to 5, and is more preferably 0 to 4, from the viewpoint of suppressing film fluidity at a high temperature, and of improving the heat resistance. [0051] Examples of the silane coupling agent include trimethoxy phenyl silane, dimethyl dimethoxy phenyl silane, triethoxy phenyl silane, dimethoxy methyl phenyl silane, vinyl trimethoxy silane, vinyl triethoxy silane, vinyl tris(2-methoxy ethoxy) silane, N-(2-aminoethyl)-3-aminopropyl methyl dimethoxy silane, N-(2-aminoethyl)-3-aminopropyl trimethoxy silane, 3-aminopropyl triethoxy silane, 3-aminopropyl trimethoxy silane, 3-glycidoxy propyl trimethoxy silane, 3-glycidoxy propyl methyl dimethoxy silane, 2-(3,4-epoxy cyclohexyl) ethyl trimethoxy silane, 3-isocyanate propyl triethoxy silane, 3-methacryloxy propyl trimethoxy silane, 3-mercapto propyl trimethoxy silane, 3-ureidopropyl triethoxy silane, N-(1,3-dimethyl butylidene)-3-(triethoxy silyl)-1-propane amine, N,N'-bis(3-(trimethoxy silyl) propyl) ethylene diamine, polyoxy ethylene propyl trialkoxy silane, polyethoxy dimethyl siloxane, and the like.

Among them, the 3-aminopropyl triethoxy silane, the 3-glycidoxy propyl trimethoxy silane, the 3-isocyanate propyl triethoxy silane, and the 3-mercapto propyl trimethoxy silane are preferable, and the trimethoxy phenyl silane, the 3-glycidoxy propyl trimethoxy silane, and the 3-mercapto propyl trimethoxy silane are more preferable.

Only one type of such silane coupling agents can be used, or two or more types thereof can be used by being combined.

[0052] The content of the coupling agent described above is preferably 0.01 part by mass to 50 parts by mass, and is more preferably 0.05 part by mass to 20 parts by mass, with respect to 100 parts by mass of the inorganic filler, from the viewpoint of obtaining a balance between the heat resistance and the preservation stability, and is even more preferably 0.5 part by mass to 10 parts by mass with respect to 100 parts by mass of the inorganic filler, from the viewpoint of improving the heat resistance.

[0053] The content of the inorganic filler in the adhesive layer 3 is preferably less than or equal to 330 parts by mass, is more preferably less than or equal to 180 parts by mass, and is even more preferably less than or equal to 100 parts by mass, with respect to 100 parts by mass of the thermoplastic resin. A lower limit of the content of the inorganic filler is not particularly limited, and is preferably greater than or equal to 1 part by mass, is more preferably greater than or equal to 5 parts by mass, and is even more preferably greater than or equal to 8 parts by mass, with respect to 100 parts by mass of the thermoplastic resin.

The content of the inorganic filler is within the range described above, and thus, the contractility of the adhesive layer 3 is readily suppressed, the elastic modulus is readily improved, and the peeling properties are readily improved.

[0054] (Organic Filler)

The adhesive layer 3 can be compounded with an organic filler. Examples of the organic filler include carbon, a rubber-based filler,

silicone-based fine particles, polyamide fine particles, polyimide fine particles, and the like. The content of the organic filler is preferably less than or equal to 300 parts by mass, is more preferably less than or equal to 200 parts by mass, and is even more preferably less than or equal to 100 parts by mass, with respect to 100 parts by mass of the thermoplastic resin. A lower limit of the content of the organic filler is not particularly limited, and is preferably greater than or equal to 5 parts by mass with respect to 100 parts by mass of the thermoplastic resin.

[0055] (Organic Solvent)

The adhesive layer 3 may be diluted by further using an organic solvent, as necessary. The organic solvent is not particularly limited, and can be set in consideration of volatility or the like at the time of forming a film from a boiling point. Specifically, a solvent having a comparatively low boiling point, such as methanol, ethanol, 2-methoxy ethanol, 2-ethoxy ethanol, 2-butoxy ethanol, methyl ethyl ketone, acetone, methyl isobutyl ketone, toluene, and xylene, is preferable from the viewpoint of preventing the curing of a film at the time of forming the film. In addition, in order to improve film forming properties, and the like, it is preferable to use a solvent having a comparatively high boiling point, such as dimethyl acetamide, dimethyl formamide, N-methyl pyrrolidone, and cyclohexanone. Only one type of such solvents can be used, or two or more types thereof can be used by being combined.

[0056] [Pressure-Sensitive Adhesive Layer]

A pressure-sensitive adhesive layer that has a pressure-sensitive adhesive force at a room temperature and has a cohesive force with

respect to the adhesive layer 3 is preferable as the pressure-sensitive adhesive layer 2. The pressure-sensitive adhesive layer 2 may be a UV type pressure-sensitive adhesive layer (cured by a high-energy ray such as an ultraviolet ray or a radioactive ray), or may be a non-UV type pressure-sensitive adhesive layer (for example, cured by heat).

[0057] In the case of using a UV type pressure-sensitive adhesive agent, it is preferable to contain an acrylic copolymer, a cross-linking agent, and a photopolymerization initiator as the pressure-sensitive adhesive agent forming the pressure-sensitive adhesive layer 2.

In the case of using a non-UV type pressure-sensitive adhesive agent, it is preferable to contain a base resin, and at least one type of functional group selected from an epoxy group, an isocyanate group, an aziridine group, and a melanine group, as a cross-linking agent that reacts with a functional group of the base resin by a cross-linking reaction, in order to adjust the pressure-sensitive adhesive force. Only one type of such cross-linking agents may be used, or two or more types thereof may be used together.

Examples of the base resin include an acrylic resin, various synthetic rubbers, natural rubber, a polyimide resin, and the like. From the viewpoint of preventing an adhesive residue of the pressure-sensitive adhesive agent, it is preferable that the base resin has a functional group that is capable of reacting with other additives, for example, a hydroxyl group, a carboxyl group, and the like.

In addition, in a case where a reaction rate is low, a catalytic agent such as amine or tin can be suitably used. In order to adjust pressure-sensitive adhesive properties, an arbitrary component such as a

tackifier such as a rosin-based tackifier and a terpene resin-based tackifier, and various surfactants may be suitably contained within a range not affecting the effect of the present invention.

5 [0058] The thickness of the pressure-sensitive adhesive layer 2 is preferably 1 μm to 100 μm , is more preferably 2 μm to 50 μm , and is even more preferably 5 μm to 40 μm . In a case where the thickness of the pressure-sensitive adhesive layer 2 is less than 1 μm , it is difficult to ensure a sufficient pressure-sensitive adhesive force with respect to the adhesive layer, and thus, there is a concern that it is difficult to perform
10 processing, whereas in a case where the thickness is greater than 100 μm , it is not economical and there are no merits on properties.

[0059] [Base Material Layer]

Known polymer sheets or tapes can be used as the base material layer 1. As a specific example, polyolefin such as crystalline
15 polypropylene, amorphous polypropylene, high-density polyethylene, medium-density polyethylene, low-density polyethylene, ultralow-density polyethylene, low-density linear polyethylene, polybutene, and polymethyl pentene, polyester such as an ethylene-vinyl acetate copolymer, an ionomer resin, an
20 ethylene-(meth)acrylic acid copolymer, an ethylene-(meth)acrylic acid ester (random and alternating) copolymer, an ethylene-butene copolymer, an ethylene-hexene copolymer, polyurethane, polyethylene terephthalate, and polyethylene naphthalate, polycarbonate, polyimide, polyether ether ketone, polyimide, polyether imide, polyamide, wholly
25 aromatic polyamide, polyphenyl sulfide, aramid (paper), glass, glass cloth, a fluorine resin, polyvinyl chloride, polyvinylidene chloride, a

cellulose-based resin, and a silicone resin are exemplified. A mixture in which a plasticizer, silica, an antiblocking material, a slip agent, an antistatic agent, and the like are mixed with the materials described above can also be used.

5 [0060] It is preferable that a layer containing at least one type selected from the polypropylene, the polyethylene-polypropylene random copolymer, the polyethylene-polypropylene block copolymer, the ethylene-vinyl acetate copolymer, the ionomer resin, and the ethylene-(meth)acrylic acid copolymer among the materials described
10 above, as a main component, is in contact with the pressure-sensitive adhesive layer. Such resins are preferable from the viewpoint of properties such as a Young's modulus, stress relaxation properties, and a melting point, the price, the recycling of a waste material after being used, and the like, and also from the viewpoint of readily obtaining a
15 surface modification effect of an ultraviolet ray.

[0061] The base material layer 1 may be a single layer, or may have a multi-layer structure in which layers formed of different materials are laminated, as necessary. As a manufacturing method of such a base material, a base material layer including different layers may be formed
20 at one time by a multi-layer extrusion method, or a tape formed by an inflation method and a single-layer extrusion method may be bonded by using an adhesive agent or may be bonded by thermal welding. In addition, the base material layer 1 may be subjected to a surface roughening treatment such as a matting treatment and a corona
25 treatment, as necessary, in order to control cohesiveness with respect to the pressure-sensitive adhesive layer 2.

[0062] <Preparation Method of Tape for Semiconductor Processing>

The tape 10 for semiconductor processing, for example, can be prepared by the following method. That is, first, a raw material resin composition of the adhesive layer 3 is dissolved in a solvent such as an organic solvent, is formed into varnish, and is applied onto a release film by a knife coating method, a roll coating method, a spray coating method, a gravure coating method, a bar coating method, a curtain coating method, and the like, and the solvent is removed, and thus, the adhesive layer 3 is formed. After that, a laminated body including the base material layer 1 and the pressure-sensitive adhesive layer 2 that is prepared separately is laminated at an ordinary temperature to 60°C. Accordingly, it is possible to obtain the tape 10 for semiconductor processing in which the pressure-sensitive adhesive layer 2 and the adhesive layer 3 are laminated on the base material layer 1 in this order.

[0063] <Application of Tape for Semiconductor Processing>

The tape 10 for semiconductor processing, for example, can be used as a dicing die bonding tape, and can also be used as a tape for temporary fixing of a substrate and a wafer. Hereinafter, each application will be described.

[0064] [Dicing Die Bonding Tape]

FIGS. 2(a) to 2(f) and FIG. 3 are sectional views for illustrating one embodiment of a manufacturing method of a semiconductor device (a semiconductor package) using the tape 10 for semiconductor processing. The manufacturing method of the semiconductor device according to this embodiment includes a pasting step (a wafer laminating step) of pasting the adhesive layer 3 of the tape 10 for

semiconductor processing to a semiconductor wafer, a dicing step of dicing a semiconductor wafer W and the adhesive layer 3, an ultraviolet ray irradiation step of irradiating the pressure-sensitive adhesive layer 2 with an ultraviolet ray, a pickup step of picking up a semiconductor element 50 to which the adhesive layer 3 is attached from the base material layer 1, and an adhesion step of allowing the semiconductor element 50 to adhere to a support substrate 60 for mounting the semiconductor element through the adhesive layer 3. Hereinafter, each step will be described with reference to the drawings.

10 [0065] (Pasting Step)

First, the tape 10 for semiconductor processing is arranged in a predetermined device. Subsequently, as illustrated in FIGS. 2(a) and 2(b), the tape 10 for semiconductor processing is pasted to the semiconductor wafer W such that the adhesive layer 3 is in contact with one surface Ws of the semiconductor wafer W. It is preferable that a circuit surface Wc of the semiconductor wafer W is a surface on a side opposite to the surface Ws.

[0066] (Dicing Step)

Next, as illustrated in FIG. 2(c), the semiconductor wafer W, the pressure-sensitive adhesive layer 2, and the adhesive layer 3 are diced. At this time, the base material layer 1 may be partially diced. As described above, the tape 10 for semiconductor processing also functions as a dicing sheet.

[0067] (Ultraviolet Ray Irradiation Step)

Next, as illustrated in FIG. 2(d), in a case where the pressure-sensitive adhesive layer 2 is a UV type pressure-sensitive

adhesive layer, the pressure-sensitive adhesive layer 2 is irradiated with an ultraviolet ray, and thus, the pressure-sensitive adhesive layer 2 is cured, and an adhesive force between the pressure-sensitive adhesive layer 2 and the adhesive layer 3 decreases. It is preferable that the wavelength of the ultraviolet ray to be emitted is 200 nm to 400 nm, and it is preferable that the irradiation is performed in an irradiation condition of an illuminance of 30 mW/cm² to 240 mW/cm² and an irradiation dose of 200 mJ to 500 mJ.

[0068] (Pickup Step)

After the ultraviolet ray is emitted, as illustrated in FIG. 2(e), the semiconductor element 50 with the adhesive layer thrust by a needle 42 from the adhesive layer 3 side is sucked by a suction collet 44 and is picked up, while the semiconductor elements 50 obtained by cutting are separated from each other by expanding the base material layer 1. Furthermore, the semiconductor element 50 with the adhesive layer includes a semiconductor element Wa and an adhesive layer 3a. In addition, the semiconductor element Wa is obtained by dividing the semiconductor wafer W, and the adhesive layer 3a is obtained by dividing the adhesive layer 3. In the pickup step, it is not necessary to perform the expansion, but it is possible to further improve pickup properties by performing the expansion.

[0069] In addition, a thrust amount of the needle 42 can be selected as necessary. Further, from the viewpoint of ensuring sufficient pickup properties with respect to an ultrathin wafer, for example, a two-stage or three-stage pickup method may be performed. In addition, the semiconductor element 50 may be picked up by a method other than the

method using the suction collet 44.

[0070] (Adhesion Step)

After the semiconductor element 50 with the adhesive layer is picked up, as illustrated in FIG. 2(f), the semiconductor element 50 with the adhesive layer adheres to the support substrate 60 for mounting the semiconductor element through the adhesive layer 3a, by thermal compression bonding. The semiconductor element 50 with the adhesive layer is mounted onto the support substrate 60 through the adhesive layer 3a, and then, the semiconductor element 50 with the adhesive layer adheres again to the semiconductor element Wa through the adhesive layer 3a, by thermal compression bonding. Accordingly, it is possible to more reliably mount a plurality of semiconductor elements Wa on the support substrate 60.

[0071] Subsequently, as illustrated in FIG. 3, it is preferable that the semiconductor element Wa and the support substrate 60 are electrically connected to each other by wire bonding 70, as necessary. At this time, the semiconductor element Wa, the adhesive layer 3a, and the support substrate 60, for example, are heated at 170°C for approximately 15 minutes to 60 minutes. Further, the semiconductor element Wa and the support substrate 60 are connected to each other by the wire bonding, and then, the semiconductor element Wa may be sealed with a resin, as necessary. A resin sealing material 80 may be formed on a surface 60a of the support substrate 60, and a solder ball 90 for electric connection with respect to an external substrate (a mother board) may be formed on a surface of the support substrate 60 on a side opposite to the surface 60a.

[0072] Furthermore, it is preferable that the adhesive layer 3a is in a semi-cured state at the time of performing resin sealing. Accordingly, a concave portion of irregularity that is formed on the surface 60a of the support substrate 60 at the time of performing the resin sealing can be
5 more excellently filled with the adhesive layer 3a. The semi-cured state indicates a state in which the adhesive layer 3a is not completely cured. The adhesive layer 3a in the semi-cured state may be finally heated and cured by using a heating treatment in the manufacturing procedure of the semiconductor device once or a plurality of times.

10 [0073] It is possible to manufacture the semiconductor device 100 by using the tape 10 for semiconductor processing through the steps as described above.

[0074] [Tape for Temporary Fixing]

15 The tape 10 for semiconductor processing can be used for temporarily fixing a substrate S onto one surface of the adhesive layer 3 in the manufacturing procedure of the semiconductor device, and for temporarily fixing the semiconductor wafer W onto the other surface of the adhesive layer 3 after the base material layer 1 and the pressure-sensitive adhesive layer 2 are peeled off.

20 [0075] FIGS. 4(a) to 4(f) are sectional views illustrating a step of manufacturing the semiconductor device by using the tape 10 for semiconductor processing as a tape for temporary fixing. In a case where the tape 10 for semiconductor processing is used as the tape for temporary fixing, none of the base material layer 1, the
25 pressure-sensitive adhesive layer 2, and the adhesive layer 3 remain on a semiconductor device that is finally manufactured (refer to FIG. 4(f)).

[0076] As illustrated in FIG. 4(a), the tape 10 for semiconductor processing is pasted to the substrate S such that the adhesive layer 3 is in contact with the surface of the substrate S. At this time, the temperature may be approximately 50°C to 90°C. In such a temperature condition, the substrate S and the tape 10 for semiconductor processing are bonded to each other, and thus, it is possible to set a state in which an adhesive force between the adhesive layer 3 and the substrate S is greater than an adhesive force between the adhesive layer 3 and the pressure-sensitive adhesive layer 2.

That is, the substrate S is to control the adhesiveness of the adhesive layer 3 in a state where the adhesive layer 3 is bonded to the substrate S. Furthermore, the adhesive layer 3 in a state of being bonded to the substrate S is heated, and thus, the adhesiveness of the adhesive layer 3 is controlled, and the adhesive layer 3 has predetermined heat resistance.

[0077] The base material layer 1 and the pressure-sensitive adhesive layer 2 are peeled off from the state illustrated in FIG. 4(a), and thus, as illustrated in FIG. 4(b), a laminated body 20 including the substrate S and the adhesive layer 3 is obtained. Subsequently, the semiconductor wafer W is pasted to the adhesive layer 3 such that the surface Ws of the semiconductor wafer W is in contact with the adhesive layer 3. Furthermore, the surface of the semiconductor wafer W on a side opposite to the surface Ws is the circuit surface Wc. Accordingly, as illustrated in FIG. 4(c), a laminated body 30 is obtained in which a base material S is bonded onto one surface F1 of the adhesive layer 3, and the semiconductor wafer W is bonded onto the other surface F2 of the

adhesive layer 3. The temperature at the time of bonding the adhesive layer 3 and the semiconductor wafer W to each other may be approximately 50°C to 90°C. In such a temperature condition, the adhesive layer 3 and the semiconductor wafer W are bonded to each other, and thus, it is possible to set a state in which an adhesive force between the adhesive layer 3 and the semiconductor wafer W is greater than an adhesive force between the adhesive layer 3 and the substrate S. [0078] After necessary processing (for example, dicing) is performed with respect to the semiconductor wafer W in the laminated body 30 illustrated in FIG. 4(c), the substrate S is peeled off by the pickup. Accordingly, as illustrated in FIG. 4(d), a laminated body 40 including the adhesive layer 3a and the semiconductor element Wa is obtained. Subsequently, the semiconductor element Wa is mounted on the support substrate 60 in a state where the circuit surface Wc of the semiconductor element Wa is directed towards the support substrate 60 (refer to FIG. 4(e)). An adhesive agent (not illustrated) may be interposed between the semiconductor element Wa and the support substrate 60. After that, the adhesive layer 3a is peeled off (refer to FIG. 4(f)). The semiconductor element Wa and the support substrate 60, for example, are electrically connected to each other by the wire bonding from the state illustrated in FIG. 4(f), as necessary, and thus, the semiconductor device is manufactured.

Examples

[0079] The present invention will be described on the basis of examples. The present invention is not limited to the following examples. [0080] (Preparation of Pressure-Sensitive Adhesive Film)

Main monomers and functional group monomers described below were used and an acrylic copolymer as a pressure-sensitive adhesive agent was obtained by a solution polymerization method. That is, 2-ethyl hexyl acrylate and methyl methacrylate were used as the main monomer, and hydroxy ethyl acrylate and an acrylic acid were used as the functional group monomer. A weight average molecular weight of the acrylic copolymer described above was 400000, and a glass transition point thereof was -38°C. A pressure-sensitive adhesive agent solution was prepared in which 10 parts by mass of a polyfunctional isocyanate cross-linking agent (Product Name: MITEC NY730A-T, manufactured by Mitsubishi Chemical Corporation) was compounded with respect to 100 parts by mass of the acrylic copolymer. The pressure-sensitive adhesive agent solution was applied onto polyethylene terephthalate (a thickness of 25 μm) subjected to a surface release treatment such that the thickness of the pressure-sensitive adhesive agent at the time of being dried became 10 μm , and was dried. Further, a polyolefin base material formed of Polypropylene/Vinyl Acetate/Polypropylene (a thickness of 100 μm) was laminated on the surface of the pressure-sensitive adhesive agent. Accordingly, a pressure-sensitive adhesive film including a pressure-sensitive adhesive layer and the polyolefin base material (a base material layer) was obtained. The pressure-sensitive adhesive film was left to stand at a room temperature for 2 weeks, and was sufficiently aged.

[0081] (Example 1)

(Preparation of Adhesive Agent Varnish)

The following materials were mixed and were subjected to

vacuum deaeration, and thus, adhesive agent varnish was obtained.

· Thermoplastic Resin: HTR-860P-3 (Product Name, manufactured by Nagase ChemteX Corporation, Glycidyl Group-Containing Acrylic Rubber, Molecular weight of 1000000, Tg of -7°C) 100 parts by mass

· Thermosetting Component: YDCN-700-10 (Product Name, manufactured by Nippon Steel & Sumikin Chemical Co., Ltd., o-Cresol Novolac Type Epoxy Resin, Epoxy Equivalent of 210) 20 parts by mass

· Thermosetting Component: MILEX XLC-LL (Product Name, manufactured by Mitsui Chemicals, Inc., Phenol Aralkyl Resin) 17 parts by mass

· Curing Accelerator: 2PZ-CN (Product Name, manufactured by SHIKOKU CHEMICALS CORPORATION, Imidazole Compound) 0.04 part by mass

· Inorganic Filler: AEROSIL R972 (Product Name, manufactured by NIPPON AEROSIL CO., LTD., Silicon Oxide) 12 parts by mass

· Silane Coupling Agent: A-189 (Product Name, manufactured by Nippon Unicar Company Limited, γ -Mercapto Propyl Trimethoxy Silane) 0.6 part by mass

· Silane Coupling Agent A-1170 (Product Name, manufactured by Nippon Unicar Company Limited, γ -Ureidopropyl Triethoxy Silane) 1.7 parts by mass

[0082] (Preparation of Tape for Semiconductor Processing)

The adhesive agent varnish described above was applied onto polyethylene terephthalate having a thickness of 75 μ m (Teijin Tetoron

Film: A-31, manufactured by Teijin Dupont Film Japan Limited) that was subjected to a surface release treatment. Accordingly, an adhesive sheet was obtained in which an adhesive layer was formed on one surface of a resin film. The adhesive sheet and the pressure-sensitive adhesive film described above were bonded to each other, and thus, a tape for semiconductor processing was obtained. Furthermore, the adhesive sheet and the pressure-sensitive adhesive film were bonded to each other such that the adhesive layer of the adhesive sheet was directly in contact with the pressure-sensitive adhesive layer of the pressure-sensitive adhesive film. The adhesive layer pressure-sensitively adheres to the pressure-sensitive adhesive layer, and thus, it is possible to reliably invert the adhesive layer formed on the polyethylene terephthalate described above to the pressure-sensitive adhesive layer side.

[0083] (Example 2)

A tape for semiconductor processing was obtained as with Example 1, except that materials used for preparing adhesive agent varnish were compounded as shown in Example 2 of Table 1.

[0084] (Comparative Example 1)

A tape for semiconductor processing was obtained as with Example 1, except that materials used for preparing adhesive agent varnish were compounded as shown in Comparative Example 1 of Table 1. Furthermore, in Table 1, "EXA-830CRP" is a product name of a thermosetting resin (a bisphenol F type epoxy resin and an epoxy equivalent of 170) manufactured by DIC Corporation.

[0085] (Comparative Example 2)

A tape for semiconductor processing was obtained as with Example 1, except that materials used for preparing adhesive agent varnish were compounded as shown in Comparative Example 2 of Table 1. Furthermore, in Table 1, "LF-4871" is a product name of a thermosetting resin (a bisphenol A type epoxy resin and an epoxy equivalent of 118) manufactured by DIC Corporation, "YDF-8170C" is a product name of a thermosetting resin (a bisphenol F type epoxy resin and an epoxy equivalent of 157) manufactured by Nippon Steel & Sumikin Chemical Co., Ltd., and "SC-2050-HLG" is a product name of a filler manufactured by Admatechs Company Limited.

[0086] (Comparative Example 3)

A tape for semiconductor processing was obtained as with Example 1, except that materials used for preparing adhesive agent varnish were compounded as shown in Comparative Example 3 of Table 1.

[0087] (Comparative Example 4)

A tape for semiconductor processing was obtained as with Example 1, except that materials used for preparing adhesive agent varnish were compounded as shown in Comparative Example 4 of Table 1.

[0088] The tapes for semiconductor processing according to the examples and the comparative examples were evaluated by the following methods.

(1) Contractility of Adhesive Layer

Each of the tapes for semiconductor processing according to the examples and the comparative examples was cut to have a size of 100

mm × 100 mm. The pressure-sensitive adhesive film (the pressure-sensitive adhesive layer and the base material layer), and the polyethylene terephthalate subjected to the surface release treatment were peeled off from each sample such that only the adhesive layer remained, and the adhesive layer was set to a measurement sample. The measurement samples according to the examples and the comparative examples were heated and cured at 130°C for 1 hour. The size of the sample after the curing treatment was measured, and a contraction ratio was calculated by the following expression. In Table 1, a sample of which the value of the contraction ratio was less than 2% was evaluated as "A", and a sample of which the value of the contraction ratio was greater than or equal to 2% was evaluated as "B".

Contraction ratio (%) = (Sample area after curing)/(Sample area before curing) × 100

[0089] (2) Thermal Elastic Modulus of Adhesive Layer after Curing Treatment

The sample after the curing that was used in the evaluation of the contractility described above was cut to have a size of 4 mm × 30 mm, and was set to a measurement sample. A tensile load was applied to the sample by using a dynamic viscoelasticity measurement device DVE-V4 (Product Name, manufactured by Rheology Co., Ltd.), and the elastic modulus of the sample was measured from -50°C to 300°C in a condition of a frequency of 10 Hz and a temperature rising rate of 10°C/minute. An elastic modulus at a temperature of 100°C was set to a thermal elastic modulus. In Table 1, a sample of which the value of the thermal elastic modulus was less than 5 MPa was evaluated as "A",

and a sample of which the value of the thermal elastic modulus was greater than or equal to 5 MPa was evaluated as "B".

[0090] (3) 90° Peeling Force of Adhesive Layer with respect to Wafer (Evaluation of Cohesive Force with respect to Wafer)

5 The sample after the curing that was used in the evaluation of the contractility described above was cut to have a width of 10 mm, and was set to a measurement sample. The measurement sample was pasted onto the surface of a silicon wafer. After that, a pressure-sensitive adhesive tape (an auxiliary tape) was pasted to the measurement sample, and the measurement sample was peeled off from the wafer at 50 mm/minute and an angle of 90°. In Table 1, a sample of which the value of the 90° peeling force was greater than or equal to 15 N/m was evaluated as "A", and a sample of which the value of the 90° peeling force was less than 15 N/m was evaluated as "B".

10 [0091] (4) Surface Roughness of Adhesive Layer after Being Peeled off

 Surface roughness (Tp) of the adhesive layer after the evaluation of "Cohesive Force of Adhesive Layer with respect to Wafer" described above (after being peeled off) was measured by using a laser microscope (manufactured by KEYENCE CORPORATION). In Table 1, a sample of which the value of the surface roughness (the value of Tp 30 was less than or equal to 30 was evaluated as "A", and a sample of which the value of the surface roughness was greater than 30 was evaluated as "B".

[0092] [Table 1]

		Example 1	Example 2	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Compound of pressure-sensitive adhesive layer [parts by mass]	Acrylic copolymer	100	100	100	100	100	100
	Polyfunctional isocyanate cross-linking agent	10	10	10	10	10	10
Compound of adhesive layer [parts by mass]	Thermoplastic resin	100	100	100	100	100	100
	HTR-860P-3						
	XLC-LL	17	14	31	-	135	20
	YDCN-700-10	20	15	26	30	95	25
	EXA-830CRP	-	-	14	-	80	-
	LF-4871	-	-	-	95	-	-
	YDF-8170C	-	-	-	100	-	-
Compound of adhesive layer [parts by mass]	Curing accelerator	0.04	0.03	0.15	0.30	0.40	0.05
	2PZ-CN						
	R972	12	11	7	-	-	13
	SC2050-HLG	-	-	-	330	180	-
	A-189	0.6	0.6	0.1	0.9	0.5	-
	A-1160	1.7	1.7	0.2	1.8	1.1	1.7
	A-187	-	-	-	-	-	0.8
Contractility after curing treatment (at 130°C for 1 hour) [%]		A	A	B	B	B	B
Thermal elastic modulus after curing treatment (at 130°C for 1 hour) @100°C [MPa]		A	A	B	B	B	A
90° Peeling force of adhesive layer with respect to wafer [N/m]		A	A	B	B	B	B
Surface roughness of adhesive layer after being peeled off		A	A	A	A	A	A

Industrial Applicability

[0093] According to the present invention, a tape for semiconductor processing having excellent general versatility in a semiconductor manufacturing procedure is provided.

5

Reference Signs List

[0094] 1: base material layer, 2: pressure-sensitive adhesive layer, 3: adhesive layer, 10: tape for semiconductor processing, F1: one surface of adhesive layer, F2: the other surface of adhesive layer, S: substrate, W: semiconductor wafer.

10

CLAIMS

1. A tape for semiconductor processing in which a base material layer, a pressure-sensitive adhesive layer, and an adhesive layer having thermosetting properties are laminated in this order,

5 wherein a contraction ratio of the adhesive layer is less than 2%, and a thermal elastic modulus of the adhesive layer is less than 5 MPa, after a curing treatment is performed at 130°C for 1 hour.

2. The tape for semiconductor processing according to claim 1,

10 wherein a peeling force of the adhesive layer with respect to a wafer is greater than or equal to 15 N/m, after the curing treatment is performed at 130°C for 1 hour.

3. The tape for semiconductor processing according to claim 1 or 2,

15 wherein in a manufacturing procedure of a semiconductor device, the tape for semiconductor processing is used

for temporarily fixing a substrate onto one surface of the adhesive layer, and

20 for temporarily fixing a wafer onto the other surface of the adhesive layer, after the base material layer and the adhesive layer are peeled off.

4. The tape for semiconductor processing according to any one of claims 1 to 3,

25 wherein none of the base material layer, the pressure-sensitive adhesive layer, and the adhesive layer remain in a semiconductor device that is finally manufactured.

5. The tape for semiconductor processing according to any one of claims 1 to 4,

wherein the adhesive layer contains a thermoplastic resin, a thermosetting resin, a curing accelerator, and a filler, and

5 when a content of the thermoplastic resin in the adhesive layer is set to 100 parts by mass, a content of the thermosetting resin in the adhesive layer is 1 part by mass to 40 parts by mass.

6. The tape for semiconductor processing according to claim 5,

10 wherein when the content of the thermoplastic resin in the adhesive layer is set to 100 parts by mass, a content of the filler in the adhesive layer is 1 part by mass to 330 parts by mass.

7. The tape for semiconductor processing according to any one of claims 1 to 6,

15 wherein the pressure-sensitive adhesive layer is formed of a non-UV type pressure-sensitive adhesive agent.