

DESCRIPTION

WORKPIECE-SECURING SHEET WITH ATTACHED RESIN LAYER

5 Technical Field

[0001]

The present invention relates to a workpiece-securing sheet with an attached resin layer, including a pressure sensitive adhesive layer provided on a base material film and a curable resin layer provided on the pressure sensitive adhesive layer.

10 Priority is claimed on Japanese Patent Application No. 2014-192505, filed September 22, 2014, the content of which is incorporated herein by reference.

Background Art

[0002]

15 A workpiece-securing sheet with an attached resin layer, including a pressure sensitive adhesive layer provided on a base material film and having a curable resin layer provided on the pressure sensitive adhesive layer, is suitable for the use in, for example, a process starting from a step of dicing a semiconductor wafer and then picking up semiconductor chips, so as to carry out a die bonding step of adhering the semiconductor

20 chips thus picked up to a substrate, a lead frame, other semiconductor chips, or the like. For example, at the time of producing a semiconductor device, the curable resin layer of the workpiece-securing sheet with an attached resin layer functions as an adhesive film for die adhesion, and in a case in which dicing is performed in a state in which the workpiece-securing sheet with an attached resin layer has been attached to a

25 semiconductor wafer by means of the curable resin, the workpiece-securing sheet with an

attached resin layer is used as a dicing die bonding sheet.

[0003]

Furthermore, in addition to the applications described above, the workpiece-securing sheet with an attached resin layer can also be used as, for example, a sheet serving as both a protective film for a semiconductor wafer or a semiconductor chip (flip chip) and a dicing sheet, or as both an adhesive film used when a flip chip is adhered to a chip-mounting unit, and a back grinding sheet.

For all of those applications, the workpiece-securing sheet with an attached resin layer is in a state of being attached to semiconductor chips by means of the curable resin layer, and the pressure sensitive adhesive layer is peeled off from the curable resin layer for each base material film. At this time, contact adhesiveness of the pressure sensitive adhesive layer may be decreased by performing a polymerization reaction on the pressure sensitive adhesive layer, as necessary.

[0004]

On the other hand, when the curable resin layer of the workpiece-securing sheet with an attached resin layer contains a filler material, strength of the curable resin layer increases. In this regard, there are occasions in which it is difficult to uniformly disperse a filler material in the curable resin layer. Furthermore, in a cured film obtained after a curable resin layer containing a filler material is cured, there is a possibility that the filler material may fall out. Thus, a workpiece-securing sheet with an attached resin layer, which has a curable resin layer that substantially does not contain any filler material, is desirable. However, unlike a workpiece-securing sheet with an attached resin layer, a pressure sensitive adhesive sheet in which a pressure sensitive adhesive layer is directly attached to a semiconductor wafer without involving a curable resin layer is known. Regarding such a pressure sensitive adhesive sheet, for example, a

pressure sensitive adhesive sheet including a pressure sensitive adhesive layer which uses a base polymer having structural units derived from a methacrylate monomer having an alkyl group having 10 to 17 carbon atoms and another two kinds of particular monomer has been disclosed (see PTL 1).

5 Citation List

Patent Literature

[0005]

[PTL 1] Japanese Unexamined Patent Application, First Publication No.

2012-136678

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Summary of Invention

Technical Problem

[0006]

However, PTL 1 neither describes nor suggests anything regarding providing a curable resin layer on a pressure sensitive adhesive layer of a pressure sensitive adhesive sheet, and the constituent components of the curable resin layer. Furthermore, in a case in which a workpiece-securing sheet with an attached resin layer, which includes a curable resin layer that substantially does not contain a filler material, is used, there is usually a problem in which so-called easy pick-up characteristics, by which semiconductor chips can be picked up easily by preventing any large external force from being applied to the workpiece-securing sheet, are deteriorated.

[0007]

The present invention was achieved in view of such circumstances, and it is an object of the invention to provide a workpiece-securing sheet with an attached resin layer having easy pick-up characteristics with respect to semiconductor chips, the

workpiece-securing sheet having a pressure sensitive adhesive layer provided on a base material film, and also having a curable resin layer that substantially does not contain a filler material, provided on the pressure sensitive adhesive layer.

Solution to Problem

5 [0008]

In order to solve the problems described above, the invention provides a workpiece-securing sheet with an attached resin layer, including: a pressure sensitive adhesive layer provided on a base material film; and a curable resin layer provided on the pressure sensitive adhesive layer, in which the pressure sensitive adhesive layer contains
10 a (meth)acrylic acid alkyl ester polymer obtained by polymerizing a monomer containing a (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms, the curable resin layer contains a polymer component (a) and a curable component (b), and the total content of the polymer component (a) and the curable component (b) of the curable resin layer is 95% by mass or more with respect to the total amount of the curable
15 resin layer.

With regard to the workpiece-securing sheet with an attached resin layer of the invention, it is preferable that the curable resin layer contain an acrylic resin as the polymer component (a), and the content of the acrylic resin with respect to the total amount of the solid content of the curable resin layer be 50% by mass or more.

20 With regard to the workpiece-securing sheet with an attached resin layer of the invention, the content of the curable component (b) of the curable resin layer is preferably 1 to 100 parts by mass with respect to the content of 100 parts by mass of the polymer component (a).

Advantageous Effects of Invention

25 [0009]

According to the invention, a workpiece-securing sheet with an attached resin layer is provided having easy pick-up characteristics with respect to semiconductor chips, the workpiece-securing sheet including: a pressure sensitive adhesive layer provided on a base material film; and a curable resin layer that substantially does not contain a filler material, that is, a curable resin layer that does not contain a filler material at all or contains a filler material to the extent that the effect obtainable by using a filler is negligible, provided on the pressure sensitive adhesive layer.

Brief Description of Drawings

10 [0010]

FIG. 1 is a cross-sectional view schematically illustrating a workpiece-securing sheet with an attached resin layer according to the invention.

Description of Embodiments

15 [0011]

<Workpiece-securing sheet with attached resin layer>

According to the invention, a workpiece-securing sheet with an attached resin layer is provided, including: a pressure sensitive adhesive layer provided on a base material film; and a curable resin layer provided on the pressure sensitive adhesive layer, in which the pressure sensitive adhesive layer contains a (meth)acrylic acid alkyl ester polymer obtained by polymerizing a monomer containing a (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms, the curable resin layer contains a polymer component (a) and a curable component (b), and the total content of the polymer component (a) and the curable component (b) of the curable resin layer is 95% by mass or more with respect to the total amount of the curable resin layer.

According to the present specification, a laminated structure of a base material film and a pressure sensitive adhesive layer is referred to as a workpiece-securing sheet.

According to the present specification, the term "polymerization" includes both homopolymerization of a monomer of a single kind, and copolymerization of multiple kinds of monomers. Therefore, according to the present specification, the term "polymer" includes both a homopolymer obtained by homopolymerizing a monomer of a single kind, and a copolymer obtained by copolymerizing multiple kinds of monomers.

[0012]

The workpiece-securing sheet with an attached resin layer is suitable for the use in, for example, a process starting from a step of dicing a semiconductor wafer and then picking up semiconductor chips, so as to carry out a die bonding step of adhering the semiconductor chips thus picked up, to a substrate, a lead frame, other semiconductor chips, or the like. In this case, the curable resin layer (resin layer) functions as an adhesive film for die adhesion, and in a case in which dicing is performed in a state in which the workpiece-securing sheet with an attached resin layer has been attached to a semiconductor wafer by means of the curable resin layer, the workpiece-securing sheet with an attached resin layer is used as a dicing die bonding sheet.

[0013]

The workpiece-securing sheet with an attached resin layer has sufficient easy pick-up characteristics, by which workpieces (semiconductor chips) can be easily picked up even with a small external force. Therefore, damage such as cracking that may occur when semiconductor chips having small thicknesses are picked up is suppressed. Such easy pick-up characteristics are further enhanced, in a case in which the pressure sensitive adhesive layer contains a compound capable of a polymerization reaction, as a result of a decrease in the contact adhesiveness of the pressure sensitive adhesive layer

after the polymerization reaction.

A workpiece-securing sheet with an attached resin layer usually undergoes deterioration of the easy pick-up characteristics, in a case in which the curable resin layer substantially does not contain a filler material. On the contrary, in the

5 workpiece-securing sheet with an attached resin layer according to the invention, since the pressure sensitive adhesive layer contains a (meth)acrylic acid alkyl ester polymer obtained by polymerizing a monomer containing a (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms, even if the curable resin layer substantially does not contain a filler material, the workpiece-securing sheet has satisfactory easy
10 pick-up characteristics. If the number of carbon atoms of the alkyl group of the (meth)acrylic acid alkyl ester used for the pressure sensitive adhesive layer is 9 or smaller, in a case in which the curable resin layer substantially does not contain a filler material, the workpiece-securing sheet with an attached resin layer does not exhibit easy pick-up characteristics for semiconductor chips. On the other hand, if the number of carbon
15 atoms of the alkyl group of the (meth)acrylic acid alkyl ester used for the pressure sensitive adhesive layer is 19 or larger, handling is difficult owing to low solubility or the like.

[0014]

Usually, in a case in which a workpiece-securing sheet having a pressure
20 sensitive adhesive layer provided on a base material film is used to directly secure semiconductor chips to the pressure sensitive adhesive layer, the semiconductor chips are detached from the pressure sensitive adhesive layer (picked up) after dicing. In a case in which the pressure sensitive adhesive layer includes a component that is polymerized by irradiation with energy radiation, the pick-up process can be carried out after the
25 contact adhesiveness of the pressure sensitive adhesive layer is decreased by irradiating

the pressure sensitive adhesive layer with energy radiation.

On the other hand, in a case in which a workpiece-securing sheet with an attached resin layer is used to secure semiconductor chips to the curable resin layer of the workpiece-securing sheet, after dicing, the semiconductor chips are detached from the pressure sensitive adhesive layer in a state in which the semiconductor chips are integrated with the curable resin layer, or in some cases, the semiconductor chips are detached from the pressure sensitive adhesive layer (picked up) after the semiconductor chips are irradiated with energy radiation.

Usually, a workpiece-securing sheet with an attached resin layer does not easily undergo the detachment described above as compared to a workpiece-securing sheet that does not include a curable resin layer, and tends to have poor detachability (easy pick-up characteristics).

On the contrary, since the workpiece-securing sheet with an attached resin layer according to the invention employs the configuration described above, the workpiece-securing sheet has excellent detachability (easy pick-up characteristics).

[0015]

Furthermore, the workpiece-securing sheet with an attached resin layer according to the invention is also suitable for the use as a sheet for forming a protective film that protects the back surface of a flip chip. In this case, the curable resin layer (resin layer) functions as a film for forming a protective film of a flip chip, and in a case in which dicing is performed in a state in which the workpiece-securing sheet with an attached resin layer is attached to a semiconductor wafer by means of the curable resin layer, the workpiece-securing sheet is used as a sheet serving as both a protective sheet for a semiconductor wafer or a semiconductor chip (flip chip) and a dicing sheet.

[0016]

Furthermore, the workpiece-securing sheet with an attached resin layer according to the invention can also be used in a case in which the curable resin layer is attached to an electrode-forming surface of a semiconductor wafer for flip chips, the surface on the reverse side of the electrode-forming surface of the semiconductor wafer is ground, and then the workpiece-securing sheet is detached while leaving the curable resin layer on the electrode-forming surface. In this case, the curable resin layer (resin layer) functions thereafter as an adhesive film when flip chips are adhered to a chip-mounting unit, and the workpiece-securing sheet with an attached resin layer is used as a sheet serving as both an adhesive film and a back grinding sheet.

[0017]

FIG. 1 is a cross-sectional view schematically illustrating the workpiece-securing sheet with an attached resin layer according to the invention.

The workpiece-securing sheet with an attached resin layer 10 illustrated in FIG. 1 has a pressure sensitive adhesive layer 12 provided on a base material film 11, and has a curable resin layer 13 provided on the pressure sensitive adhesive layer 12, and thus the workpiece-securing sheet 10 is configured to include a curable resin layer 13 on a pressure sensitive adhesive layer 12 of a workpiece-securing sheet 1. Furthermore, the workpiece-securing sheet with an attached resin layer 10 also has a release film 14 provided on the curable resin layer 13.

In the workpiece-securing sheet 10, the pressure sensitive adhesive layer 12 is laminated on the surface 11a of the base material film 11, and the curable resin layer 13 is laminated on a portion of the surface 12a of the pressure sensitive adhesive layer 12. In the surface 12a of the pressure sensitive adhesive layer 12, the release film 14 is laminated on the exposed surface where the curable resin layer 13 is not laminated, and on the surface 13a (top surface and lateral surfaces) of the curable resin layer 13.

However, the workpiece-securing sheet with an attached resin layer according to the invention is not intended to be limited to the example illustrated in FIG. 1.

[0018]

[Base material film]

5 Regarding the material for the base material film, various resins are preferable, and specific examples thereof include polyethylenes (low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE), and the like), polypropylene, polybutene, polybutadiene, polymethylpentene, polyvinyl chloride, a vinyl chloride polymer, polyethylene terephthalate, polybutylene terephthalate, 10 polyurethane, polyurethane acrylate, polyimide, an ethylene-vinyl acetate polymer, an ionomer resin, an ethylene-(meth)acrylic acid polymer, an ethylene-(meth)acrylic acid ester polymer, polystyrene, polycarbonate, a fluororesin, and a hydrogenated product, a modification product, a crosslinked product, or a polymerization product of any one of these resins.

15 According to the present specification, the term "(meth)acryl" is considered as a concept including both "acryl" and "methacryl".

[0019]

 The base material film may be composed of one layer (single layer), or may be composed of multiple layers of two or more layers. In a case in which the base material 20 film is composed of multiple layers, the materials of the respective layers may all be the same, or may all be different, and it is also acceptable that only some of them are the same.

[0020]

 The thickness of the base material film can be selected as appropriate according 25 to the purpose; however, the thickness is preferably 50 to 300 μm , and more preferably

60 to 100 μm .

The "thickness of the base material film" as described above is a value expressed as an average of thicknesses measured at five arbitrary spots using a contact type thickness meter.

5 [0021]

The base material film may be a film that has been subjected, on the surface, to a surface roughening treatment based on a sand blast treatment or a solvent treatment; or to an oxidation treatment such as a corona discharge treatment, an electron beam irradiation treatment, a plasma treatment, an ozone-ultraviolet irradiation treatment, a flame
10 treatment, a chromic acid treatment, or a hot air treatment, in order to enhance the adhesiveness between the base material film and the pressure sensitive adhesive layer provided thereon. Furthermore, the base material film may also be a film having a surface that has been subjected to a primer treatment.

Among these, the base material film is particularly preferably a film that has
15 been subjected to an electron beam irradiation treatment on the surface, from the viewpoint that generation of fragments of the base material film caused by friction of the blade at the time of dicing is suppressed.

[0022]

[Pressure sensitive adhesive layer]

20 The pressure sensitive adhesive layer contains the (meth)acrylic acid alkyl ester polymer described above.

The pressure sensitive adhesive layer can be formed using a pressure sensitive adhesive composition which includes intended components such as the (meth)acrylic acid alkyl ester polymer. Then, the ratio of contents between the non-volatile
25 components in the pressure sensitive adhesive composition is maintained as the same

ratio in the pressure sensitive adhesive layer.

[0023]

The thickness of the pressure sensitive adhesive layer can be selected as appropriate according to the purpose; however, the thickness is preferably 1 to 100 μm ,
5 more preferably 1 to 60 μm , and particularly preferably 1 to 30 μm .

The "thickness of the pressure sensitive adhesive layer" described above is a value expressed as the average of thicknesses measured at five arbitrary spots with a contact type thickness meter. When it is difficult to directly apply a contact type thickness meter to the pressure sensitive adhesive layer, the thickness may be calculated
10 by measuring the overall thickness as described above in a state in which the base material film and other films such as a release material that will be described below are superposed, and taking the difference between the overall thickness and the thickness of the other films that are superposed (measured by a method similar to the method described above).

15 [0024]

((Meth)acrylic acid alkyl ester polymer)

The (meth)acrylic acid alkyl ester polymer is a product obtained by polymerizing a monomer containing a (meth)acrylic acid alkyl ester in which the number of carbon atoms of the alkyl group that constitutes the alkyl ester is 10 to 18. According
20 to the present specification, unless particularly stated otherwise, a simple description of "(meth)acrylic acid alkyl ester" is intended to mean the "(meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms" as described above.

The alkyl group having 10 to 18 carbon atoms of the (meth)acrylic acid alkyl ester may be any one of a linear group, a branched group and a cyclic group, and in the
25 case of being cyclic, the alkyl group may be any of a monocyclic group or a polycyclic

group; however, a linear or branched alkyl group is preferred.

[0025]

Preferred examples of the (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms include (meth)acrylic acid alkyl esters having chain-liked
5 alkyl groups, such as decyl (meth)acrylate, undecyl (meth)acrylate, dodecyl (meth)acrylate (lauryl (meth)acrylate), tridecyl (meth)acrylate, tetradecyl (meth)acrylate (myristyl (meth)acrylate), pentadecyl (meth)acrylate, hexadecyl (meth)acrylate (palmityl (meth)acrylate), heptadecyl (meth)acrylate, octadecyl (meth)acrylate (stearyl (meth)acrylate), and isooctadecyl (meth)acrylate (isostearyl (meth)acrylate); and
10 (meth)acrylic acid cycloalkyl esters such as isobornyl (meth)acrylate and dicyclopentanyl (meth)acrylate. Furthermore, regarding the (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms, among those described above, dodecyl (meth)acrylate (lauryl (meth)acrylate) or isooctadecyl (meth)acrylate (isostearyl (meth)acrylate) is particularly preferred from the viewpoint of obtaining an effect by
15 which the easy pick-up characteristics against workpieces are enhanced.

[0026]

Regarding the (meth)acrylic acid alkyl ester polymer, an energy radiation-polymerizable polymer that is polymerized by irradiation with energy radiation can also be used, and a preferred example of such a polymer is a polymer having a
20 hydroxyl group and having a polymerizable group in a side chain through a urethane bond. Such a (meth)acrylic acid alkyl ester polymer is crosslinked, for example, when the hydroxyl group of this polymer reacts with an isocyanate group in an isocyanate-based crosslinking agent that will be described below. Also, when such an acrylic acid ester polymer has a polymerizable group in a side chain, detachability from
25 an adherend is enhanced as a result of a decrease in the contact adhesiveness of the

pressure sensitive adhesive layer after the polymerization reaction, for example, compared to the case in which a polymerization reaction is induced by irradiation with energy radiation using a separate, low-molecular-weight energy ray-polymerizable compound. Thus, an effect in which the easy pick-up characteristics against workpieces are enhanced is obtained. Furthermore, since it is not necessary to use a separate, low-molecular-weight energy ray-polymerizable compound, in a case in which a curable resin layer is formed on the pressure sensitive adhesive layer as will be discussed later, migration of such a low-molecular-weight energy ray-polymerizable compound from the pressure sensitive adhesive layer to the curable resin layer is suppressed, and changes in the characteristics of the curable resin layer are suppressed.

[0027]

The preferred (meth)acrylic acid alkyl ester polymer as described above is usually obtained by using a composition formed by blending the (meth)acrylic acid alkyl ester and a hydroxyl group-containing monomer, polymerizing this composition to obtain a polymer, and causing the hydroxyl group possessed by the polymer to react with the isocyanate group of a compound having an isocyanate group and a polymerizable group. Here, in order to react a hydroxyl group with an isocyanate group (forming a urethane bond), it is necessary to further use a catalyst such as an organotin compound. This catalyst remains in the reaction system after completion of the reaction; however, it is difficult to completely remove the catalyst from the (meth)acrylic acid alkyl ester polymer thus obtained, or even if removal thereof is possible, since a step for the removal is added, the operation becomes complicated, and productivity is also decreased. Thus, usually, a method of leaving the catalyst unremoved from the reaction system after completion of the reaction is employed, and therefore, the catalyst remains in the (meth)acrylic acid alkyl ester polymer thus obtained.

[0028]

The catalyst remaining in the (meth)acrylic acid alkyl ester polymer is capable of carrying on any unintended crosslinking reaction when the pressure sensitive adhesive composition that uses such a polymer is stored. Also, in a case in which the mole
5 number of isocyanate groups in the isocyanate-based crosslinking agent with respect to 1 mole of hydroxyl groups in the (meth)acrylic acid alkyl ester polymer is large, this tendency is particularly strong.

In this regard, according to the present invention, even in a case in which the mole number of the isocyanate group is large, the progress of any unintended
10 crosslinking reaction such as described above is suppressed by using a reaction retardant that will be described below. From the viewpoint that this suppressing effect is further enhanced, in regard to the (meth)acrylic acid alkyl ester polymer, the residual amount (content) of the catalyst is preferably 2% by mass or less, more preferably 1% by mass or less, and even more preferably 0.5% by mass or less.

15 [0029]

Among the (meth)acrylic acid alkyl ester polymers as described above, a more preferred example of the polymer is a reaction product between a copolymer obtainable from the (meth)acrylic acid alkyl ester and a hydroxyl group-containing (meth)acrylic acid ester as essential monomers and a compound having an isocyanate group and a
20 polymerizable group, in which the hydroxyl group of the copolymer and the isocyanate group of the compound having an isocyanate group and a polymerizable group are chemically combined.

[0030]

Examples of the hydroxyl group-containing (meth)acrylic acid ester include
25 hydroxymethyl (meth)acrylate, 2-hydroxyethyl (meth)acrylate, and 2-hydroxypropyl

(meth)acrylate.

[0031]

Examples of the compound having an isocyanate group and a polymerizable group include an isocyanate group-containing (meth)acrylic acid alkyl ester such as

5 2-methacryloyloxyethyl isocyanate.

[0032]

The preferred (meth)acrylic acid alkyl ester polymer described above may be a polymer formed when a further optional compound is involved in the reaction in addition to the aforementioned essential monomers and compound, or may be a product formed

10 when a monomer is polymerized as the optional compound.

Examples of the optional monomer include a non-hydroxyl group-containing (meth)acrylic acid ester that is irrelevant to the (meth)acrylic acid alkyl ester, (meth)acrylic acid, itaconic acid, and a non-(meth)acrylic monomer.

[0033]

15 Examples of the non-hydroxyl group-containing (meth)acrylic acid ester include (meth)acrylic acid alkyl esters in which the alkyl group that constitutes the alkyl ester is linear or branched and has 1 to 9 carbon atoms, such as methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, pentyl (meth)acrylate, hexyl (meth)acrylate, heptyl (meth)acrylate, n-octyl (meth)acrylate, isooctyl (meth)acrylate, 20 2-ethylhexyl (meth)acrylate, n-nonyl (meth)acrylate, and isononyl (meth)acrylate; aralkyl (meth)acrylates such as benzyl (meth)acrylate; cycloalkenyl (meth)acrylates such as dicyclopentenyl (meth)acrylate; cycloalkenyloxyalkyl (meth)acrylates such as dicyclopentenylloxyethyl (meth)acrylate; imide (meth)acrylates; and glycidyl group-containing (meth)acrylates such as glycidyl (meth)acrylate.

25 [0034]

Examples of the non-(meth)acrylic monomer include vinyl acetate, acrylonitrile, styrene, and N-methylolacrylamide.

[0035]

The components used for the production of the (meth)acrylic acid alkyl ester polymer (constituent components of the polymer), such as the (meth)acrylic acid alkyl ester, the hydroxyl group-containing (meth)acrylic acid ester, the compound having an isocyanate group and a polymerizable group, and the optional compound, may be composed of only one kind in all cases, or may be composed of two or more kinds.

[0036]

In regard to the (meth)acrylic acid alkyl ester polymer (this is not limited to the (meth)acrylic acid alkyl ester polymer of a preferred embodiment such as described above, which has a hydroxyl group and also has a polymerizable group in a side chain through a urethane bond), the proportion of the aforementioned (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms is preferably 60% by mass or more, more preferably 70% by mass or more, and particularly preferably 75% by mass or more, with respect to the sum of the masses of all the monomers used for polymerization. The proportion of the (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms in the (meth)acrylic acid alkyl ester polymer is 100% by mass or less with respect to the sum of the masses of all the monomers used for polymerization.

[0037]

The (meth)acrylic acid alkyl ester polymer included in the pressure sensitive adhesive layer may be composed of only one kind, or may be composed of two or more kinds.

Furthermore, in regard to the monomers including the (meth)acrylic acid alkyl ester with an alkyl group having 10 to 18 carbon atoms, the monomer to be included in

addition thereto is not particularly limited; however, examples of such a monomer include a hydroxyl group-containing (meth)acrylic acid ester, a non-hydroxyl group-containing (meth)acrylic acid ester, (meth)acrylic acid, itaconic acid, and a non-(meth)acrylic monomer, all of which are irrelevant to the (meth)acrylic acid alkyl ester. Specific examples of the hydroxyl group-containing (meth)acrylic acid ester, the non-hydroxyl group-containing (meth)acrylic acid ester, and the non-(meth)acrylic monomer are as described above.

[0038]

In regard to the pressure sensitive adhesive layer, the content of the (meth)acrylic acid alkyl ester polymer is preferably 75% by mass or more, and more preferably 80% by mass or more. In order to form such a pressure sensitive adhesive layer, the content of the (meth)acrylic acid alkyl ester polymer in the pressure sensitive adhesive composition is preferably 75% by mass or more, and more preferably 80% by mass or more, with respect to the total amount of all the components other than the solvent in the pressure sensitive adhesive composition. Furthermore, the content of the (meth)acrylic acid alkyl ester polymer in the pressure sensitive adhesive composition may be 100% by mass.

[0039]

A preferred example of the pressure sensitive adhesive composition is a composition which includes an isocyanate-based crosslinking agent and a reaction retardant, in addition to the (meth)acrylic acid alkyl ester polymer. In regard to such a pressure sensitive adhesive composition, since the progress of any unintended crosslinking reaction is suppressed during the storage of the composition, changes in the characteristics such as viscosity during storage are suppressed, and the composition exhibits high preservability.

[0040]

(Isocyanate-based crosslinking agent)

The isocyanate-based crosslinking agent is not particularly limited as long as it is a crosslinking agent having an isocyanate group ($-N=C=O$), and preferred examples include 2,4-tolylene diisocyanate; 2,6-tolylene diisocyanate; 1,3-xylylene diisocyanate; 1,4-xylylene diisocyanate; diphenylmethane-4,4'-diisocyanate; diphenylmethane-2,4'-diisocyanate; 3-methyldiphenylmethane diisocyanate; hexamethylene diisocyanate; isophorone diisocyanate; dicyclohexylmethane-4,4'-diisocyanate; dicyclohexylmethane-2,4'-diisocyanate; a compound obtainable by adding any one or both of tolylene diisocyanate and hexamethylene diisocyanate to all or some of the hydroxyl groups of a polyol such as trimethylolpropane; and lysine diisocyanate.

[0041]

The isocyanate-based crosslinking agent included in the pressure sensitive adhesive composition may be composed of only one kind, or may be composed of two or more kinds.

[0042]

It is preferable that the mole number of the isocyanate groups present in the isocyanate-based crosslinking agent in the pressure sensitive adhesive composition be 0.2 times or more the mole number of the hydroxyl groups present in the (meth)acrylic acid alkyl ester polymer in the pressure sensitive adhesive composition. When such a configuration is adopted, the pressure sensitive adhesive layer has reduced contact adhesiveness to workpieces (curable resin layer or the like) after being cured by UV irradiation or the like, and thereby, the easy pick-up characteristics of the workpiece-securing sheet are enhanced.

On the other hand, according to the present invention, the mole number of the isocyanate groups present in the isocyanate-based crosslinking agent in the pressure sensitive adhesive composition is preferably 3 times or less the mole number of the hydroxyl groups present in the (meth)acrylic acid alkyl ester polymer in the pressure sensitive adhesive composition. When such a configuration is adopted, the effect of suppressing the generation of side products between the isocyanate-based crosslinking agent molecules is further increased.

That is, the mole number of the isocyanate groups present in the isocyanate-based crosslinking agent in the pressure sensitive adhesive composition is preferably in the range of 0.2 to 3 times the mole number of the hydroxyl groups present in the (meth)acrylic acid alkyl ester polymer in the pressure sensitive adhesive composition.

[0043]

The content of the isocyanate-based crosslinking agent in the pressure sensitive adhesive composition may be regulated as appropriate such that the mole number of the isocyanate groups is in the range described above; however, in addition to satisfying such conditions, the content of the isocyanate-based crosslinking agent is preferably 3 to 20 parts by mass, and more preferably 5 to 15 parts by mass, with respect to the content of 100 parts by mass of the (meth)acrylic acid alkyl ester polymer.

20 [0044]

(Reaction retardant)

The reaction retardant is to suppress the progress of any unintended crosslinking reaction in the pressure sensitive adhesive composition during storage.

The (meth)acrylic acid alkyl ester polymer usually contains a catalyst that has been used for the production of the polymer, as explained above. Examples of the

reaction retardant include an agent that inhibits the action of this catalyst in a pressure sensitive adhesive composition, and preferred examples include an agent that forms a chelate complex using a chelate for the catalyst. For example, in a case in which the catalyst is an organotin compound, an example of the reaction retardant is a compound which forms a chelate complex with tin.

A more specific preferred example of the reaction retardant is a compound having two or more carbonyl groups ($-\text{C}(=\text{O})-$) in the molecule, and examples of a compound having two carbonyl groups in the molecule include dicarboxylic acids, keto acids, and diketones.

10 [0045]

Among them, a more preferred example of the reaction retardant is a compound having a carbonylmethylcarbonyl group ($-\text{C}(=\text{O})-\text{CH}_2-\text{C}(=\text{O})-$), and specific examples thereof include β -keto acids such as malonic acid and acetoacetic acid;

β -keto acid esters such as methyl acetoacetate, ethyl acetoacetate, n-propyl acetoacetate, isopropyl acetoacetate, n-butyl acetoacetate, isobutyl acetoacetate, tert-butyl acetoacetate, methyl propionyl acetate, ethyl propionyl acetate, n-propyl propionyl acetate, isopropyl propionyl acetate, n-butyl propionyl acetate, tert-butyl propionyl acetate, methyl butyryl acetate, ethyl butyryl acetate, n-propyl butyryl acetate, isopropyl butyryl acetate, n-butyl butyryl acetate, tert-butyl butyryl acetate, methyl isobutyryl acetate, ethyl isobutyryl acetate, n-propyl isobutyryl acetate, isopropyl isobutyryl acetate, n-butyl isobutyryl acetate, tert-butyl isobutyryl acetate, methyl 3-oxoheptanoate, ethyl 3-oxoheptanoate, n-propyl 3-oxoheptanoate, isopropyl 3-oxoheptanoate, n-butyl 3-oxoheptanoate, tert-butyl 3-oxoheptanoate, methyl 5-methyl-3-oxohexanoate, ethyl 5-methyl-3-oxohexanoate, n-propyl 5-methyl-3-oxohexanoate, isopropyl 5-methyl-3-oxohexanoate, n-butyl 5-methyl-3-oxohexanoate, tert-butyl

5-methyl-3-oxohexanoate, methyl 4,4-dimethyl-3-oxopentanoate, ethyl 4,4-dimethyl-3-oxopentanoate, n-propyl 4,4-dimethyl-3-oxopentanoate, isopropyl 4,4-dimethyl-3-oxopentanoate, n-butyl 4,4-dimethyl-3-oxopentanoate, tert-butyl 4,4-dimethyl-3-oxopentanoate, methyl benzoyl acetate, dimethyl malonate, diethyl malonate, methyl ethyl malonate, di-n-propyl malonate, diisopropyl malonate, di-n-butyl malonate, di-tert-butyl malonate, and methyl tert-butyl malonate; and

β -diketones (1,3-diketones) such as acetylacetone and dibenzoylmethane.

[0046]

The reaction retardant included in the pressure sensitive adhesive composition may be composed of only one kind, or may be composed of two or more kinds.

[0047]

It is preferable that the pressure sensitive adhesive composition include a reaction retardant in an amount of 0.01% to 2% by mass with respect to the total amount of all the components. When the content of the reaction retardant is more than or equal to the lower limit, the pressure sensitive adhesive composition has a higher effect of suppressing the progress of any unintended crosslinking reaction during the storage of the composition. Furthermore, when the content of the reaction retardant is less than or equal to the upper limit, in a case in which the pressure sensitive adhesive layer is provided by applying and drying the pressure sensitive adhesive composition, the reaction retardant can be volatilized by drying, and thereby, excessive remaining of the reaction retardant in the pressure sensitive adhesive layer can be prevented.

[0048]

It is desirable if the content of the reaction retardant in the pressure sensitive adhesive composition is appropriately regulated such that the proportion by mass of the pressure sensitive adhesive composition in the total amount of all the components is in

the range such as described above; however, in addition to satisfying such conditions, the proportion by mass is preferably 0.01 to 10 parts by mass, and more preferably 0.05 to 5 parts by mass, relative to the content of 100 parts by mass of the (meth)acrylic acid alkyl ester polymer.

5 [0049]

(Photopolymerization initiator)

It is more preferable that the pressure sensitive adhesive composition further include a photopolymerization initiator, in addition to the (meth)acrylic acid alkyl ester polymer, the isocyanate-based crosslinking agent, and the reaction retardant.

10 The photopolymerization initiator may be any known photopolymerization initiator, and specific examples include α -ketol-based compounds such as 4-(2-hydroxyethoxy)phenyl (2-hydroxy-2-propyl) ketone, α -hydroxy- α,α' -dimethylacetophenone, 2-methyl-2-hydroxypropiophenone, and 1-hydroxycyclohexyl phenyl ketone; acetophenone-based compounds such as
15 methoxyacetophenone, 2,2-dimethoxy-2-phenylacetophenone, 2,2-diethoxyacetophenone, and 2-methyl-1-[4-(methylthio)-phenyl]-2-morpholinopropane-1; benzoin ether-based compounds such as benzoin ethyl ether, benzoin isopropyl ether, and anisoïn methyl ether; ketal-based compounds such as benzyl dimethyl ketal; aromatic sulfonyl chloride-based compounds such as 2-naphthalenesulfonyl chloride; photoactive
20 oxime-based compounds such as 1-phenone-1,1-propanedione-2-(o-ethoxycarbonyl)oxime; benzophenone-based compounds such as benzophenone, benzoylbenzoic acid, and 3,3'-dimethyl-4-methoxybenzophenone; thioxanthone-based compounds such as thioxanthone, 2-chlorothioxanthone, 2-methylthioxanthone, 2,4-dimethylthioxanthone,
25 isopropylthioxanthone, 2,4-dichlorothioxanthone, 2,4-diethylthioxanthone, and

2,4-diisopropylthioxanthone; camphor-quinone; halogenated ketones; acylphosphine oxide; and acyl phosphonates.

[0050]

The content of the photopolymerization initiator in the pressure sensitive adhesive composition is preferably 0.05 to 20 parts by mass relative to the content of 100 parts by mass of the (meth)acrylic acid alkyl ester polymer.

[0051]

(Solvent)

It is more preferable that the pressure sensitive adhesive composition further include a solvent in addition to the (meth)acrylic acid alkyl ester polymer.

The solvent is not particularly limited; however, preferred examples include hydrocarbons such as toluene and xylene; alcohols such as methanol, ethanol, 2-propanol, isobutyl alcohol (2-methylpropan-1-ol), and 1-butanol; esters such as ethyl acetate; ketones such as acetone and methyl ethyl ketone; ethers such as tetrahydrofuran; and amides (compounds having amide bonds) such as dimethylformamide and N-methylpyrrolidone.

The solvent included in the pressure sensitive adhesive composition may be composed of only one kind, or may be composed of two or more kinds.

[0052]

The content of the solvent in a case in which the pressure sensitive adhesive composition includes a solvent is preferably 40% to 90% by mass, and more preferably 50% to 80% by mass, with respect to the total mass of the pressure sensitive adhesive composition.

[0053]

(Other components)

The pressure sensitive adhesive composition may also include other components that are irrelevant to the isocyanate-based crosslinking agent, reaction retardant, photopolymerization initiator and solvent, in addition to the (meth)acrylic acid alkyl ester polymer, to the extent that the effects of the invention are not impaired.

5 Regarding the other components, any known components may be used, or the components can be arbitrarily selected according to the purpose, without any particular limitations. However, preferred examples include various additives such as a dye, a pigment, a deterioration-preventing agent, an antistatic agent, a flame retardant, a silicone compound, and a chain transfer agent.

10 [0054]

The pressure sensitive adhesive composition is obtained by blending the (meth)acrylic acid alkyl ester polymer and the components other than the polymer.

The order of addition of the respective components described above at the time of blending is not particularly limited, and two or more kinds of components may be
15 added simultaneously.

The method for mixing the respective components at the time of blending is not particularly limited, and the method may be selected as appropriate from known methods such as, for example, a method of mixing the components by rotating a stirring bar or a stirring blade; a method of mixing the components using a mixer; and a method of
20 mixing the components by applying ultrasonic waves.

The temperature and time at the time of adding and mixing of the respective components are not particularly limited as long as the respective components incorporated are not deteriorated, and may be regulated as appropriate. However, the temperature is preferably 15°C to 30°C.

25 [0055]

[Curable resin layer]

The curable resin layer contains a polymer component (a) and a curable component (b), and the total content of the polymer component (a) and the curable component (b) in the curable resin layer is 95% by mass or more, preferably 97% by mass or more, and more preferably 98% by mass or more, or may be 100% by mass with respect to the total amount of the curable resin layer. Such a curable resin layer substantially does not contain a filler material (filler material (c) that will be described below). According to the invention, even if such a curable resin layer is provided, the workpiece-securing sheet with an attached resin layer has easy pick-up characteristics as explained above. Furthermore, since the curable resin layer substantially does not contain a filler material, the workpiece-securing sheet with an attached resin layer according to the present invention does not have a problem that is characteristic in the case in which a filler material is included, such as that the filler material is in a state of being non-uniformly dispersed in the curable resin layer, and the filler material falls off from the cured film after the curable resin layer is cured.

According to the present specification, the phrase "the curable resin layer substantially does not contain a filler material" implies that the curable resin layer does not contain a filler material at all, or the curable resin layer contains only a small amount of a filler material to the extent that the effect obtainable by using a filler is negligible. Specifically, the phrase implies that the amount of the filler material included in the curable resin layer is less than 5% by mass, preferably less than 3% by mass, and more preferably less than 1% by mass, with respect to the total amount of the solid content of the curable resin composition that forms the curable resin layer.

[0056]

The curable resin layer can be formed using a curable resin composition

containing intended components such as the polymer component (a) and the curable component (b). The ratio of the contents of non-volatile components in the curable resin composition becomes the same as the ratio in the curable resin layer.

[0057]

5 According to the invention, the polymer component (a) is a component that may be regarded to be formed as a result of a polymerization reaction of a polymerizable compound. Furthermore, the curable component (b) is a component that is capable of a curing (polymerization) reaction. According to the invention, the polymerization reaction also includes a polycondensation reaction.

10 The polymer component (a) and the curable component (b) are main constituent components of the curable resin layer that are necessary for the curable resin layer to provide its effects. Although there are components that correspond to both the polymer component (a) and the curable component (b), such a component is handled not as a curable component (b) but as a polymer component (a) according to the invention.

15 [0058]

The thickness of the curable resin layer can be selected as appropriate according to the purpose; however, the thickness is preferably 1 to 100 μm , more preferably 5 to 75 μm , and particularly preferably 5 to 50 μm . Furthermore, the average thickness of the curable resin layer can be determined by the same measurement method as that used for
20 the average thickness of the pressure sensitive adhesive layer as described above.

The "thickness of the curable resin layer" is a value expressed as the average of thicknesses measured at five arbitrary spots using a contact type thickness meter. When it is difficult to directly apply a contact type thickness meter to the curable resin layer, the thickness may be calculated by measuring the overall thickness as described above in a
25 state in which the base material film and other layers such as the pressure sensitive

adhesive layer and a release material that will be described below are superposed, and taking the difference between the overall thickness and the thickness of the other layers that are superposed (measured by a method similar to the method described above, or measured by the measurement method for the pressure sensitive adhesive layer described
5 above).

[0059]

It is preferable that the curable resin layer have pressure-sensitive adhesiveness, and it is preferable that the curable resin layer have heat-curability. It is more preferable that the curable resin layer have both pressure-sensitive adhesiveness and heat-curability.
10 A curable resin layer having both pressure-sensitive adhesiveness and heat-curability can be attached, in an uncured state, by lightly pressing the curable resin layer to various adherends. Furthermore, the curable resin layer may also be attachable to various adherends by heating and softening the curable resin layer. The curable resin layer undergoes thermal curing and then finally becomes a cured product having high impact
15 resistance. Such a cured product has excellent shear strength and can maintain sufficient adhesive characteristics even under severe high temperature and high humidity conditions.

[0060]

(Polymer component (a))

20 The polymer component (a) is a polymer compound intended for imparting film-forming properties, flexibility, and the like to the curable resin layer. There are occasions in which the polymer component (a) also corresponds to the curable component (b). For example, a phenoxy resin or an acrylic resin having an epoxy group in a side chain corresponds to the polymer component (a), and may also correspond to
25 the curable component (b). Such a component is handled as a polymer component (a).

In regard to the polymer component (a), one kind of compound may be used singly, or two or more kinds of compounds may be used in combination.

[0061]

Regarding the polymer component (a), an acrylic resin, a polyester resin, a urethane resin, an acrylurethane resin, a silicone resin, a rubber-based polymer, a phenoxy resin or the like can be used; however, an acrylic resin is preferred.

[0062]

Regarding the acrylic resin, a known acrylic polymer can be used.

The weight-average molecular weight (M_w) of the acrylic resin is preferably 10,000 to 2,000,000, and more preferably 100,000 to 1,500,000. If the weight-average molecular weight of the acrylic resin is too small, the adhesive force between the curable resin layer and the pressure sensitive adhesive layer is increased, and defective pick-up of semiconductor chips may occur. Furthermore, if the weight-average molecular weight of the acrylic resin is too large, the curable resin layer may not be able to conform to the irregular surface of an adherend, and this may become a cause of the generation of voids and the like.

According to the present specification, unless particularly stated otherwise, the weight-average molecular weight is a value measured by a gel permeation chromatography (GPC) method and calculated relative to polystyrene standards.

[0063]

The glass transition temperature (T_g) of the acrylic resin is preferably -60°C to 70°C , and more preferably -30°C to 50°C . If the T_g of the acrylic resin is too low, the peeling force between the curable resin layer and the pressure sensitive adhesive layer increases, and defective pick-up of semiconductor chips may occur. Also, if the T_g of the acrylic resin is too high, there is a risk that the adhesive force for securing a

semiconductor wafer may become insufficient.

[0064]

Examples of the monomer that constitutes an acrylic resin include (meth)acrylic acid esters, including alkyl (meth)acrylates with a chain-like alkyl group having 1 to 18 carbon atoms, such as methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, isooctyl (meth)acrylate, n-octyl (meth)acrylate, n-nonyl (meth)acrylate, isononyl (meth)acrylate, decyl (meth)acrylate, undecyl (meth)acrylate, dodecyl (meth)acrylate (lauryl (meth)acrylate), tridecyl (meth)acrylate, tetradecyl (meth)acrylate (myristyl (meth)acrylate), pentadecyl (meth)acrylate, hexadecyl (meth)acrylate (palmityl (meth)acrylate), heptadecyl (meth)acrylate, and octadecyl (meth)acrylate (stearyl (meth)acrylate);

(meth)acrylates having a cyclic skeleton, such as a cycloalkyl (meth)acrylate, benzyl (meth)acrylate, isobornyl (meth)acrylate, dicyclopentanyl (meth)acrylate, dicyclopentenyl (meth)acrylate, dicyclopentenyl oxyethyl (meth)acrylate, and imide (meth)acrylate;

hydroxyl group-containing (meth)acrylates such as hydroxymethyl (meth)acrylate, 2-hydroxyethyl (meth)acrylate, and 2-hydroxypropyl (meth)acrylate; and glycidyl group-containing (meth)acrylates such as glycidyl (meth)acrylate.

Furthermore, the acrylic resin may also be a product obtained by polymerizing a monomer such as acrylic acid, methacrylic acid, itaconic acid, vinyl acetate, acrylonitrile, styrene, or N-methylolacrylamide.

The monomers that constitute the acrylic resin may be used singly, or two or more kinds thereof may be used.

According to the present specification, the term "polymer", "resin", or the like, all of which are used for substances formed by polymerizing monomers, means a

"polymer", a "resin", or the like formed from constituent units (also called repeating units) derived from the aforementioned monomers. Furthermore, according to the present specification, with regard to the "polymer", "resin", or the like, in a case in which the amount of use of a monomer used for such production is explained in connection with
5 the ratio of mass, mole number, or the like, such a ratio can be read as a ratio of a constituent unit derived from the aforementioned monomer with respect to the total amount of the "polymer", "resin", or the like obtained by polymerizing the monomer. That is, for example, in a case in which it is described that monomers X and Y are used at proportions of 20% by mass and 80% by mass, respectively, and a polymer Z is obtained
10 by polymerizing these, in regard to such a polymer Z, the proportions of the constituent unit derived from monomer X and the constituent unit derived from monomer Y with respect to the total mass of the polymer Z can be read as 20% by mass and 80% by mass, respectively.

[0065]

15 The acrylic resin may have a functional group capable of being bonded to another compound, such as a vinyl group, a (meth)acryloyl group, an amino group, a hydroxyl group, a carboxyl group, or an isocyanate group. Bonding to another compound may be achieved by means of a crosslinking agent (f) that will be described below, or the functional group may be directly bonded to another compound without
20 involving the crosslinking agent (f). When acrylic resins are bonded to each other through these functional groups, the package reliability of a semiconductor device using the workpiece-securing sheet with an attached resin layer tends to increase.

[0066]

In a case in which the curable resin composition includes an acrylic resin as the
25 polymer component (a), the content of the acrylic resin in the curable resin composition

is preferably 50% by mass or more with respect to the total amount of the solid content of the curable resin composition. When the content is in such a range, in a case in which the curable resin composition is used for a process of curing the curable resin layer all at once at the time of resin-sealing semiconductor chips, the curable resin layer acquires preferable characteristics. This is because in such a process, wire bonding to chips is achieved before resin sealing of semiconductor chips is performed; however, even when the curable resin layer before curing is exposed to high temperature, wire bonding can be performed in a state in which hardness is maintained to a certain extent. That is, when the content of the acrylic resin in the curable resin composition is relatively large, even before thermal curing, the storage modulus of the curable resin layer can be made high. For this reason, even when the curable resin layer is in an uncured state or in a semi-cured state, vibration and displacement of chips at the time of wire bonding is suppressed, and wire bonding can be performed stably.

Furthermore, in a case in which the curable resin composition includes an acrylic resin as the polymer component (a), the content of the acrylic resin in the curable resin composition is more preferably 50% to 90% by mass with respect to the total amount of the solid content of the curable resin composition. In a case in which the content of the acrylic resin is relatively large as described above, the adhesiveness between the pressure sensitive adhesive layer and the curable resin layer increases, and the adhesive force tends to increase. However, when the pressure sensitive adhesive layer according to the invention is used, the adhesive force between the pressure sensitive adhesive layer and the curable resin layer is decreased, and the easy pick-up characteristics for semiconductor chips are enhanced.

As such, in a case in which the curable resin layer includes an acrylic resin as the polymer component (a), the content of the acrylic resin in the curable resin layer is

preferably 50% by mass or more, and more preferably 50% to 90% by mass.

[0067]

According to the invention, in order to enhance the detachability of the workpiece-securing sheet (pressure sensitive adhesive layer) from the curable resin layer, to enhance the easy pick-up characteristics, or to suppress the generation of voids or the like by conforming of the curable resin layer to the irregular surface of an adherend, a thermoplastic resin other than the acrylic resin as the polymer component (a) (hereinafter, may be simply referred to as "thermoplastic resin") may be used singly, or may be used in combination with the acrylic resin.

10 The thermoplastic resin is such that the weight-average molecular weight is preferably 1,000 to 100,000, and more preferably 3,000 to 80,000.

The glass transition temperature (T_g) of the thermoplastic resin is preferably -30°C to 150°C , and more preferably -20°C to 120°C .

15 Examples of the thermoplastic resin include a polyester resin, a urethane resin, a phenoxy resin, polybutene, polybutadiene, and polystyrene.

The thermoplastic resins may be used singly, or two or more kinds thereof may be used in combination.

[0068]

20 As a result of using the thermoplastic resin, effects such as described above may be obtained; however, on the other hand, there is a risk that when the curable resin layer before curing is exposed to high temperature, hardness may decrease, and the suitability for wire bonding of the curable resin layer in an uncured state or in a semi-cured state may be deteriorated. Thus, it is preferable to set the content of the thermoplastic resin in the curable resin composition after such effects are taken into consideration.

25 According to the invention, it is preferable to use the thermoplastic resin in

combination with an acrylic resin.

[0069]

(Curable component (b))

5 Examples of the curable component (b) include an epoxy-based thermosetting resin, a thermosetting polyimide resin, a urethane resin, an unsaturated polyester resin, and a silicone resin. Among these, an epoxy-based thermosetting resin is preferred. The curable component (b) may also correspond to the polymer component (a); however, such a component is regarded as the polymer component (a).

[0070]

10 · Epoxy-based thermosetting resin

An epoxy-based thermosetting resin is formed from an epoxy resin and a thermal curing agent.

The epoxy-based thermosetting resin may be used singly, or two or more kinds thereof may be used in combination.

15 [0071]

Regarding the epoxy resin, known resins may be used, and specific examples include bifunctional or higher-functional epoxy compounds such as a polyfunctional epoxy resin, a biphenyl compound, a bisphenol A diglycidyl ether and a hydrogenated product thereof, an ortho-cresol-novolac epoxy resin, a dicyclopentadiene type epoxy resin, a biphenyl type epoxy resin, a bisphenol A type epoxy resin, a bisphenol F type epoxy resin, and a phenylene skeleton type epoxy resin.

[0072]

Furthermore, regarding the epoxy resin, an epoxy resin having an unsaturated hydrocarbon group may also be used. An example of the epoxy resin having an
25 unsaturated hydrocarbon group is a compound formed as a portion of the epoxy resin of a

polyfunctional epoxy resin converted to a group containing an unsaturated hydrocarbon group. Such a compound can be produced by, for example, subjecting an epoxy group to an addition reaction with acrylic acid. Furthermore, an example of the epoxy resin having an unsaturated hydrocarbon group is a compound in which a group containing an unsaturated hydrocarbon group is directly bonded to an aromatic ring that constitutes an epoxy resin, or the like. The unsaturated hydrocarbon group is an unsaturated group that is polymerizable, and specific examples thereof include an ethenyl group (vinyl group), a 2-propenyl group (allyl group), an acryloyl group, a methacryloyl group, an acrylamide group, and a methacrylamide group. An acryloyl group is preferred.

An epoxy resin having an unsaturated hydrocarbon group has higher compatibility with an acrylic resin, compared to an epoxy resin that does not have an unsaturated hydrocarbon group. For this reason, when a curable resin composition including an epoxy resin having an unsaturated hydrocarbon group is used, the package reliability of a semiconductor device is enhanced.

[0073]

It is preferable that the epoxy resin have a high softening point or a high glass transition temperature, from the viewpoint that the easy pick-up characteristics are enhanced.

[0074]

The number-average molecular weight of the epoxy resin is not particularly limited; however, from the viewpoints of curability, strength after curing, and heat resistance of the curable resin layer, the number-average molecular weight is preferably 300 to 30,000, more preferably 400 to 10,000, and particularly preferably 500 to 3,000.

The epoxy equivalent of the epoxy resin is preferably 100 to 1,000 g/eq, and more preferably 300 to 800 g/eq.

[0075]

The epoxy resin may be used singly, or two or more kinds thereof may be used in combination.

[0076]

5 The thermal curing agent functions as a curing agent for the epoxy resin.

An example of the thermal curing agent is a compound having two or more functional groups that are capable of reacting with epoxy groups in one molecule.

Examples of the functional group include a phenolic hydroxyl group, an alcoholic

hydroxyl group, an amino group, a carboxyl group, and a group obtained by converting

10 an acid group into an anhydride. Preferred examples include a phenolic hydroxyl group, an amino group, and a group obtained by converting an acid group into an anhydride, and a phenolic hydroxyl group and an amino group are more preferred, while a phenolic hydroxyl group is particularly preferred.

[0077]

15 Among the thermal curing agents, examples of a phenolic curing agent (curing agent having a phenolic hydroxyl group) include a polyfunctional phenolic resin, a biphenol, a novolac type phenolic resin, a dicyclopentadiene-based phenolic resin, and an aralkyl phenolic resin.

Among the thermal curing agents, examples of an amine-based curing agent
20 (curing agent having an amino group) include DICY (dicyandiamide).

[0078]

The thermal curing agent may also be a compound having an unsaturated hydrocarbon group.

Examples of the thermal curing agent having an unsaturated hydrocarbon group
25 include a compound obtained by substituting some of hydroxyl groups of a phenolic

resin with groups each containing an unsaturated hydrocarbon group; and a compound in which a group containing an unsaturated hydrocarbon group is directly bonded to an aromatic ring of a phenolic resin. The unsaturated hydrocarbon group for a thermal curing agent is the same as the unsaturated hydrocarbon group for the epoxy resin having
5 an unsaturated hydrocarbon group described above.

[0079]

It is preferable that the thermal curing agent have a high softening point or a high glass transition temperature, from the viewpoint that the easy pick-up characteristics are enhanced.

10 [0080]

The number-average molecular weight of the thermal curing agent is preferably 300 to 30,000, more preferably 400 to 10,000, and particularly preferably 500 to 3,000.

[0081]

The thermal curing agent may be used singly, or two or more kinds thereof may
15 be used in combination.

[0082]

The content of the thermal curing agent in the curable resin composition is preferably 0.1 to 500 parts by mass, and more preferably 1 to 200 parts by mass, relative to the content of 100 parts by mass of the epoxy resin. If the content of the thermal
20 curing agent is too small, adhesiveness may not be obtained due to insufficient curing. If the content of the thermal curing agent is excessive, the coefficient of moisture absorption of the curable resin layer is increased, and the package reliability may be deteriorated.

[0083]

25 The content of the curable component (b) in the curable resin composition

(curable resin layer) is preferably 1 to 100 parts by mass, more preferably 1.5 to 75 parts by mass, and particularly preferably 2 to 60 parts by mass, relative to the content of 100 parts by mass of the polymer component (a). When the content of the curable component (b) is in the range such as described above, hardness of the curable resin layer before curing tends to be maintained, and the suitability for wire bonding of the curable resin layer in an uncured state or in a semi-cured state is enhanced. On the other hand, in a case in which the content of the curable component (b) is a relatively small amount compared to the content of the polymer component (a), having an increased adhesive force between the pressure sensitive adhesive layer and the curable resin layer by employing components having high softening points or high glass transition temperatures as the various components of the curable component (b), is suppressed. Even if it is attempted to enhance the easy pick-up characteristics, the easy pick-up characteristics may not be sufficiently enhanced. However, when the pressure sensitive adhesive layer according to the invention is used, the adhesive force between the pressure sensitive adhesive layer and the curable resin layer is decreased, and the easy pick-up characteristics for semiconductor chips are enhanced.

[0084]

The curable resin layer may be a resin layer formed using a curable resin composition which further contains, in addition to the polymer component (a) and the curable component (b), other components that are irrelevant to these components as necessary, in order to improve the various physical properties of the curable resin layer.

Examples of the other components contained in the curable resin composition include a filler material (c), a curing accelerator (d), a coupling agent (e), a crosslinking agent (f), and general-purpose additives (g).

[0085]

(Filler material (c))

Usually, when the curable resin composition includes a filler material (c), adjustment of the coefficient of thermal expansion of the resin composition is facilitated. Therefore, when the coefficient of thermal expansion of the curable resin layer after
5 curing is optimized with respect to a semiconductor chip or a metal or an organic substrate using such a curable resin composition, package reliability can be enhanced.

Furthermore, usually, when a curable resin composition containing a filler material (c) is used, the coefficient of moisture absorption of the curable resin layer after curing can be reduced.

10 The filler material (c) is a component that is irrelevant to any of the polymer component (a) and the curable component (b).

[0086]

However, according to the invention, as explained above, since the curable resin layer does not contain the filler material (c), or the content of the filler material (c) is
15 adjusted to be more than 0% by mass and less than 5% by mass, the content of the filler material (c) in the curable resin composition is less than 5% by mass, preferably less than 3% by mass, and more preferably less than 1% by mass, with respect to the total amount of the solid content of the curable resin composition.

[0087]

20 The filler material (c) is preferably an inorganic filler material (c), and preferred examples of the inorganic filler material include powders of silica, alumina, talc, calcium carbonate, titanium white, red iron oxide, silicon carbide, boron nitride, and the like; beads obtained by spherically shaping these silica and the like; single crystal fibers of these silica and the like; and glass fibers.

25 Among these, the inorganic filler material is preferably a silica filler or an

alumina filler.

The inorganic filler material (c) may be used singly, or two or more kinds thereof may be used in combination.

[0088]

5 (Curing accelerator (d))

A curing accelerator (d) is used to adjust the curing rate of the curable resin composition, and is a component that is irrelevant to any of the polymer component (a) and the curable component (b).

Preferred examples of the curing accelerator (d) include tertiary amines such as
10 triethylenediamine, benzyldimethylamine, triethanolamine, dimethylaminoethanol, and tris(dimethylaminomethyl)phenol; imidazoles (imidazoles in which one or more hydrogen atoms have been substituted by groups other than hydrogen atoms) such as 2-methylimidazole, 2-phenylimidazole, 2-phenyl-4-methylimidazole, 2-phenyl-4,5-dihydroxymethylimidazole, and
15 2-phenyl-4-methyl-5-hydroxymethylimidazole; organic phosphines (phosphines in which one or more hydrogen atoms have been substituted by organic groups) such as tributylphosphine, diphenylphosphine, and triphenylphosphine; and tetraphenylboron salts such as tetraphenylphosphonium tetraphenylborate and triphenylphosphine tetraphenylborate.

20 The curing accelerator (d) may be used singly, or two or more kinds thereof may be used in combination.

[0089]

In the case of using the curing accelerator (d), the content of the curing accelerator (d) in the curable resin composition is preferably 0.01 to 10 parts by mass,
25 and more preferably 0.1 to 1 part by mass, relative to the content of 100 parts by mass of

the curable component (b). When the content of the curing accelerator (d) is in such a range, the curable resin layer has excellent adhesive characteristics even under high temperature and high humidity conditions, and even in a case in which the curable resin layer is exposed to harsh reflow conditions, high package reliability can be attained. If the content of the curing accelerator (d) is too small, the effects obtainable by using the curing accelerator (d) are not sufficiently obtained, and if the content of the curing accelerator (d) is excessive, a highly polar curing accelerator (d) migrates within the curable resin layer toward the adhesion interface with an adherend under high temperature and high humidity conditions, and is segregated. Thereby, reliability of the package is deteriorated.

[0090]

(Coupling agent (e))

When a compound having a functional group which reacts with an inorganic compound and a functional group which reacts with an organic functional group is used as a coupling agent (e), the adhesiveness and close attachability of the curable resin layer to adherends can be enhanced. Furthermore, by using the coupling agent (e), for a cured product obtainable by curing the curable resin layer, water resistance can be enhanced without impairing heat resistance of the cured product.

The coupling agent (e) is a component that is irrelevant to any of the polymer component (a) and the curable component (b).

[0091]

The coupling agent (e) is preferably a compound having a functional group which reacts with the functional groups of the polymer component (a), the curable component (b), and the like, and the coupling agent (e) is desirably a silane coupling agent.

Preferred examples of the silane coupling agent include

γ -glycidoxypentyltrimethoxysilane, γ -glycidoxypentylmethyldiethoxysilane,
 β -(3,4-epoxycyclohexyl)ethyltrimethoxysilane, γ -(methacryloxypropyl)trimethoxysilane,
 γ -aminopentyltrimethoxysilane, N-6-(aminoethyl)- γ -aminopentyltrimethoxysilane,
 5 N-6-(aminoethyl)- γ -aminopentylmethyldiethoxysilane,
 N-phenyl- γ -aminopentyltrimethoxysilane, γ -ureidopentyltriethoxysilane,
 γ -mercaptopentyltrimethoxysilane, γ -mercaptopentylmethyldimethoxysilane,
 bis(3-triethoxysilylpropyl)tetrasulfane, methyltrimethoxysilane, methyltriethoxysilane,
 vinyltrimethoxysilane, vinyltriacetoxysilane, and imidazolesilane.

10 The coupling agent (e) may be used singly, or two or more kinds thereof may be used in combination.

[0092]

In the case of using the coupling agent (e), the content of the coupling agent (e) in the curable resin composition is preferably 0.03 to 20 parts by mass, more preferably
 15 0.05 to 10 parts by mass, and particularly preferably 0.1 to 5 parts by mass, relative to 100 parts by mass of the total content of the polymer component (a) and the curable component (b). If the content of the coupling agent (e) is too small, the aforementioned effects obtainable by using the coupling agent (e) may not be obtained, and if the content of the coupling agent (e) is too large, there is a possibility that outgases may be
 20 generated.

[0093]

(Crosslinking agent (f))

In a case in which the acrylic resin having a functional group that is capable of bonding to the functional groups of other compounds, such as an isocyanate group, is

used as the polymer component (a), in order to achieve crosslinking by bonding this functional group to other compounds, a crosslinking agent (f) can be used. The initial adhesive force and cohesive force of the curable resin layer can be regulated by crosslinking using a crosslinking agent (f) as described above.

5 Examples of the crosslinking agent (f) include an organic polyvalent isocyanate compound and an organic polyvalent imine compound.

The crosslinking agent (f) is a component that is irrelevant to any of the polymer component (a) and the curable component (b).

[0094]

10 Examples of the organic polyvalent isocyanate compound include an aromatic polyvalent isocyanate compound, an aliphatic polyvalent isocyanate compound, an alicyclic polyvalent isocyanate compound; trimers, isocyanurate forms, and adduct forms (reaction products with low molecular weight, active hydrogen-containing compounds, such as ethylene glycol, propylene glycol, neopentyl glycol, trimethylolpropane, or castor
15 oil; for example, trimethylolpropane adduct xylylene diisocyanate) of those compounds; and a terminal isocyanate urethane prepolymer obtainable by causing an organic polyvalent isocyanate compound to react with a polyol compound.

[0095]

More specific examples of the organic polyvalent isocyanate compound include
20 2,4-tolylene diisocyanate; 2,6-tolylene diisocyanate; 1,3-xylylene diisocyanate; 1,4-xylene diisocyanate; diphenylmethane-4,4'-diisocyanate; diphenylmethane-2,4'-diisocyanate; 3-methyldiphenylmethane diisocyanate; hexamethylene diisocyanate; isophorone diisocyanate; dicyclohexylmethane-4,4'-diisocyanate; dicyclohexylmethane-2,4'-diisocyanate; a
25 compound obtainable by adding any one or both of tolylene diisocyanate and

hexamethylene diisocyanate to all or some of the hydroxyl groups of a polyol such as trimethylolpropane; and lysine diisocyanate.

[0096]

Examples of the organic polyvalent imine compound include

- 5 N,N'-diphenylmethane-4,4'-bis(1-aziridinecarboxamide),
trimethylolpropane-tri- β -aziridinyl propionate, tetramethylolmethane-tri- β -aziridinyl propionate, and N,N'-toluene-2,4-bis(1-aziridinecarboxamide) triethylenemelamine.

[0097]

- In a case in which an isocyanate-based crosslinking agent is used as the
10 crosslinking agent (f), it is preferable to use a hydroxyl group-containing polymer as the acrylic resin as the polymer component (a). In a case in which the crosslinking agent (f) has an isocyanate group, and the acrylic resin has a hydroxyl group, a crosslinked structure can be conveniently introduced into the curable resin layer by a reaction between the crosslinking agent (f) and the acrylic resin.

- 15 [0098]

In the case of using the crosslinking agent (f), the content of the crosslinking agent (f) in the curable resin composition is preferably 0.01 to 20 parts by mass, more preferably 0.1 to 10 parts by mass, and particularly preferably 0.5 to 5 parts by mass, relative to the content of 100 parts by mass of the polymer component (a).

- 20 [0099]

(General-purpose additives (g))

Examples of the general-purpose additives (g) include well-known plasticizers, antistatic agents, oxidation inhibitors, pigments, dyes, and gettering agents.

- The general-purpose additives (g) are components that are irrelevant to any one
25 of the polymer component (a) and the curable component (b).

[0100]

(Solvent)

It is preferable that the curable resin composition further include a solvent, in order to improve handleability of the resin composition through dilution.

5 The solvent included in the curable resin composition may be the same one as the solvent for the pressure sensitive adhesive composition described above.

The solvent included in the curable resin composition may be composed of only one kind, or may be composed of two or more kinds.

10 The solvent included in the curable resin composition is preferably methyl ethyl ketone or the like, from the viewpoint of uniformly mixing the various components used in the curable resin composition.

The solvent is a component that is irrelevant to any one of the polymer component (a) and the curable component (b).

[0101]

15 The total content of the polymer component (a) and the curable component (b) in the curable resin layer is, as described above, 95% by mass or more, more preferably 97% by mass or more, and even more preferably 98% by mass or more, with respect to the total amount of the curable resin layer. In order to form such a curable resin layer, the total content of the polymer component (a) and the curable component (b) in the
20 curable resin composition is 95% by mass or more, more preferably 97% by mass or more, and even more preferably 98% by mass or more, with respect to the total amount of all the components other than the solvent in the curable resin composition.

25 Furthermore, the total content of the polymer component (a) and the curable component (b) in the curable resin layer may be 100% by mass with respect to the total amount of the curable resin layer.

[0102]

The curable resin composition is obtained by blending the various components described above for configuring this resin composition, and for example, the curable resin composition may be obtained by a method similar to the method used in the case of the pressure sensitive adhesive composition described above, except that the blending components are different.

In the case of using a solvent, the solvent may be used after mixing the solvent with any of the blending components other than the solvent, and diluting in advance this blending component. Alternatively, the solvent may also be used by mixing the solvent with these blending components, without having any one of the blending components other than the solvent diluted in advance.

[0103]

The easy pick-up characteristics for semiconductor chips, which will be explained in connection with the workpiece-securing sheet with an attached resin layer according to the invention, can be evaluated by, for example, setting the injection speed of the needle and the pressure intensity to predetermined conditions, using a commercially available die bonder, and examining whether semiconductor chips on the surface of the workpiece-securing sheet with an attached resin layer can be picked up under these conditions. At this time, the easy pick-up characteristics can be determined to be relatively satisfactory, for example, in a case in which pick-up is performed continuously for 100 chips in total, and pick-up of all the chips is successfully achieved, or in a case in which pick-up of one or more chips is successfully achieved, and then pick-up of any one of the second and following chips is failed.

[0104]

<Method for producing workpiece-securing sheet with attached resin layer>

The workpiece-securing sheet with an attached resin layer according to the invention can be produced by, for example, forming a pressure sensitive adhesive layer using the above-described pressure sensitive adhesive composition on a base material film, and forming a curable resin layer using the above-described curable resin composition on the pressure sensitive adhesive layer.

[0105]

The pressure sensitive adhesive layer can be formed by applying a pressure sensitive adhesive composition on the surface of a base material film (surface 11a of a base material film 11 in FIG. 1), and drying the pressure sensitive adhesive composition. At this time, the pressure sensitive adhesive composition thus applied may be crosslinked by heating the composition, as necessary. The heating conditions may be set to, for example, 100°C to 130°C for 1 to 5 minutes; however, the heating conditions are not limited to this. Furthermore, the pressure sensitive adhesive layer can also be formed by pasting a pressure sensitive adhesive layer that has been formed by applying a pressure sensitive adhesive composition on the release layer surface of a release material and drying the composition, on the surface of a base material film, and removing the release material.

[0106]

Application of the pressure sensitive adhesive composition on the surface of a base material film or on the release layer surface of a release material may be performed by any known method, and examples of the method include methods of using various coaters such as an air knife coater, a blade coater, a bar coater, a gravure coater, a roll coater, a roll knife coater, a curtain coater, a die coater, a knife coater, a screen coater, a Meyer bar coater, and a kiss coater.

[0107]

The curable resin layer can be formed using a curable resin composition, by a method similar to the method used for the case of forming a pressure sensitive adhesive layer on a base material film such as described above; however, usually, it is difficult to directly apply a curable resin composition on a pressure sensitive adhesive layer. Thus, for example, a method of separately forming a curable resin layer and pasting this on the surface of the pressure sensitive adhesive layer, such as a method of pasting a curable resin layer that has been formed by applying a curable resin composition on the release layer surface of a release material and drying the composition, on the surface of the pressure sensitive adhesive layer, and removing the release material, is preferred.

10 [0108]

Furthermore, the workpiece-securing sheet with an attached resin layer according to the invention can also be produced by, in addition to the method described above, for example, a method of forming a pressure sensitive adhesive layer using the pressure sensitive adhesive composition, forming a curable resin layer using the curable resin composition, subsequently superposing these pressure sensitive adhesive layer and curable resin layer to produce a laminate, and pasting a base material film on the surface of the pressure sensitive adhesive layer of this laminate.

The conditions for forming the pressure sensitive adhesive layer and the curable resin layer in this case are the same as those for the method described above.

20

EXAMPLES

[0109]

Hereinafter, the invention will be explained in more detail by way of specific Examples. However, the invention is not intended to be limited to the Examples disclosed below.

25

[0110]

<Production of workpiece-securing sheet with attached resin layer>

[Example 1]

A workpiece-securing sheet with an attached resin layer having the
5 configuration illustrated in FIG. 1 was produced. More specifically, the production was
conducted as follows.

[0111]

(Production of acrylic acid alkyl ester polymer)

Into a reaction vessel equipped with a cooling tube, a nitrogen inlet tube, a
10 thermometer, and a stirring apparatus, lauryl acrylate (hereinafter, abbreviated to "LA")
(80 parts by mass), 2-hydroxyethyl acrylate (hereinafter, abbreviated to "HEA") (20 parts
by mass), benzoyl peroxide (0.2 parts by mass), ethyl acetate (70 parts by mass), and
toluene (30 parts by mass) were introduced, and a polymerization reaction was performed
for 8 hours at 60°C under a nitrogen gas stream. Thus, an acrylic polymer (A) was
15 obtained. The blending proportions of the various components are presented in the
following Table 1.

To this acrylic polymer (A), 2-methacryloyloxyethyl isocyanate (hereinafter,
abbreviated to "MOI") (22 parts by mass, about 80 mol% with respect to HEA) and
dibutyltin laurate (hereinafter, abbreviated to "DBTL") (0.13 parts by mass) were added,
20 and an addition reaction was performed for 12 hours at 23°C under an air stream. Thus,
an intended acrylic acid alkyl ester polymer (A-1) was obtained in the form of a 47 % by
mass solution. The blending proportions of the various components are presented in the
following Table 1.

[0112]

25 (Production of pressure sensitive adhesive composition)

To the acrylic acid alkyl ester polymer (A-1) (100 parts by mass) obtained as described above, photopolymerization initiator (Z-1) ("IRGACURE 651" manufactured by Ciba Specialty Chemicals Inc., benzyl dimethyl ketal) (3 parts by mass) and acetylacetone (1 part by mass) as a reaction retardant were added, and the mixture was
5 diluted with methyl ethyl ketone. Subsequently, the dilution was thoroughly stirred. To this, a tolylene diisocyanate trimer adduct of trimethylolpropane ("CORONATE L" manufactured by Nippon Polyurethane Industry Co., Ltd.) (7.5 parts by mass, an amount which provides 1 mole of isocyanate groups available for one mole of residual hydroxyl groups in the acrylic acid ester polymer (A-1)) was added as an isocyanate-based
10 crosslinking agent (B-1), and the mixture was stirred at 23°C. Thus, a pressure sensitive adhesive composition having a solid content concentration of 25% by mass was obtained. The numbers of parts incorporated for this "Production of pressure sensitive adhesive composition" are all values calculated related to the solid content. The blending proportions of the various components are presented in the following Table 1.

15 [0113]

(Production of workpiece-securing sheet)

The pressure sensitive adhesive composition obtained as described above was applied on the silicone-treated release surface of a polyethylene terephthalate (PET) release liner, and the pressure sensitive adhesive composition was heated and dried for 2
20 minutes at 120°C. Thus, a pressure sensitive adhesive layer having a thickness of 10 μm was formed. Subsequently, an ethylene-methacrylic acid polymer film having a thickness of 100 μm as a base material film was pasted on the surface of this pressure sensitive adhesive layer, and the assembly was stored for 168 hours at 23°C. Thus, a workpiece-securing sheet was obtained.

[0114]

(Production of curable resin composition)

An acrylic resin ("SG-P3" manufactured by Nagase ChemteX Corporation) (87.8 parts by mass), an epoxy resin ("NC-3000" manufactured by Nippon Kayaku Co., Ltd.) (12 parts by mass), a phenolic resin ("MEH-7851-H" manufactured by Meiwa Plastic Industries, Ltd.) (10 parts by mass), triphenylphosphine (0.2 parts by mass) as a curing accelerator, and a silane coupling agent ("KBM403" manufactured by Shin-Etsu Chemical Co., Ltd., 3-glycidoxypyltrimethoxysilane) (1 part by mass) were dissolved in methyl ethyl ketone, and thus a methyl ethyl ketone solution having a solid content concentration of 20% by mass was obtained as a curable resin composition.

[0115]

(Production of workpiece-securing sheet with attached resin layer)

The curable resin composition obtained as described above was applied on a release liner ("SP-PET381031" manufactured by Lintec Corporation), and the curable resin composition was dried for 1 minute at 100°C. Thus, a curable resin layer having a thickness of 20 μm was formed. Furthermore, a release liner of the same kind as the release liner described above was pasted on the curable resin layer. Then, the assembly was subjected to half-cut-off into a circular shape having a diameter of 150 mm so as to cut the pasted release liner and the curable resin layer, and then unnecessary parts on the outside the circular shape were removed. Subsequently, the release liner was removed from the workpiece-securing sheet thus obtained. Furthermore, the release liner that had been half-cut together with this curable resin layer was removed from the curable resin layer, and the pressure sensitive adhesive layer of the workpiece-securing sheet was pasted on the surface of the curable resin layer. Thus, a workpiece-securing sheet with an attached resin layer was obtained.

[0116]

<Evaluation of workpiece-securing sheet with attached resin layer>

For the workpiece-securing sheet with an attached resin layer obtained as described above, the easy pick-up characteristics were evaluated by the method described
5 below.

[0117]

(Easy pick-up characteristics)

The workpiece-securing sheet with an attached resin layer obtained as described above was pasted at 60°C on a surface of a silicon wafer (diameter: 150 mm, thickness:
10 100 μm) that had been polished #2000, using a tape mounter ("Adwill RAD2500" manufactured by Lintec Corporation). Subsequently, this was secured to a ring frame for wafer dicing, and then the silicon wafer was diced into a size of 10 mm × 10 mm using a dicing apparatus ("DFD651" manufactured by Disco Corporation) to obtain chips. At the time of this dicing, the base material film was cut into a depth of 20 μm from the
15 surface. Subsequently, the workpiece-securing sheet with an attached resin layer was irradiated with ultraviolet radiation through the base material film side, using an ultraviolet irradiation apparatus ("Adwill RAD2000" manufactured by Lintec Corporation) under the conditions of 220 mW/cm² and 190 mJ/cm². Subsequently, it was evaluated whether chips could be picked up when the injection speed of the needle
20 was set to 1 mm/s, and the pressure intensity was set to 0.2 mm, using a die bonder ("BESTEM-D02" manufactured by Canon Machinery Inc.). Needles were arranged in 4 rows of pins in an area which measured 8 mm on each side. The evaluation was conducted by performing pick-up continuously for 100 chips, and the case in which pick-up of all chips was successful was rated as "A"; the case in which pick-up of one or

more chips was successfully achieved, and then pick-up of any one of the second and the following chips failed, was rated as "A1"; and the case in which pick-up of the first chip failed, was rated as "B". The results are presented in the following Table 1.

[0118]

5 <Production and evaluation of workpiece-securing sheet with attached resin layer>

[Example 2, Comparative Examples 1 and 2, and Reference Example 1]

Workpiece-securing sheets with an attached resin layer were produced in the same manner as in Example 1, except that the blending components used at the time of
10 producing the acrylic acid alkyl ester polymer, and the blending components used at the time of producing the curable resin composition were changed as indicated in the following Table 1, and the workpiece-securing sheets were evaluated. The results are presented in the following Table 1.

The acrylic acid alkyl ester polymers obtained here were designated as acrylic
15 acid alkyl ester polymer (A-2) (Example 2), acrylic acid alkyl ester polymer (R-1) (Comparative Example 1), and acrylic acid alkyl ester polymer (R-2) (Comparative Example 2 and Reference Example 1), respectively.

Furthermore, in all of Examples, Comparative Examples, and Reference Examples, the pressure sensitive adhesive composition was adjusted to a solid content
20 concentration of 25% by mass by adjusting the amount of methyl ethyl ketone.

[0119]

In the following Table 1, "2EHA" means 2-ethylhexyl acrylate, "ISTA" means isostearyl acrylate, and "MA" means methyl acrylate.

Furthermore, the "filler material" is "SC2050MA" manufactured by Admatechs
25 Co., Ltd.

The symbol "-" in the column for blending components means that this component was not incorporated.

[0120]

[Table 1]

			Example 1	Example 2	Comparative Example 1	Comparative Example 2	Reference Example 1
Blending components for acrylic acid alkyl ester copolymer	Acrylic acid alkyl ester (parts by mass)	LA	80	-	-	-	-
		ISTA	-	80	-	-	-
		2EHA	-	-	80	-	-
		MA	-	-	-	80	80
	Hydroxyl group-containing monomer (parts by mass)	HEA	20	20	20	20	20
	Isocyanate compound (mol% with respect to hydroxyl group-containing monomer)	MOI	80	80	80	80	80
Catalyst (parts by mass)		DBTL	0.13	0.13	0.13	0.13	0.03
Blending components for curable resin composition	Acrylic resin (parts by mass)		87.8	87.8	87.8	87.8	87.8
	Epoxy resin (parts by mass)		12	12	12	12	12
	Phenolic resin (parts by mass)		10	10	10	10	10
	Curing accelerator (parts by mass)		0.2	0.2	0.2	0.2	0.2
	Coupling agent (parts by mass)		1	1	1	1	1
	Filler (parts by mass)		-	-	-	-	40
Evaluation results	Easy pick-up characteristics		A	A	B	B	A

[0121]

As shown in Table 1, the workpiece-securing sheets with an attached resin layer of Examples 1 and 2 were produced by using LA (having an alkyl group having 12 carbon atoms) or ISTA (having an alkyl group having 18 carbon atoms) as the acrylic acid alkyl ester for the production of the acrylic acid alkyl ester polymer (polymers (A-1) and (A-2)), and adjusting the total content of the polymer component (a) and the curable component (b) in the curable resin layer to 98.9% by mass, and the workpiece-securing sheets exhibited easy pick-up characteristics.

On the contrary, the workpiece-securing sheets with an attached resin layer of Comparative Examples 1 and 2 were produced using MA (having an alkyl group having 1 carbon atom) or 2EHA (having an alkyl group having 8 carbon atoms) as the acrylic acid alkyl ester for the production of the acrylic acid alkyl ester polymer (polymers (R-1) and (R-2)), and the workpiece-securing sheets did not exhibit easy pick-up characteristics.

The workpiece-securing sheet with an attached resin layer of Reference Example 1 was produced using MA as the acrylic acid alkyl ester for the production of the acrylic acid alkyl ester polymer; however, since a filler was incorporated into the curable resin layer, the workpiece-securing sheet exhibited easy pick-up characteristics.

As shown in Table 1, in the respective examples, a case in which pick-up of one or more chips was successfully achieved, and then pick-up of any one of the second and following chips failed, that is, a case in which the easy pick-up characteristics were rated as "A1", was not observed.

Industrial Applicability

[0122]

The invention can be utilized for the production of semiconductor chips and the like.

Reference Signs List

5	[0123]	
	1	Workpiece-securing sheet
	10	Workpiece-securing sheet with attached resin layer
	11	Base material film
	11a	Surface of base material film
10	12	Pressure sensitive adhesive layer
	12a	Surface of pressure sensitive adhesive layer
	13	Curable resin layer
	13a	Surface of curable resin layer
	14	Release film
15		

CLAIMS

1. A workpiece-securing sheet with an attached resin layer, comprising:
a pressure sensitive adhesive layer provided on a base material film; and
5 a curable resin layer provided on the pressure sensitive adhesive layer,
wherein the pressure sensitive adhesive layer contains a (meth)acrylic acid alkyl
ester polymer obtained by polymerizing a monomer containing a (meth)acrylic acid alkyl
ester with an alkyl group having 10 to 18 carbon atoms,
the curable resin layer contains a polymer component (a) and a curable
10 component (b), and
the total content of the polymer component (a) and the curable component (b) in
the curable resin layer is 95% by mass or more with respect to the total amount of the
curable resin layer.
- 15 2. The workpiece-securing sheet with an attached resin layer according to
Claim 1, wherein the curable resin layer contains an acrylic resin as the polymer
component (a), and
the content of the acrylic resin with respect to the total amount of the solid
content of the curable resin layer is 50% by mass or more.
- 20 3. The workpiece-securing sheet with an attached resin layer according to
Claim 1 or 2, wherein the content of the curable component (b) in the curable resin layer
is 1 to 100 parts by mass with respect to the content of 100 parts by mass of the polymer
component (a).