

DESCRIPTION

WAFER PROCESSING FILM AND METHOD FOR MANUFACTURING SEMICONDUCTOR DEVICE BY USING WAFER PROCESSING FILM

Technical Field

[0001]

The present invention relates to a wafer processing film and more specifically to a wafer processing film comprising a dicing and die bonding film having two functions of a dicing tape and a die bonding film. The invention also relates to a method for manufacturing semiconductor devices by using such wafer processing film.

Background Art

[0002]

Lately, there is developed a dicing and die bonding film having two functions of a dicing tape for fixing a semiconductor wafer in dicing the semiconductor wafer into individual semiconductor chips and of a die bonding film (referred to also as a die attaching film) for adhering diced semiconductor chips to lead frames, package substrates and others or for stacking and adhering semiconductor chips with each other in a stacked package.

[0003]

Taking workability in pasting to the semiconductor wafer and in attaching to the ring frame in dicing into consideration, such dicing and die bonding film is pre-cut.

[0004]

FIGs. 5 and 6 show an example of such pre-cut dicing and die bonding film. FIGs. 5, 6(A) and 6(B) are a schematic diagram, a plan view and a section view, respectively, of a wafer processing film 30 having a dicing and die bonding film 35. The wafer processing film 30 comprises a releasing film 31, an adhesive layer 32 and a removable adhesive film 33. The adhesive layer 32 has a shape formed corresponding to a shape of a semiconductor wafer, i.e., a shape of a circular label. The removable adhesive film 33 is what a peripheral area of a circular part corresponding to a dicing ring frame is removed and has a circular label portion 33a and a peripheral portion 33b surrounding the outside of the circular label portion 33a as shown in the figures. The adhesive layer 32 and the circular label portion 33a of the removable adhesive film 33 are laminated by aligning their centers. The circular label portion 33a of the removable adhesive film 33 also covers the adhesive layer 32 and contacts with the releasing film 31 by the peripheral part thereof. The dicing and die bonding film 35 is thus composed of a laminated structure of the adhesive layer 32 and the circular label portion 33a of the removable adhesive film 33.

[0005]

The semiconductor wafer is diced first by releasing

the releasing film 31 from the adhesive layer 32 and the removable adhesive film 33 in the laminated state, pasting a back surface of a semiconductor wafer W on the adhesive layer 32 as shown in FIG. 7 and sticking and fixing a dicing ring frame R on an outer peripheral part of the circular label portion 33a of the removable adhesive film 33. Then, the semiconductor wafer W is diced in this state to form individualized semiconductor chips. After that, a hardening process such as irradiation of ultraviolet rays is implemented on the removable adhesive film 33 (33a) to pick up the semiconductor chips. Because an adhesive force of the removable adhesive film 33 (33a) drops due to the hardening process, the removable adhesive film 33 may be released readily from the adhesive layer 32 and the semiconductor chips may be picked up while attaching the adhesive layer 32 on the back of the semiconductor chips. The adhesive layer 32 functions as a die bonding film in bonding the semiconductor chips to lead frames, package substrates or another semiconductor chips.

[0006]

By the way, as shown in FIGs. 5 and 6, the part where the adhesive layer 32 is laminated with the circular label portion 33a of the removable adhesive film 33 is thicker than other parts in the wafer processing film 30 described above. Still more, the releasing film part 31 exposed between the circular label portion 33a and the peripheral

portion 33b is a part from which the removable adhesive film 33 is removed and has a difference in level of thickness of the removable adhesive film 33 between the parts of the removable adhesive film 33 (33a and 33b).

Due to that, when the long wafer processing film 30 is wound in a roll state as a merchandize by using a cylindrical winding core, the difference in level described above caused by the removable adhesive film 33 and the releasing film 31 overlaps in the part where the adhesive layer 32 is laminated with the circular label portion 33a of the removable adhesive film 33 and a phenomenon of transferring the difference in level to the surface of the soft adhesive layer 32, i.e., transferred marks (referred to also as label marks, wrinkles or rolling marks) as shown in FIG. 8, occurs as a result. Such transferred marks appear remarkably especially when the adhesive layer 32 is formed of a soft resin and is thick and when the wafer processing film 30 is wound more. When such transferred marks are created, the adhesive layer 32 is pasted to the back surface of the semiconductor wafer W while entrapping air between the adhesive layer 32 and the semiconductor wafer W, so that the adhesive layer 32 does not adhere tightly with the semiconductor wafer W. As a result, there is a possibility of causing an adhesion failure and causing a failure in processing the semiconductor wafer.

[0007]

Although it is conceivable to weaken a winding pressure of the wafer processing film in order to suppress the transferred marks described above, this method may cause winding displacements of the merchandize and may cause such a trouble in actually using the wafer processing film that it becomes difficult to set the wafer processing film on a tape mounter for example.

[0008]

In order to suppress the label marks as described above, Patent Document 1 discloses an adhesive sheet in which a supporting layer having a thickness equal to or more than a total thickness of an adhesive layer and a removable adhesive film is provided at an outer part of the adhesive layer and removable adhesive film on a releasing base. With the supporting layer, the adhesive sheet of Patent Document 1 suppresses the transferred marks by dispersing or concentrating the winding pressure which is otherwise applied to the adhesive sheet, to the supporting layer.

Prior Art Document

[Patent Document 1]

[0009]

Japanese Patent Application Laid-open No. 2007-2173

Disclosure of Invention

Problems to be Solved by the Invention

[0010]

However, because the supporting layer is formed at parts on the releasing base other than the adhesive layer and the removable adhesive film which are required in manufacturing the semiconductor devices in the adhesive sheet of Patent Document 1, there are such problems that a width of the supporting layer is limited, the width of the supporting layer is narrow as compared to an outer diameter of the adhesive layer and removable adhesive film and its label mark suppressing effect is not enough. Still more, because the supporting layer has no adhesiveness in general and is not pasted fully with the releasing base (PET film), there are such problems that the supporting layer may float from the releasing base at part where the supporting layer is narrowest, the float portion described above may be caught by an apparatus in pasting the dicing and die bonding film to the semiconductor wafer and the semiconductor wafer may be damaged.

[0011]

Although it is also conceivable to widen the width of the supporting layer, it becomes difficult to use existing facilities because a width of the whole wafer processing film has to be also widened. Still more, because the supporting layer is a part discarded in the end, widening of the width of the supporting layer leads to an increase of a material cost.

[0012]

Accordingly, the present invention aims at solving the above-mentioned problems by providing a wafer processing film capable of suppressing such transferred marks otherwise generated in the adhesive layer when the wafer processing film having the adhesive layer and removable adhesive film is wound in a roll. The invention also aims at providing a method for manufacturing semiconductor devices by using such wafer processing film.

Means for Solving the Problems

[0013]

In order to achieve the above-mentioned objects, a wafer processing film of a first aspect of the invention comprises a removable adhesive film composed of a long base film and a long film-like removable adhesive layer provided on the base film and a long film-like adhesive layer provided on the removable adhesive layer, and the removable adhesive layer contains a radiation polymerizing compound and a photoinitiator.

[0014]

According to the wafer processing film of the invention described above, because the removable adhesive layer contains the radiation polymerizing compound and the photoinitiator, it becomes possible to form a hardened removable adhesive layer part and a non-hardened removable adhesive layer part at desirable positions and with

desirable sizes and shapes by illuminating light having a wavelength to which the photoinitiator reacts to the desirable position of the removable adhesive layer. Therefore, it is possible to harden the part corresponding to the ring frame of the removable adhesive layer by exposing the removable adhesive layer at the position corresponding to the ring frame and to lower an adhesive force thereof to release the adhesive layer at the position corresponding to that part.

[0015]

Although the adhesive layer pre-cut into a desirable shape, e.g., a circular plane, has been used to prevent the adhesive from remaining on the ring frame in releasing the wafer processing film after its use because it has been difficult to release the adhesive layer from an adherend in the past, it becomes unnecessary to pre-cut the adhesive layer and the removable adhesive film into a predetermined shape because the adhesive layer may be released after lowering the adhesiveness of the removable adhesive layer at the position corresponding to the ring frame as described above. As a result, it becomes possible to prevent any transferred mark from being left in the adhesive layer in winding the wafer processing film in a roll as a merchandize.

[0016]

According to a wafer processing film of a second

aspect of the invention, a wafer processing film comprises a removable adhesive film composed of a long base film and a long film-like removable adhesive layer provided on the base film; and a long film-like adhesive layer provided on the removable adhesive layer and characterized in that the removable adhesive layer contains a thermal polymerizing compound.

[0017]

According to the wafer processing film of the invention described above, it becomes possible to form a hardened removable adhesive layer part and a non-hardened removable adhesive layer part at desirable positions and with desirable sizes and shapes by irradiating heat to a desirable position of the removable adhesive layer. Therefore, it is possible to harden the part corresponding to the ring frame of the removable adhesive layer by exposing the removable adhesive layer at the position corresponding to the ring frame and to lower the adhesive force thereof to release the adhesive layer at the position corresponding to that part. Then, it becomes unnecessary to pre-cut the adhesive layer and the removable adhesive film into a predetermined shape. As a result, it becomes possible to prevent any transferred mark from being left in the adhesive layer in winding the wafer processing film in a roll as a merchandize.

[0018]

According to a wafer processing film of a third aspect of the invention, the removable adhesive film is not pre-cut into a shape corresponding to the ring frame and the adhesive layer is not pre-cut into a shape corresponding to a semiconductor wafer in the wafer processing film of the first or second aspect of the invention described above.

[0019]

According to the wafer processing film of the invention described above, because the adhesive layer and the removable adhesive layer are not pre-cut, there exists no difference in level otherwise created in the part where the adhesive layer is laminated with the removable adhesive film in winding the wafer processing film in a roll as a merchandize and it is possible to prevent the transferred marks from being left in the adhesive layer.

[0020]

According to a wafer processing film of a fourth aspect of the invention, the adhesive layer is provided with a cut at position located outside of an outer circumference of the semiconductor wafer and inside of an outer circumference of the ring frame in the wafer processing film of any one of the first through third aspects of the invention described above.

[0021]

According to the wafer processing film of the

invention described above, it is possible to lower the adhesive force of the removable adhesive layer part at the position corresponding to the ring frame by hardening that part and to release the adhesive layer from that part from the cut as a starting point.

[0022]

According to a wafer processing film of a fifth aspect of the invention, a protection film is pasted releasably on the surface of the adhesive layer and the protection film has a radiation polymerizing compound and is provided with a cut at position located outside of the outer circumference of the semiconductor wafer and inside of the outer circumference of the ring frame in the wafer processing film of any one of the first, third and fourth aspects of the invention described above.

[0023]

According to the wafer processing film of the invention described above, it becomes possible to harden the part corresponding to the ring frame of the removable adhesive layer by releasing the part on the outside of the cut of the protection film and by exposing the removable adhesive layer at the position corresponding to the ring frame by using the remaining part as a mask. Thereby, it is possible to lower the adhesive force of the part and to release the adhesive layer at the position corresponding to that part.

[0024]

A method for manufacturing semiconductor devices of a first aspect of the invention is what uses the wafer processing film of any one of first through fifth aspects of the invention described above and comprises steps of:

hardening a part other than a part corresponding to a wafer of the removable adhesive layer and corresponding at least to the ring frame and releasing the adhesive layer from the hardened removable adhesive layer part;

pasting the wafer to the adhesive layer;

fixing the ring frame to the removable adhesive layer;

dicing the wafer to form individualized chips and the adhesive layer; and

hardening the part of the removable adhesive layer corresponding to the wafer to pick up the individualized chips and the adhesive layer.

[0025]

According to the method for manufacturing semiconductor devices of the invention described above, it is possible to harden the part other than the part corresponding to the semiconductor wafer (referred to also simply as 'wafer' hereinafter) and at least corresponding to the ring frame of the removable adhesive layer and the part corresponding to the wafer of the removable adhesive layer stepwise to lower the adhesiveness of the removable

adhesive layer and to change releasable positions between the adhesive layer and the removable adhesive layer. Accordingly, it is possible to make desirable design changes of the semiconductor devices without involving large-scale changes of existing facilities.

[0026]

It is noted that because the adhesive layer and the removable adhesive layer need not be pre-cut as for the wafer processing film before manufacturing the semiconductor devices in the method for manufacturing the semiconductor devices of the invention described above, there exists no difference in level otherwise created in the part where the adhesive layer is laminated with the removable adhesive film when the wafer processing film is wound in a roll as a merchandize and it becomes possible to prevent the transferred marks from being left in the adhesive layer.

Advantageous Effects of the Invention

[0027]

According to the wafer processing film of the first aspect of the invention, because the removable adhesive layer contains the radiation polymerizing compound and the photoinitiator, it becomes possible to form the hardened removable adhesive layer part and the non-hardened removable adhesive layer part at desirable positions and with desirable sizes and shapes by illuminating light

having the wavelength to which the photoinitiator reacts to the desirable position of the removable adhesive layer. Therefore, it is possible to harden the part corresponding to the ring frame of the removable adhesive layer by exposing the removable adhesive layer at the position corresponding to the ring frame and to lower the adhesive force thereof to release the adhesive layer at the position corresponding to that part.

Due to that, it becomes unnecessary to pre-cut the adhesive layer and the removable adhesive film into a predetermined shape. As a result, it becomes possible to prevent any transferred mark from being left in the adhesive layer in winding the wafer processing film in a roll as a merchandize.

Accordingly, it is possible to prevent the adhesion between the adhesive layer and the semiconductor wafer from dropping due to air otherwise entrapped between the adhesive layer and the semiconductor wafer and to prevent adhesion failure in bonding the semiconductor chips to the lead frames, package substrates or to other semiconductor chips and troubles in processing the wafer.

[0028]

According to the wafer processing film of the second aspect of the invention, it becomes possible to form the hardened removable adhesive layer part and the non-hardened removable adhesive layer part at desirable

positions and with desirable sizes and shapes by irradiating heat to the desirable position of the removable adhesive layer. Therefore, it is possible to harden the part corresponding to the ring frame of the removable adhesive layer by irradiating heat to the removable adhesive layer at the position corresponding to the ring frame and to lower the adhesive force thereof to release the adhesive layer at the position corresponding to that part. Then, it becomes unnecessary to pre-cut the adhesive layer and the removable adhesive film into a predetermined shape. As a result, it becomes possible to prevent any transferred mark from being left in the adhesive layer in winding the wafer processing film in a roll as a merchandise.

Accordingly, it is possible to prevent the adhesion between the adhesive layer and the semiconductor wafer from dropping due to the air otherwise entrapped between the adhesive layer and the semiconductor wafer and to prevent adhesion failure in bonding the semiconductor chips to the lead frames, package substrates or to other semiconductor chips and troubles in processing the wafer.

[0029]

According to the wafer processing film of the third aspect of the invention, because the adhesive layer and the removable adhesive layer are not pre-cut, there exists no difference in level otherwise created in the part where

the adhesive layer is laminated with the removable adhesive film in winding the wafer processing film in a roll as a merchandize and it is possible to prevent the transferred marks from being left in the adhesive layer. Accordingly, it is possible to prevent the adhesion between the adhesive layer and the semiconductor wafer from dropping due to the air otherwise entrapped between the adhesive layer and the semiconductor wafer and to prevent adhesion failure in bonding the semiconductor chips to the lead frames, package substrates or to other semiconductor chips and troubles in processing the wafer.

[0030]

According to the wafer processing film of the fourth aspect of the invention, it becomes possible to harden the removable adhesive layer part corresponding to the ring frame, to lower the adhesive force of that part and to release the adhesive layer from that part from the cut as the starting point.

[0031]

According to the wafer processing film of the fifth aspect of the invention, it becomes possible to harden the part corresponding to the ring frame of the removable adhesive layer by releasing the part on the outside of the cut of the protection film and by exposing the removable adhesive layer at the position corresponding to the ring frame by using the remaining part as the mask. Then, it

is possible to lower the adhesiveness of the part and to release the adhesive layer at the position corresponding to that part.

[0032]

According to the method for manufacturing the semiconductor devices of the first aspect of the invention, it is possible to harden the part other than the part corresponding to the semiconductor wafer and at least corresponding to the ring frame of the removable adhesive layer and the part corresponding to the wafer of the removable adhesive layer stepwise to lower the adhesive force of the removable adhesive layer and to change releasable positions between the adhesive layer and the removable adhesive layer. Accordingly, it is possible to make desirable design changes of the semiconductor devices without involving large-scale changes of the existing facilities.

It is noted that because the adhesive layer and the removable adhesive layer need not be pre-cut as for the wafer processing film before manufacturing the semiconductor devices in the method for manufacturing the semiconductor devices, there exists also no difference in level otherwise created in the part where the adhesive layer is laminated with the removable adhesive film when the wafer processing film is wound in a roll as a merchandize and it becomes possible to prevent the

transferred marks from being left in the adhesive layer.

Brief Description of Drawings

[0033]

[FIG. 1] FIG. 1 is a section view of a wafer processing film according to an embodiment.

[FIG. 2] FIG. 2 is a section view of a wafer processing film according to a modified example of the embodiment.

[FIG. 3] FIG. 3 is a diagram for explaining a method for manufacturing a semiconductor device by using the wafer processing film of the embodiment.

[FIG. 4] FIG. 4 is a diagram for explaining the method for manufacturing the semiconductor device by using the wafer processing film of the embodiment.

[FIG. 5] FIG. 5 is an outline view of a prior art wafer processing film.

[FIG. 6] (A) is a plan view of the prior art wafer processing film and FIG. (B) is a section view thereof.

[FIG. 7] FIG. 7 is a showing a state in which a dicing and die bonding film is pasted with a dicing ring frame.

[FIG. 8] FIG. 8 is schematic diagram explaining a trouble of the prior art wafer processing film.

Best Modes for Carrying Out the Invention

[0034]

Embodiments of the present invention will be explained below with reference to the drawings. FIG. 1 is a section view of a wafer processing film according to

the embodiment, FIG. 2 is a section view of a wafer processing film according to a modified example of the embodiment, and FIG. 3 and FIG.4 are diagrams for explaining a method for manufacturing a semiconductor device by using the wafer processing film of the embodiment.

[0035]

[First Embodiment]

Each component of a wafer processing film of a first embodiment of the invention will be explained below in detail. As shown in FIG. 1, the wafer processing film 10 of the first embodiment of the invention is a dicing and die bonding film 15 having a removable adhesive film 14 composed of a base film 11 and a removable adhesive layer 12 provided on the base film 11 and an adhesive layer 13 provided on the removable adhesive layer 12. The adhesive layer 13 is not pre-cut into a shape each corresponding to a semiconductor wafer and the removable adhesive film 14 is not pre-cut into a shape each corresponding to a ring frame. In the present embodiment, the removable adhesive film 14 and the adhesive layer 13 are laminated on the long base film 11 like a long film and the wafer processing film 10 has no part where thickness is different.

[0036]

When the dicing and die bonding film 15 is circulated as a merchandize, it is circulated in a market as a wafer

processing film 10 by pasting a protection film, i.e., a releasing film not shown, on the whole surface of the dicing and die bonding film on the side of the adhesive layer 13. Now, the releasing film, the adhesive layer 13 and the removable adhesive film 14 composed of the base film 11 and the removable adhesive layer 12, i.e., the components of the wafer processing film 10, will be explained.

[0037]

(Releasing Film)

Known releasing films such as polyethylene-telephthalate (PET), polyethylene, and other releasing-treated films may be used for the releasing film used for the wafer processing film 10. Although a thickness of the releasing film is not specifically defined and may be set appropriately, it is preferable to be 25 to 50 μm .

[0038]

(Adhesive Layer)

The adhesive layer 13 is used after when the semiconductor wafers are pasted and diced and in picking up individualized semiconductor chips (or referred to just as a 'chip' hereinafter) as an adhesive. That is, the adhesive is released from the removable adhesive film 14, is attaches to the chips and is used in fixing the chips to substrates and lead frames. Accordingly, the adhesive

layer 13 has a releasing quality capable of being released from the removable adhesive film 14 while attaching to the individualized chips. The adhesive layer 13 also has enough adhesive reliability for adhering and fixing the chips to the substrates and lead frames in carrying out die bonding.

[0039]

The adhesive layer 13 is what adhesive is filmed and known polyimide resin, polyamide resin, polyetherimide resin, polyamide-imide resin, polyether resin, polyester resin, polyether-imide resin, phenoxy resin, polysulfone resin, polyethersulfone resin, polyphenylene sulfide resin, Polyether ketone resin, rinated polypropylene resin, acryl resin, polyurethane resin, epoxy resin, polyacrylamide resin, melamine resin and other and their mixture used for adhesives may be used for the adhesive layer 13. Still more, it is preferable to add silane coupling agent or titanium coupling agent as an additive to the material and their mixture described above in order to intensify their adhesive strength to the chips and lead frames.

[0040]

Although a thickness of the adhesive layer 13 is not specifically limited, it is preferable to be 5 to 100 μm in general. The adhesive layer 13 of the wafer processing film 10 of the embodiment is laminated on the whole surface

of the removable adhesive layer 12 of the removable adhesive film 14, is not pre-cut into a shape corresponding to a shape of the semiconductor wafer and others and is provided with a cut 13a disposed at position on the outside at least from a position corresponding to the semiconductor wafer and on the inside from a position corresponding to a ring frame. Although the cut 13a may be provided at part where inner and outer circumferences of the ring frame are positioned when the ring frame is pasted, the cut 13a is provided on the adhesive layer 13 at the position corresponding to an outer circumference of the semiconductor wafer in the present embodiment.

[0041]

Accordingly, it becomes possible to lower the adhesive force of removable adhesive layer part by hardening the removable adhesive layer part formed under the adhesive layer part at the part outside from the cut 13a of the adhesive layer 13 and to release the adhesive layer 13 from the hardened part of the removable adhesive layer 12 from the cut 13a as a starting point before fixing the ring frame to the removable adhesive layer 12. It is noted that instead of the cut 13a described above provided at the position corresponding to the outer circumference of the semiconductor wafer, it is also possible to provide cuts at the position corresponding to the inner and outer circumference of the ring frame to harden the removable

adhesive layer part at the position corresponding to the ring frame and to release the part corresponding to the ring frame of the adhesive layer 13 from the removable adhesive layer 12.

[0042]

As a result, it becomes possible to form the wafer processing film in which the adhesive layer 13 lies at the part where the semiconductor wafer is pasted, no adhesive layer lies at the part where the dicing ring frame is pasted and only the removable adhesive film 14 lies there.

[0043]

(Removable adhesive film)

The removable adhesive film 14 of the present embodiment is what the removable adhesive layer 12 is provided on the base film 11. The removable adhesive film 14 has an enough adhesive force so as not to release the wafer in dicing the wafer and a low adhesive force so as to be able to release the chips readily from the adhesive layer 13 in picking up the chips after dicing. To that end, the removable adhesive layer 12 of the removable adhesive film 14 contains a radiation polymerizing compound and a photoinitiator.

[0044]

Although any prior art known materials may be used as the base film 11 of the removable adhesive film 14 without no specific restriction, it is preferable to use

materials having radio-translucency because the removable adhesive layer 12 of the removable adhesive film 14 of the embodiment contains the radiation-hardening radiation-polymerizing compound.

[0045]

As its material, it is possible to enumerate polyethylene, polypropylene, ethylene-propylene copolymer, polybutene-1, poly-4-methylpentene-1, ethylene-vinyl acetate copolymer, ethylene-methyl acrylate copolymer, ethylene-acrylate copolymer, homopolymer or copolymer or their mixture of α -olefine such as ionomer, polyurethane, styrene-ethylene-butene or pentene copolymer, thermoplastic elastomer such as polyamide-polyol copolymer and their mixture for example. The base film 11 may be a mixture of those two or more materials selected from these groups or may be what they are single-layered or multi-layered. Although a thickness of the base film 11 is not specifically limited and may be appropriately set, it is preferable to be 50 to 200 μ m.

[0046]

The resin used for the removable adhesive layer 12 of the removable adhesive layer 12 is not specifically limited and known chlorinated polypropylene resin, acryl resin, polyester resin, polyurethane resin, epoxy resin and others that are used for removable adhesive agents.

[0047]

It is preferable to modify the removable adhesive agent by appropriately blending acryl adhesive agent, radiation polymerizing compound, photoinitiator, hardening agent and other to the resin of the removable adhesive layer 12. The resin of the removable adhesive layer 12 of the present embodiment contains the radiation polymerizing compound. Accordingly, it becomes possible to readily release the removable adhesive layer 12 from the adhesive layer 13 by radiation hardening by blending the radiation polymerizing compound in the removable adhesive layer 12. Although a thickness of the removable adhesive layer 12 is not specifically limited and may be set appropriately, it is preferable to be 5 to 30 μm .

[0048]

As the radiation polymerizing compound, it is possible to apply, for example, trimethylolpropane triacrylate, pentaerythritol triacrylate, Pentaerythritol tetraacrylate, dipentaerythritol monohydroxy pentaacrylate, dipentaerythritol hexaacrylate, 1,4-butylene glycol diacrylate, 1,6 hexanediol diacrylate, polyethylene glycol diacrylate, oligoester acrylate and others.

[0049]

Beside the acrylate compounds described above, it is also possible to use urethane acrylate oligomer. The

urethane acrylate oligomer may be obtained by reacting isocyanate-terminated urethane prepolymer obtained by reacting a polyester or polyether type polyol compound with a polyvalent isocyanate compound (e.g., 2,4-tolylenediisocyanate, 2,6-tolylenediisocyanate, 1,3-xylylene diisocyanate, 1,4-xylylene diisocyanate, diphenyl-methane 4,4-diisocyanate and others) with acrylate or methacrylate having hydroxyl group (e.g., 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, 2-hydroxypropyl acrylate, 2-hydroxypropyl methacrylate, polyethylene glycol acrylate, polyethylene glycol methacrylate and others). It is noted that a mixture of two or more resins selected from the above may be used for the removable adhesive layer 12.

[0050]

The resin of the removable adhesive layer 12 of the present embodiment contains the photoinitiator. The photoinitiator may be, for example, α -ketol compounds such as 4-(2-hydroxyethoxy) phenyl (2-hydroxyethoxy-2-propyl) ketone, α -hydroxyethoxy- α , α' -dimethylacetophenone, 2-methyl-2-hydroxypropiophenone and 1-hydroxycyclohexyl phenyl ketone; acetophenone-based compounds such as methoxy acetophenone, 2,2-dimethoxy-2-phenylacetophenone, 2,2-diethoxy acetophenone and 2-methyl-1-[4-(methylthio)-phenyl]-2-morpholino

propane-1; benzoin ether compounds such as benzoin ethyl ether, benzoin isopropyl ether and anisoil methyl ether; ketal compounds such as benzyl dimethyl ketal; aromatic sulfonyl chloride compounds such as naphthalene sulfonyl chloride; photoactive oxime compounds such as 1-phenon-1, 1-propanedione-2-(o-ethoxycarbonyl) oxime; benzophenone compounds such as benzophenone, benzoylbenzoic acid and 3,3'-dimethyl-4-methoxybenzophenone; thioxanthone compounds such as thioxanthone, 2-chloro thioxanthone, 2-methyl thioxanthone, 2,4-dimethyl thioxanthone, isopropyl thioxanthone, 2,4-dichloro thioxanthone, 2,4-diethyl thioxanthone and 2,4-diisopropyl thioxanthone; camphorquinone; halogenated ketone; acylphosphin oxide, acylphosphonate and others. A blending quantity of these photoinitiators is preferable to be 0.01 to 5 mass parts to 100 mass parts of acrylic copolymer.

[0051]

Since the removable adhesive layer 12 contains the radiation polymerizing compound and the photoinitiator, it becomes possible to form a hardened part of the removable adhesive layer 12 and a non-hardened part of the removable adhesive layer 12 at desirable positions with desirable sizes and shapes by selecting a range to which light is illuminated. Accordingly, because it is possible to form the hardened part of the removable

adhesive layer 12 stepwise, light is illuminated to a part outside of the ring frame of the removable adhesive layer 12 in pasting the ring frame to the removable adhesive layer 12 to lower the adhesive force of that part and to release the adhesive layer 13. As a result, because it becomes unnecessary to pre-cut the adhesive layer 13 and the removable adhesive film 14 covering the adhesive layer 13 into a predetermined shape and there exists no difference in level otherwise generated at the part where the adhesive layer 13 is laminated with the removable adhesive film 14 when the wafer processing film 10 is wound in a roll as a merchandize, it is possible to prevent transferred marks otherwise generated in the adhesive layer 13.

[Modified Example of First Embodiment]

[0052]

As shown in FIG. 2, a wafer processing film 50 of an exemplary modification of the first embodiment is provided with a releasable protection film 17 on the whole surface of the adhesive layer 13 of the wafer processing film 10 (see FIG. 1) of the first embodiment. Specifically, the protection film 17 is provided on the adhesive layer 13' of the dicing and die bonding film 15' having the removable adhesive film 14 composed of the base film 11 and the removable adhesive layer 12 provided on the base film 11 and the adhesive layer 13' provided on the

removable adhesive layer 12. The protection film 17 has a radiation shielding property. The protection film 17 has also a cut 17a formed corresponding to the ring frame. While the cut 17a may be formed respectively at parts where the inner and outer circumferences of the ring frame are located when the ring frame is pasted, it may be formed only at part where the inner circumference is located. The adhesive layer 13' is also provided with a cut 13b formed at the position corresponding to the cut 17a of the protection film 17.

[0053]

Since the protection film 17 having the radiation shielding property and the cut 17a formed corresponding to the ring frame is releasably pasted on the surface of the adhesive layer 13' as described above, it becomes possible to sensitize and to harden only the part of the removable adhesive layer 12 corresponding to the ring frame by exposing the wafer processing film 50 after releasing the part of the protection film 17 corresponding to the ring frame. Thus, the adhesive force of the hardened part can be weakened. Accordingly, the adhesive layer part located on the part whose adhesive force is weakened can be released from the cut 13b as a starting point. Therefore, it become unnecessary to pre-cut the removable adhesive film 14 and the adhesive layer 13' into a predetermined shape. As a result, it is possible to

prevent transferred marks from being left in the adhesive layer 13' in winding the wafer processing film 50 in a roll as a merchandize. Still more, because it is not necessary to paste a photo mask otherwise separately prepared after releasing the protection film 17, it becomes possible to cut man-our and production costs.

[0054]

It is noted that the adhesive layer 13', i.e., the component, of the wafer processing film 50 may be made of the same material with the adhesive layer 13 used in the wafer processing film 10 described above and the removable adhesive film 14 used in the wafer processing film 50 may be made of the same material with the removable adhesive film 14 used in the wafer processing film 10.

[0055]

(Protection Film)

Known releasing-treated films such as polyethylene-telephthalate (PET), polyethylene and other films may be used for the protection film 17 used for the wafer processing film 50 as long as it has the radiation shielding property. Although a thickness of the protection film 17 is not specifically defined and may be set appropriately, it is preferable to be 25 to 50 μm .

[0056]

Among the films having the radiation shielding property, a film having ultraviolet shielding quality may

be a film molded from a thermoplastic resin composition whose main component is thermoplastic resin such as acrylic resin, fluorine resin, vinyl chloride resin and the like and in which ultraviolet absorber is added and kneaded. Although the thermoplastic resins used as the main component described above may be used solely or as a combination of two or more resins, it is preferable to use the acrylic resin and fluorine resin in order to assure excellent weather resistance for a long period of time. The acrylic resin and fluorine resin may be solely used respectively or may be used in combination.

[0057]

Although the ultraviolet absorber described above is not specifically defined, benzophenone ultraviolet absorbers, benzotriazole ultraviolet absorbers, cyanoacrylate ultraviolet absorbers and the like may be suitably used. Those ultraviolet absorbers may be used solely or in combination of two or more absorbers.

[Second Embodiment]

[0058]

Similarly to the wafer processing film 10 (see FIG. 1) of the first embodiment of the invention, a wafer processing film of a second embodiment of the invention has a removable adhesive film (corresponds to reference numeral 14 in FIG. 1) composed of a base film (corresponds to numeral 11 in FIG. 1) and a removable adhesive layer

(corresponds to numeral 12 in FIG. 1) provided on the base film and an adhesive layer (corresponds to numeral 13 in FIG. 1) provided on the removable adhesive layer. The removable adhesive film and adhesive layer are not pre-cut into shapes corresponding to a ring frame and a semiconductor wafer. The adhesive layer is provided with a cut at position corresponding to the inner circumference of the ring frame.

A difference between the wafer processing film of the second embodiment of the invention and the wafer processing film 10 of the first embodiment of the invention is that while the removable adhesive layer 12 of the removable adhesive film 14 of the wafer processing film 10 of the first embodiment contains the radiation polymerizing compound and the photoinitiator, the removable adhesive layer of the removable adhesive film of the wafer processing film of the second embodiment contains a thermal polymerizing compound, instead of the radiation polymerizing compound and the photoinitiator. Because the removable adhesive layer of the wafer processing film of the second embodiment contains the thermal polymerizing compound, it becomes possible to form parts where the removable adhesive layer is hardened and is not hardened at desirable positions and with desirable sizes and shapes by selecting a range to which heat is irradiated.

[0059]

Accordingly, it becomes possible to form the part where the removable adhesive layer is hardened stepwise also in the case of the wafer processing film of the second embodiment, similarly to the case of the wafer processing film 10 of the first embodiment of the invention. Then, the ring frame may be pasted to the removable adhesive layer by irradiating heat to a part outside of the ring frame of the removable adhesive layer to lower the adhesive force of that part and by releasing the adhesive layer. As a result, it becomes unnecessary to pre-cut the adhesive layer and the removable adhesive film covering the adhesive layer into the predetermined shape, so that no difference in level otherwise generated in the part where the adhesive layer is laminated with the removable adhesive film exists when the wafer processing film is wound in a roll as a merchandize and thus it becomes possible to prevent transferred marks from being left in the adhesive layer.

[0060]

The thermo-polymerizing compound may be what is polymerized by heat such as those compounds having a functional group such as a glycidyl group, acryloyl group, methacryloyl group, hydroxyl group, carboxyl group, isocyanurate groups, amino group, amide group and others. These compounds may be used solely or in combination of

two or more groups. It is noted that the compound which is hardened by heat, which drops the adhesive force of the hardened part of the removable adhesive layer and which can be released between the adhesive layer and the removable adhesive layer is used by taking heat resistance of the wafer processing film into consideration.

[0061]

It is noted that a modified example of the second embodiment similar to the modified example of the first embodiment can be applied also in the second embodiment of the invention.

[Method for Manufacturing Semiconductor Devices]

[0062]

A method for manufacturing semiconductor devices by using the wafer processing film 10 of the first embodiment will be explained with reference to FIGs. 3 and 4. FIGs. 3 and 4 are diagrams explaining the method for manufacturing the semiconductor devices by using the wafer processing film 10 of the first embodiment. FIG. 3(A) is a section view of the wafer processing film showing a state in which the releasing film 16 is pasted on the adhesive layer 13, FIG. 3(B) is a section view of a wafer and the wafer processing film showing a state in which the wafer W is pasted on the wafer processing film, FIG. 3(C) is a section view of the wafer and the wafer processing film showing a state in which a part of the removable

adhesive layer 12 is hardened and the adhesive layer on the hardened removable adhesive layer part 12a is released, FIG. 3(D) is a section view of the wafer and the wafer processing film showing a state in which the wafer is diced and FIG. 3(E) is a section view of the wafer and the wafer processing film showing a state in which the part of the removable adhesive layer 12b at position corresponding to the wafer is hardened.

Further, FIG. 4(A) is a section view of the wafer and the wafer processing film showing a state in which the wafer processing film to which the diced wafer is pasted is mounted on an expanding device and FIG. 4(B) is a section view of the wafer and the wafer processing film after being expanded.

[0063]

(Preparation Step)

As shown in FIG. 3(A), there is prepared the wafer processing film in which the releasing film 16 is pasted, from the side of the adhesive layer 13, on the dicing and die bonding film 15 having the removable adhesive film 14 composed of the base film 11 and the removable adhesive layer 12 provided on the base film 11 and the adhesive layer 13 having the cut 13a formed into a shape corresponding to an outer circumference of a semiconductor wafer. Because the adhesive layer 13 and others are not pre-cut, there exists no difference in level otherwise created at

the part where the adhesive layer 13 is laminated with the removable adhesive film 14 when the wafer processing film is wound in a roll as a merchandize while pasting the releasing film 16. Thus, it is possible to prevent transferred marks from being left in the adhesive layer 13.

[0064]

(Pasting Step)

Next, as shown in FIG. 3(B), the releasing film 16 is peeled from the wafer processing film and the adhesive layer 13 of the dicing and die bonding film 15 is pasted with a back surface of a semiconductor wafer W. It is noted that in the following steps, the ring frame 20 and the semiconductor wafer W are not conveyed while pasting with the long dicing and die bonding film 15. Rather, it is preferable to dice the dicing and die bonding film 15 along the outer circumference of the ring frame 20 before or after pasting the ring frame 20 in conveying one set each of the ring frame 20 and the semiconductor wafer W individually.

[0065]

(First Ultraviolet Irradiating Step)

Next, ultraviolet rays having a wavelength to which the photoinitiator contained in the removable adhesive layer 12 reacts are irradiated to harden the removable adhesive layer part 12a other than the part corresponding

to the semiconductor wafer W among the removable adhesive layer 12. If the ultraviolet rays are irradiated from above the dicing and die bonding film 15, i.e., from the side in which the semiconductor wafer W is pasted, at this time, the semiconductor wafer W becomes a mask and the ultraviolet rays are irradiated to the removable adhesive layer part 12a other than the part corresponding to the semiconductor wafer W. Then, as a result of dropping the adhesive force of the removable adhesive layer part 12a other than the part corresponding to the semiconductor wafer W, only the adhesive layer 13 above the hardened removable adhesive layer part 12a can be released from the cut 13a provided on the adhesive layer 13 as a starting point as shown in FIG. 3(C).

[0066]

(Dicing Step)

Next, as shown in FIG. 3(D), the ring frame 20 is pasted with the outer circumference part of the wafer processing film, i.e., the removable adhesive layer part 12a whose adhesive force is lowered, by utilizing the remaining adhesive force and by applying pressure. Then, the semiconductor wafer W as well as the adhesive layer 13 are mechanically diced by using a dicing blade not shown to divide into a plurality of semiconductor chips C.

[0067]

(Second Ultraviolet Irradiating Step)

Then, as shown in FIG. 3(E), ultraviolet rays are irradiated to the removable adhesive layer part 12b corresponding to the position of the wafer which has been divided into the plurality of semiconductor chips C from the underneath of the dicing and die bonding film 15 to harden the removable adhesive layer part 12b. As a result of lowering the adhesive force of the part 12b, it becomes possible to release the adhesive layer 13 on the part 12b.

[0068]

(Mounting Step)

After hardening the removable adhesive layer part 12b corresponding to the position of the wafer which has been divided into the plurality of semiconductor chips C by irradiating the ultraviolet rays, the wafer processing film holding the plurality of divided semiconductor chips C is mounted on a stage 21 of an expanding device as shown in FIG. 4(A). As shown in the figure, the expanding device has a hollow columnar thrusting member 22.

[0069]

(Expanding Step)

Then, as shown in FIG. 4(B), an expanding step of stretching the removable adhesive film 14, composed of the base film 11 and the removable adhesive layer 12 (12a and 12b) holding the diced semiconductor chips C and the adhesive layers 13, in a peripheral direction of the ring frame 20 is carried out. Specifically, the hollow

columnar thrusting member 22 is elevated from the side of the lower surface of the removable adhesive film 14 toward the removable adhesive film 14 holding the plurality of diced semiconductor chips C and adhesive layers 13 to stretch the removable adhesive film 14 in the peripheral direction of the ring frame 20. The expanding step allows distances among the semiconductor chips C to be widened and recognizability of the semiconductor chips C by means of a CCD camera and the like to be enhanced. It becomes also possible to prevent the semiconductor chips C from adhering again which otherwise occurs when the neighboring semiconductor chips C contact with each other in picking up the semiconductor chips C.

[0070]

(Pick-up Step)

After carrying out the expanding step, a pick-up step of picking up the semiconductor chips C while expanding the removable adhesive film 14. Specifically, the semiconductor chips C are pushed up by pins not shown from the underneath of the removable adhesive film 14 and the semiconductor chips C are adsorbed by an adsorbing jig from the side of an upper surface of the removable adhesive film 14 to pick up the individualized semiconductor chips C together with the adhesive layers 13 adhering to the semiconductor chips C.

[0071]

(Die Bonding Step)

After carrying out the pick-up step, a die bonding step is carried out. Specifically, the semiconductor chips C are bonded to lead frames, package substrates and the like by the adhesive layers 13 picked up together with the semiconductor chips C in the pick-up step to manufacture semiconductor devices.

[0072]

It is noted that when the semiconductor devices are manufactured by using the wafer processing film 50 of the exemplary modification of the first embodiment, because the wafer processing film 50 (FIG. 2) has the protection film 17 having the radiation shielding property and the cut 17a formed corresponding to the ring frame R is pasted releasably on the surface of the adhesive layer 13', the part of the protection film 17 corresponding to the ring frame R may be released and the protection film 17 remaining on the adhesive layer 13' without being released may be used as a mask. Accordingly, it is possible to manufacture semiconductor devices by the same steps with the prior art pre-cut dicing and die bonding film 15' after irradiating ultraviolet rays to the part corresponding to the ring frame R of the removable adhesive layer 12 by using the protection film 17 as a mask to lower the adhesive force and peeling and removing the adhesive layer 13' located above that.

[0073]

It is noted that because the wafer processing film containing the reactive photoinitiator in the removable adhesive layer 12 is used in the method of manufacturing the semiconductor devices by using the wafer processing film 10 of the first embodiment, the ultraviolet rays are irradiated in the two steps to change the positions, sizes and shapes of the removable adhesive layer 12 to be hardened. However, when the wafer processing film of the second embodiment is used, because the wafer processing film contains the thermal polymerizing compound in the removable adhesive layer 12, thermal hardening of the removable adhesive layer part 12a and the removable adhesive layer part 12b is carried out in two steps by selecting the heat irradiating ranges to change the positions, sizes and shapes of the removable adhesive layer 12 to be hardened.

[0074]

As described above, according to the wafer processing film of the present embodiment, it is possible to fully suppress transferred marks from being left in the adhesive layer in winding up The wafer processing film in a roll, to prevent the adhesion between the adhesive layer and the semiconductor wafer from dropping due to air otherwise entrapped between the adhesive layer and the semiconductor wafer and to prevent adhesion failure in

bonding the semiconductor chips to the lead frames, package substrates or to other semiconductor chips and troubles in processing the wafer. Still more, according to the method for manufacturing the semiconductor devices by using the wafer processing film of the invention, desirable design changes of the semiconductor devices can be made without involving large-scale changes of existing facilities.

Description of Reference Numerals

[0075]

10, 30, 50:	wafer processing film
11:	base film
12:	removable adhesive layer
13, 13':	adhesive layer
13a, 13b:	cut of adhesive layer
14:	removable adhesive film
15, 15':	dicing and die bonding film
16:	releasing film
17:	protection film
17a:	cut of protection film
20:	ring frame

CLAIMS

1. A wafer processing film, comprising:

a removable adhesive film composed of a long base film and a long film-like removable adhesive layer provided on said base film; and

a long film-like adhesive layer provided on said removable adhesive layer; characterized in that

said removable adhesive layer contains a radiation polymerizing compound and a photoinitiator.

2. A wafer processing film, comprising:

a removable adhesive film composed of a long base film and a long film-like removable adhesive layer provided on said base film; and

a long film-like adhesive layer provided on said removable adhesive layer; characterized in that

said removable adhesive layer contains a thermal polymerizing compound.

3. The wafer processing film according to Claim 1 or 2, wherein said removable adhesive film is not pre-cut into a shape corresponding to a ring frame; and

said adhesive layer is not pre-cut into a shape corresponding to a semiconductor wafer.

4. The wafer processing film according to any one

of Claims 1 through 3, wherein said adhesive layer is provided with a cut at position located outside of an outer circumference of the semiconductor wafer and inside of an outer circumference of said ring frame.

5. The wafer processing film according to any one of Claims 1, 3 and 4, wherein a protection film is pasted releasably on the surface of said adhesive layer; and

said protection film has a radiation polymerizing compound and is provided with a cut at position located outside of the outer circumference of the semiconductor wafer and inside of the outer circumference of said ring frame.

6. A method for manufacturing semiconductor devices by using the wafer processing film according to any one of Claims 1 through 5, comprising steps of:

hardening a part other than a part corresponding to a wafer of said removable adhesive layer and corresponding at least to the ring frame and releasing said adhesive layer from the hardened removable adhesive layer part;

pasting said wafer to said adhesive layer;

fixing said ring frame to said removable adhesive layer;

dicing said wafer to form individualized chips and the adhesive layer; and

hardening the part of said removable adhesive layer corresponding to the wafer to pick up said individualized chips and the adhesive layer.