MULTI-FUNCTIONAL TAPE FOR SEMICONDUCTOR PACKAGE AND A METHOD FOR MANUFACTURING SEMICONDUCTOR DEVICE USING THE SAME

Technical Field

The present invention relates to a multifunction tape for a semiconductor package and a method of fabricating semiconductor devices using the same.

Background Art

High capacity of semiconductor devices is generally accomplished by a high integration technique for increasing the number of cells per unit area in view of quality and by a packaging technique through lamination of plural chips in view of quantity.

As a conventional packaging technique, a multi-chip packaging (MCP) method has generally been used. In the MCP method, plural chips are laminated on top of each other by applying a bonding agent and are electrically connected to each other via wire bonding. As a result, the overall package size becomes greater than a space of the laminated chips by a space for wire bonding, thereby providing an unnecessary space.

To solve such a problem of the MCP method, a wafer level stack packaging (WSP) method is developed. In the WSP method, silicon through-electrodes are formed in a wafer having a circuit formed thereon and are filled with a conductive material to provide direct electrical connection between layers.

Both the MCP method and the WSP method increase the capacity of the semiconductor device in view of quantity by bonding plural chips with a bonding agent and laminating the chips on top of each other. In the MCP method, since the chips are electrically connected to each other by wire bonding, each of the chips has an open circuit-formed side and has the bonding agent applied to the opposite side (that is, ground side) thereof to connect the chips to each other.

Therefore, the MCP method requires a separate adhesive tape, which is provided to the circuit-formed side only during a back grinding process. Then, a dicing process and a pick-up/die-attachment process are performed after attaching a tape, which has an adhesive layer and a bonding layer, to the opposite side (ground side) of the chip to the

circuit-formed side.

In other words, the adhesive tape for use in the back grinding process does not provide other functions except that it can be used for the back grinding process.

On the other hand, in the WSP method, since the chips are connected to each other via the through-electrodes instead of wire bonding, it is necessary to apply the bonding agent to the circuit-formed side of the chip to connect the chips with each other.

Accordingly, the WSP method requires a tape that can be applied not only to the back grinding process but also to both the dicing process and the pick-up/die-attachment process, instead of the tape that can been used only for the back grinding process.

Disclosure

Technical Problem

An embodiment of the present disclosure seeks to provide a multifunction tape for semiconductor packaging, which allows a back-grinding process, a dicing process and/or a pickup-die attaching process to be consistently performed using a single multifunction tape in a WSP process.

Another embodiment of the present disclosure seeks to provide a method of manufacturing a semiconductor device using the multifunction tape.

Technical Solution

An embodiment of the present invention is conceived to solve the problems as described above, and an embodiment of the present invention seeks to provide a multifunction tape for a semiconductor package, which can be commonly applied to a rear-side grinding process, a dicing process and/or a pick-up/die-attachment process in a WSP method.

Another embodiment of the present invention seeks to provide a method of fabricating semiconductor devices using the multifunction tape.

According to an aspect of the present invention, a multifunction tape for a semiconductor package includes a UV-curable adhesive layer on one side of a base film; and first and second bonding layers on the adhesive layer, wherein the multifunction tape is bonded to a device-formed side of a semiconductor substrate having a plurality of devices thereon while performing a process of grinding a side of the semiconductor substrate opposite to the device-formed side and a process of dicing the semiconductor substrate into individual chips with a dicing tape having a UV-curable adhesive layer

bonded to the ground side of the semiconductor substrate, and the first and second bonding layers of the multifunction tape are bonded to the individual chips while the chips separated from each other by the dicing process are picked up and die-attached.

According to another aspect of the present invention, a multifunction tape for a semiconductor package includes a UV-curable adhesive layer on one side of a base film; and first and second bonding layers on the adhesive layer, wherein the multifunction tape is bonded to a device-formed side of a semiconductor substrate having a plurality of devices thereon while performing a process of grinding a side of the semiconductor substrate opposite to the device-formed side and a process of dicing the semiconductor substrate into individual chips with a dicing tape having a UV-curable adhesive layer bonded to the ground side of the semiconductor substrate, and the first and second bonding layers of the multifunction tape are bonded to the individual chips while the chips separated from each other by the dicing process are picked up and die-attached.

According to a further aspect of the present invention, a method of fabricating a semiconductor device include bonding a multifunction tape to one side of a semiconductor substrate having bumps (circuit pattern) formed thereon, the multifunction tape comprising a UV-curable adhesive layer on one side of a base film, and first and second bonding layers on the adhesive layer; grinding a back side of the semiconductor substrate; bonding a dicing tape to the ground side of the semiconductor substrate; dicing the semiconductor substrate into individual chips; picking up the chips with the first and second bonding layers bonded thereto after removing the dicing tape; and die-attaching the chips using the first and second bonding layers.

According to yet another aspect of the present invention, a method of fabricating a semiconductor device include bonding a multifunction tape to one side of a semiconductor substrate having bumpers (circuit pattern) formed thereon, the multifunction tape comprising a UV-curable adhesive layer on one side of a base film, and first and second bonding layers on the adhesive layer; grinding a back side of the semiconductor substrate; dicing the semiconductor substrate into individual chips; picking up the chips with the first and second bonding layers bonded thereto; and die-attaching the chips using the first and second bonding layers.

Advantageous Effects

According to one embodiment, the multifunction tape for semiconductor packaging enables a back-grinding process, a dicing process and a pickup-die attaching process to be consistently performed using a single tape. In particular, the multifunction tape includes a first bonding layer containing a UV curing agent in an interface between the adhesive layer and the second bonding layer so that the first bonding layer may be hardened along with the adhesive layer during UV curing, thereby significantly improving peeling characteristics of the adhesive layer.

This multifunction tape allows the back-grinding process and the pickup-die attaching process to be consistently performed using a single tape. Moreover, the multifunction tape allows the back-grinding process, dicing process and pickup-die attaching process to be consistently performed using a single tape.

Brief Description of The Drawings

The above and other aspects, features and advantages of the present invention will become apparent from the following description of exemplary embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a sectional view of a multifunction tape for semiconductor package according to an embodiment of the present invention;

Figs. 2 to 9 are sectional views of a method of fabricating a semiconductor device according to a first embodiment of the present invention; and

Figs. 10 to 15 are sectional views of a method of fabricating a semiconductor device according to a second embodiment of the present invention.

Detailed Description of The Embodiment

Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings.+

Referring to Fig. 1, which is a sectional view of a multifunction tape for a semiconductor package according to an embodiment of the present invention, the multifunction tape includes a base film 100, an adhesive layer 110, a first bonding layer 105, a second bonding layer 120, and a protective film 130.

Herein, the term "bonding layer" means a layer that enables only bonding to an object, and the term "adhesive layer" means a layer that can be adhered to an object and

can be removed therefrom after curing or the like. For example, a UV-curable adhesive refers to an adhesive that will be applied to a semiconductor wafer or the like and can be cured and peeled therefrom by UV irradiation.

Further, the bonding layer refers to a layer to which a semiconductor wafer will be bonded, and which will be separated from the adhesive layer but bonded to individual chips, when dicing the semiconductor wafer into the chips and picking up the chips, so as to be used as a bonding agent when the chips are secured to a board or lead frame.

Further, the adhesive layer means a layer that has a lower peeling force than the bonding layer with respect to an object and can be used for temporary joining.

Since the multifunction tape of the present invention may be consistently used through the back grinding process, dicing process and die-bonding process, it is very advantageous when the multifunction tape is applied to the WSP method in which die-attachment is performed with the bonding agent applied to a circuit-formed side of a semiconductor wafer.

<Base film>

First, the base film 100 of the multifunction tape 10 according to this embodiment will be described.

The base film 100 is substantially the same as that of a conventional tape that is generally used for the back grinding process.

Various plastic films may be used as the base film of the tape for the back grinding process. For example, a thermoplastic expandable plastic film may be used as the base film.

When a wafer having a circuit design is exposed to physical impact during the back grinding process, cracks may be formed in the wafer or the wafer can be broken.

Thus, the base film has thermoplastic and expandable properties to protect the wafer by absorbing and relieving the impact during the back grinding process.

Further, the base film may allow ultraviolet transmission. In particular, since the adhesive layer 110 is a UV-curable adhesive composition, the base film may exhibit good transmission of ultraviolet rays in the wavelength at which the adhesive composite can be cured.

Therefore, the base film 100 does not contain a UV absorbent or the like.

The base film 100 has chemical stability. That is, since the base film contacts CMP slurries during polishing and is exposed to physical impact during back grinding, the base film is formed to have chemical stability.

Since polymers such as polyolefin polymer generally have chemical stability, the polymers may be suitably used for the base film 100.

Examples of polymer films for use in the base film include polyolefin-based films such as polyethylene, polypropylene, ethylene/propylene copolymers, polybutene-1, ethylene/vinyl acetate copolymers, mixtures of polyethylene/styrene butadiene rubber, polyvinyl chloride films, and the like.

The base film may comprise plastics such as polyethylene terephthalate, polycarbonate, poly(methyl methacrylate) and the like; thermoplastic elastomers such as polyurethane, polyamide-polyol copolymers, and the like; or mixtures thereof.

The base film 100 may have a multilayer structure to improve a bonding force with respect to the adhesive layer or to improve impact absorption during the back grinding process.

The base film may be prepared by blending and melting polyolefin chips to produce a polyolefin melt, followed by extruding or blowing the polyolefin melt.

Thermal resistance and mechanical properties of the base film will be determined according to the kind of blended chips. The base film may be subjected to surface modification to improve the bonding force with respect to the adhesive layer 110.

The surface modification may be a physical or chemical process. An example of the physical process includes a plasma process, and an example of the chemical process includes an in-line coating process, a primer process, and the like. In this embodiment, the surface modification of the base film is performed by a corona-discharge process so as to allow the adhesive layer 110 to be coated thereon.

The base film 100 may have a thickness of 30~300㎛ in terms of workability and UV transmission.

A thickness of the base film 100 less than causes easy deformation of the base film by heat during UV irradiation and cannot sufficiently relieve impact by the back grinding process. If the thickness of the base film 100 is greater than 300㎛, a single roll of a finished product has a smaller length than the thickness thereof in practice, thereby disadvantageously increasing time for roll replacement.

The base film 100 may have a thickness of 50~200㎛ to fill up the wafer surface on which bumps are formed to provide severe roughness.

<Adhesive layer>

Next, the UV-curable adhesive layer 100 of the multifunction tape 10 according to the embodiment will be described.

Although the adhesive layer 100 is not limited to a particular material, properties before and after UV irradiation are important in selection of the material for the adhesive layer 100. Before UV irradiation, the adhesive layer 100 exhibits strong tack to prevent the wafer from being damaged due to vibration or movement and to prevent chemical materials such as CMPs from invading interfaces between the respective layers during the back grinding process by strongly holding the first and second insulation bonding layers 105, 120 and the wafer on the adhesive layer 100. Further, after UV irradiation, the adhesive layer exhibits an increased cohesive force and contracts by a crosslinking reaction to allow the adhesive layer 110 and the base film 100 to be easily peeled from the wafer, to which the first and second insulation bonding layers 105, 120 are bonded, by a reel-shaped bonding tape through a significant reduction in bonding force of the adhesive layer 110 to the first insulation bonding layer 105. In other words, any material may be used for the adhesive layer 100 so long as it fulfills the aforementioned properties before and after the UV irradiation.

Generally, the adhesive layer 110 in a tape for use in the back grinding process may comprise a UV-curable composition or a non-UV curable composition.

In a general tape for the back grinding process, the non-UV curable composition provides a comparatively low bonding force before UV irradiation, so that the adhesive layer can be easily peeled from the wafer by a reel-shaped bonding tape without UV irradiation.

In the WSP method, however, the adhesive layer 110 must be peeled from the first insulation bonding layer 105 which is an organic interface. In this case, since the adhesive layer comprising the non-UV curable composition is not substantially peeled off by the reel-shaped bonding tape, the UV-curable composition is used for an adhesive layer of a tape for use in the WSP method.

There are two types of UV-curable composition. One is a mixture composition of

UV-curable acrylate and an acrylic adhesive binder acting to form and support a coating layer. The other composition has a structure wherein UV-curable acrylate is provided to a side chain of an acrylic adhesive binder.

When the mixture composition is applied to a general tape for use in the back grinding process, there is no transition of the UV-curable acrylate, which is mainly composed of low molecular weight materials, since a target member of the tape is an inorganic material such as wafers. As a result, the bonding force between the adhesive layer and the wafer is significantly reduced after UV irradiation to allow the adhesive layer to be peeled off by the reel-shaped bonding tape.

In a tape for use in the WSP method, however, since the adhesive layer 110 contacts an organic interface such as the first insulation bonding layer 105, the mixture composition of the adhesive layer allows partial transition of low molecular weight acrylate into the first insulation bonding layer 105 and the acrylate is cured by UV rays during the transition, thereby causing an increase in bonding force between the layers after UV irradiation.

Thus, according to this invention, the adhesive layer 110 may have the structure wherein the UV-curable carbon-to-carbon double bond is provided to the side chain of the acrylic adhesive binder, rather than the mixture composition.

The structure wherein a low molecular weight material having a carbon-to-carbon double bond is provided to a side chain of an adhesive resin exhibiting adhesive properties through a chemical reaction so as to behave like a single molecule is referred to as an intrinsic adhesion composition.

The intrinsic adhesion composition is prepared by polymerizing an adhesive resin and providing a carbon-to-carbon double bond to the polymerized adhesive resin.

Reaction mechanism for providing a low molecular weight acrylate having a carbon-to-carbon double bond in the inherent adhesion binder is as follows.

The reaction mechanism may be obtained by combinations of functional groups, such as a combination of a carboxyl group and an epoxy group, a combination of a hydroxyl group and an isocyanate group, a combination of a carboxyl group and an amine group, and the like, which permit easy polymerization to an acrylic side chain.

Additionally, any combination of functional groups can be used so long as the combination enables the reaction mechanism to provide a low molecular weight acrylate

having the carbon-to-carbon double bond to a side chain of an adhesive polymer. Each of the functional groups may be selectively applied to the adhesive polymer binder or low molecular weight acrylate.

According to an embodiment of the invention, the intrinsic adhesive binder has a molecular weight of 100,000~1,000,000 and is prepared by providing a low molecular weight material having the carbon-to-carbon double bond and containing a terminal isocyanate group to a side chain of a binder copolymer through a urethane reaction.

The UV-curable adhesive composition may be prepared by mixing a thermosetting agent, a photo initiator, and the like in addition to the prepared adhesive binder.

Any kind of thermosetting agent may be used so long as it can be cured through reaction with a functional group provided to the side chain of the adhesive binder.

If the functional group provided to the side chain is a carboxyl group, an epoxy curing agent may be used as the thermosetting agent, and if the functional group provided to the side chain is a hydroxyl group, an isocyanate curing agent may be used.

Additionally, a melamine curing agent may be used as the thermosetting agent. Further, a mixture of at least two selected from the epoxy curing agent, the isocyanate curing agent, and the melamine curing agent may be used.

The thermosetting agent must be added to the adhesive layer to provide a bonding force with respect to the polyolefin base film.

Any kind of photo initiator including ketone and acetonephenone-based photo initiators may be used so long as it allows molecular chains to be broken by UV rays to produce radicals.

When the photo initiator is contained in the adhesive layer, the carbon-to-carbon double bond of the side chain in the adhesive binder is subjected to a crosslinking reaction by the radicals to raise the glass transition temperature of the adhesive layer, so that the adhesive layer loses tack properties.

As a result, the adhesive layer can be peeled from the first insulation-bonding layer 105 with minimal force.

The adhesive layer 110 may be formed on the base film 110 by direct coating or may be transferred to the base film 110 after coating the adhesive layer to a release film and drying the adhesive layer.

When the adhesive layer is directly coated on the polyolefin base film, the adhesive layer is generally dried at 60℃ or more, which causes the polyolefin base film to significantly contract while passing through a drier, thereby providing dimensional instability. Therefore, the adhesive layer is generally formed on the base film by transfer coating.

Irrespective of the former or the latter, any coating process including bar coating, gravure coating, comma coating, reverse-roll coating, applicator coating, spray coating, and the like can be used to form the adhesive layer 100 so long as it can form the adhesive coat on the base film.

<First bonding layer>

In the multifunction tape according to this embodiment, the adhesive layer 110 is coated on the base film 100, and the first (insulation) bonding layer 105 is laminated on the adhesive layer 110.

The first insulation bonding layer 105 is designed to allow part thereof to be cured by ultraviolet rays so as to allow not only the adhesive layer 110 but also the first insulation bonding layer 105 contacting the adhesive layer 110 to be cured by UV irradiation, thereby significantly enhancing peeling characteristics of the multifunction tape.

Since the first insulation bonding layer 105 acts as a bonding agent for finally bonding upper and lower chips, it has properties capable of satisfying reliability of a semiconductor packaging level. Further, the first insulation bonding layer 105 has enhanced workability for packaging, that is, enhanced peeling characteristics for removing the base film 100 and the adhesive layer 110 from the first and second insulation bonding layers 105, 120 without damage to the bonding layers after back grinding.

Like the second insulation bonding layer 120, the first insulation bonding layer 105 is also bonded at about 60℃ to the wafer surface, which has a circuit design and severe roughness thereon and is die-attached at about 200℃ to a support substrate such as a lead frame or PCB after dicing.

Any composition can be used for the first insulation bonding layer 105 so long as it can maintain the bonding force between the upper and lower chips while satisfying reliability of a semiconductor packaging level.

This is because the first insulation bonding layer 105 is also bonded at one side to

the wafer or the like with the other side thereof contacting the second insulation bonding layer 120 when the chips are stacked in multiple layers in the WSP method, irrespective of a need for improvement in peeling characteristics in terms of process.

According to an embodiment of the invention, the first insulation bonding layer 105 is composed of a mixture of an acrylic resin having film formability and a high molecular weight and an epoxy resin acting as a curing part.

Since both the first insulation bonding layer 105 and the second insulation bonding layer 120 are provided as film-type bonding agents, a thermoplastic resin having good film formability and a curing part providing a bonding force are used in the first and second insulation bonding layers 105 and 120.

According to an embodiment of this invention, the acrylic resin is used as the thermoplastic resin. An example of the acrylic resin includes an acrylic rubber that is a copolymer of acrylic ester or methacrylic ester and acrylonitrile.

Any epoxy resin may be used for the first insulation bonding layer so long as it can provide the bonding force in a cured state. Here, since it is necessary to have two or more functional groups to perform a curing reaction, the epoxy resin may be selected from the group consisting of a bisphenol A-type epoxy resin, a phenol novolac epoxy resin, and a cresol novolac epoxy resin.

Further, the first insulation bonding layer 105 may contain a curing accelerator for curing the epoxy resin. The curing accelerator may be selected from the group consisting of imidazole curing accelerators, amine curing accelerators, phenol curing accelerators, and the like.

It is necessary for the acrylic resin, the epoxy resin, and the curing accelerator to exhibit low moisture absorption during curing. The first insulation bonding layer 105 may further contain inorganic particles such as silica to improve dimensional stability and thermal resistance.

The first insulation bonding layer 105 may further contain a silane coupling agent, if necessary.

In addition to the compositions providing the reliability of the semiconductor packaging level and bonding capability, the first insulation bonding layer 105 also contains a UV-curable polymer that has the carbon-to-carbon double bond.

Even when the adhesive layer 105 on the first insulation bonding layer 105 has

reduced tack by UV curing, it is not easily peeled from the wafer or the like by the reel-shaped bonding film. Thus, the first insulation bonding layer 105 is cured by UV irradiation to improve peeling characteristics.

According to an embodiment of this invention, a compound added to the first insulation bonding layer 105 and having the carbon-to-carbon double bond may be a polymeric material.

Even in the case of UV curing, low molecular weight compounds such as oligomers or monomers are likely to undergo partial transition into the adhesive layer 110, which contacts the low molecular weight compounds, and are cured at an interface between the adhesive layer and the low molecular weight compounds by UV irradiation during transition, thereby significantly deteriorating peeling characteristics after UV irradiation.

According to an embodiment of the invention, a polymeric compound with the carbon-to-carbon double bond provided to a polymer chain is used as the UV-curable compound which is added to the first insulation bonding layer 105.

According to an embodiment of the invention, the UV-curable polymer compound is an adhesive binder that has a molecular weight of 100,000~1,000,000 and is prepared by providing a low molecular weight material having a carbon-to-carbon double bond and containing a terminal isocyanate group to a side chain of a binder copolymer through a urethane reaction.

The first insulation bonding layer 105 comprises 0.1~10 parts by weight of the UV-curable polymer compound with respect to 100 parts by weight of the main components of the bonding layer, that is, the acrylic resin, the epoxy resin, and the curing accelerator.

Given an amount of the UV-curable polymer compound less than 0.1 parts by weight, the first insulation bonding layer 105 does not perform the UV curing reaction. As a result, the tack is not significantly reduced and the peeling characteristics between the adhesive layer 11 and the first insulation bonding layer 105 are not improved. Given an amount of the UV-curable polymer compound exceeding 10 parts by weight, the bonding force of the first insulation bonding layer 105 to the chips is lowered.

Since the UV-curable compound is added to the first insulation bonding layer 105, it is necessary to add the photo initiator for accomplishing a radical curing reaction upon

UV irradiation.

The photo initiator may be added in an amount of 0.1~5 parts by weight with respect to 100 parts by weight of the UV-curable compound.

After UV irradiation, a 180 degree average peeling force between the first insulation bonding layer 105 and the adhesive layer 110 is 0.01N/25mm or less.

As in the adhesive layer 110, the first insulation bonding layer 105 may be formed by any coating process that can form a uniform coating layer.

The first insulation bonding layer 105 may have a thickness of 1~100㎛, and may have a thickness of 2~30㎛. If the first insulation bonding layer 105 has a thickness of 2㎛ or less, it does not exhibit a suitable bonding force between the upper and lower chips. On the other hand, a thickness of the first insulation bonding layer 105 greater than 30㎛ will increase the size of the semiconductor package. Here, an increase in thickness of the first insulation bonding layer 105 exceeding 30㎛ will make it difficult to accomplish thickness uniformity when bonding chips to each other or a chip to a substrate, and will cause a fillet phenomenon as in the case of using a liquid bonding agent, thereby deteriorating reliability in semiconductor packaging.

<Second Bonding Layer>

Next, the second (insulation) bonding layer 120 of the multifunction tape 10 will be described.

The second insulation bonding layer 120 is a bonding layer that directly contacts the wafer surface. In the WSP, the second insulation bonding layer 120 does not create a void on the wafer surface having bumps and severe roughness thereon during lamination, and allows the upper and lower chips to be strongly bonded to each other through die attachment.

In other words, since the second insulation bonding layer 120 finally bonds the upper and lower chips to each other, it has properties capable of satisfying reliability of a semiconductor packaging level. Further, the second insulation bonding layer 120 has enhanced workability for packaging. That is, it fills up the wafer surface having the roughness so as not to create a void on the wafer surface during a mounting process, thereby preventing chipping or cracking during a dicing process and reliability deterioration by swelling even after die attachment.

The second insulation bonding layer 120 is bonded at about 60℃ to the wafer surface on which circuit bumps are formed.

The second insulation bonding layer 120 may have a storage modulus of 0.1~10 MPa at 60℃.

If the second insulation bonding layer 120 has a storage modulus less than 0.1 MPa at 60℃, it is likely to undergo the fillet phenomenon due to excessively high fluidity. If the second insulation bonding layer 120 has a storage modulus more than 10 MPa at 60℃, it does not have suitable fluidity and viscosity to sufficiently fill up the wafer surface having the bumps at a mounting temperature of 60℃.

In this embodiment, components of the second insulation bonding layer 120 are similar to those of the first insulation bonding layer 105.

Like the first insulation bonding layer 105, the second insulation bonding layer 120 is composed of a mixture of an acrylic resin having film formability and a high molecular weight and an epoxy resin acting as a curing agent.

Here, the second insulation bonding layer 120 does not contain the UV-curable polymer compound and the photo initiator, which are added to the first insulation bonding layer 105.

Since the second insulation bonding layer 120 is also provided as a film-type bonding agent, a thermoplastic resin having good film formability and a curing part providing a bonding force are used in the second insulation bonding layer 120.

As in the first insulation bonding layer 105, the second insulation layer 120 contains the acrylic resin as the thermoplastic resin.

An example of the acrylic resin includes an acrylic rubber that is a copolymer of acrylic ester or methacrylic ester and acrylonitrile.

Any epoxy resin may be used for the second insulation bonding layer so long as it can provide the bonding force in a cured state. Here, since it is necessary to have two or more functional groups to perform a curing reaction, the epoxy resin may be selected from the group consisting of a bisphenol A-type epoxy resin, a phenol novolac epoxy resin, and a cresol novolac epoxy resin.

Further, the second insulation bonding layer 120 may contain a curing accelerator for curing the epoxy resin. The curing accelerator may be selected from the group consisting of imidazole accelerators, amine accelerators, phenol accelerators, and the like.

As such, the second insulation bonding layer 120 essentially consists of the acrylic resin acting as the binder, the epoxy resin acting as the curing part, and the curing accelerator for curing the epoxy resin. In order to allow the second insulation bonding layer 120 to have a storage modulus of 0.1~10 MPa at 60℃ as described above, the acrylic resin used as the binder in the second insulation bonding layer may be added in an amount of 30~70 parts by weight with respect to 100 parts by weight of the other components of the second insulation bonding layer 120, and have a glass transition temperature of -20~20℃.

When the acrylic resin has a glass transition temperature of -20~20℃, the second insulation bonding layer 120 can provide sufficient fluidity to fill up the rough wafer surface having the bump thereon at a mounting temperature of 60℃. Even when the acrylic resin has a glass transition temperature of -20~20℃, however, an added amount less than 30 parts by weight of the acrylic resin with respect to 100 parts by weight of the other components of the second insulation bonding layer makes it difficult to roll the multifunction tape since the film-shaped bonding agent is likely to be broken due to lack of an absolute amount and film formation capability of the acrylic binder. An added amount exceeding 70 parts by weight of the acrylic resin causes excessively high fluidity of the bonding layer, thereby deteriorating dimensional stability and causing the fillet phenomenon when the chips are bonded to the bonding layer.

The second insulation bonding layer 120 may further contain inorganic particles such as silica in order to improve dimensional stability and thermal resistance.

Particularly, the second insulation bonding layer 120 contacting the wafer surface may contain at least one silane coupling agent or a mixture of silane coupling agents to increase a bonding force with respect to the wafer. As in the adhesive layer 110 and the first insulation bonding layer 105, the second insulation bonding layer 120 may be formed by any coating process if it can form a uniform coating layer.

The second insulation bonding layer 120 may have a thickness of 1~100㎛, preferably, 2~30㎛. A thickness of the second insulation bonding layer 120 less than 2㎛ does not provide a suitable bonding force to the bonding layer between the chips, and a thickness of the second insulation bonding layer 120 greater than 30㎛ increases the size of a semiconductor package, which is incompatible with a trend for compactness and light weight of the semiconductor package.

<Protective film>

Next, the protective film 130 of the multifunction tape according to the embodiment of the invention will be described.

According to the embodiment, any protective film can be used as the protective film 130 so long as it can protect the second insulation bonding layer 120 formed as the outermost part of the film from foreign matter or impact.

Generally, a running film for coating the second insulation bonding layer is used as the protective film 130.

Since the protective film is removed from the multifunction tape during the semiconductor packaging process, a polyethylene terephthalate film is generally used for ensuring easy separation of the protective film therefrom.

The protective film 130 may be subjected to surface modification with polydimethylsiloxane or fluoride releasing agents to have release properties.

Next, a method of fabricating a semiconductor device using the multifunction tape as described above according to embodiments of the present invention will be described with reference to the accompanying drawings.

Figs. 2 to 9 are sectional views of a method of fabricating a semiconductor device according to a first embodiment of the present invention.

In the following description, like elements will be denoted by like reference numerals throughout the drawings and a repetitious description will be omitted.

A multifunction tape according to an embodiment of the invention as shown in Fig. 2 includes a base film 100, an adhesive layer 110, a first bonding layer 105, a second bonding layer 120, and a protective film 130 (see Fig. 1), which will be removed during the packaging process.

A semiconductor wafer 200 includes a plurality of semiconductor devices on which bumps (metal protrusions) 210 are formed.

The multifunction tape is attached to a circuit-formed side of the wafer 200. Specifically, the multifunction tape is attached to the circuit-formed side such that the bumps 210 are buried in the first and second bonding layers 105 and 120 (see Fig. 3).

Here, in order to increase the bonding force and prevent generation of voids, the

multifunction tape is heated to a predetermined temperature.

Then, the back side of the wafer 200 is ground to a depth indicated by a dotted line (see Fig. 4).

Then, an adhesive tape 203 for dicing is bonded to the ground side of the wafer 200 (see Fig. 5). Next, the plural semiconductor devices on the wafer are divided into individual chips by dicing (see Fig. 6). Here, the adhesive tape 203 for dicing is formed with a UV-curable adhesive layer 204.

Dicing may be performed by blade dicing or laser dicing. Since heat is generated during the blade dicing or the laser dicing, a large amount of water is jetted to remove the heat. Therefore, the first and second bonding layers 105, 120 are not stuck to the wafer even when heat is generated during the dicing. Further, since the first and second bonding layers 105, 120 have a low moisture absorption rate, they are not substantially influenced by the water.

Next, ultraviolet rays are irradiated to cure the adhesive layers 110, 204 and an expanding process is then performed to expand a separation distance between the diced chips such that the chips can be easily picked up (see Fig. 7).

Finally, the dicing tape 203, the base film 100 and the adhesive layer 110 are sequentially removed from the multifunction tape, and the chips having the first and second bonding layers 105 and 120 are picked up (see Fig. 8).

Here, the first and second bonding layers 105 and 120 are used as bonding agents during a die-bonding or attachment process in a semiconductor package to fabricate semiconductor devices.

Figs. 10 to 15 are sectional views of a method of fabricating a semiconductor device according to a second embodiment of the present invention.

Referring to Fig. 10, first, a multifunction tape having the same configuration as that of the above embodiment, and a semiconductor wafer 200 having bumps 210 are prepared.

Then, the multifunction tape is attached to a circuit-formed side of the wafer 200 (see Fig. 11), and the back side of the wafer 200 is ground to a depth indicated by a dotted line (see Fig. 12).

Next, dicing is performed using the multifunction tape without a separate dicing tape to divide a plurality of semiconductor devices on the wafer 200 into individual chips

(see Fig. 13).

Then, ultraviolet rays are irradiated to cure the adhesive layers 110, 204 and an expanding process is performed to expand a separation distance between the diced chips such that the chips can be easily picked up (see Fig. 14).

Finally, the chips with the first and second bonding layers 105 and 120 attached thereto are picked up from the multifunction tape (see Fig. 15).

Here, the first and second bonding layers 105 and 120 are used as bonding agents during the die-bonding or attachment process in the semiconductor packaging process to fabricate semiconductor devices.

In the embodiment shown in Figs. 10 to 15, the back grinding process, the dicing process and the die-attachment process are consistently performed using a single multifunction tape.

Next, the present invention will be described in detail with reference to examples, which are given not for restriction of the present invention but by way of illustration only.

<Example 1>

1. Preparation of an adhesive layer A-1

A reflux condenser, a thermometer, and a dropping panel were equipped to a 2L 4-neck flask in which 220g of ethyl acetate and 150g of toluene were charged.

After raising the temperature of the solution in the flask to 60℃, a mixture of methylmethacrylate 118g, butylacrylate monomer 75g, 2-ethylhexyl acetate 187g, 2-hydroxyethylmethacrylate 120g, acrylic acid 30g, and benzoil peroxide 2.0g was added to the flask dropwise through the dropping panel at 90℃ for 3 hours.

While adding the mixture, the solution was stirred at 250 rpm, and the reactant was then reacted for 3 hours at the same temperature. Then, 1.0g of diazoisobutyronitrile was further added to the reactant in the flask, which in turn was maintained for 5 hours, thereby finishing polymerization.

Next, 15g of isocyanoethylmethacrylate was added to the prepared polymer binder resin, and reacted therewith at room temperature for 24 hours, thereby preparing an inherent adhesive binder CA-100.

The inherent adhesive binder CA-100 had a viscosity of 8000 cps and contained 40% solid particles.

Next, a UV-curable adhesive composition was prepared by adding 8g of poly-isocyanate curing agent AK-75 (Aekyung Chemical Co., Ltd.) and 1g of IC-184 (Ciba-Geigy Ltd.) to 100g of the inherent adhesive binder CA-100 which contained 40% of solid particles and had a weight average molecular weight of 400,000.

The UV-curable adhesive composition was coated to 10 microns on one side of a 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) using an applicator, and dried at 80℃ for 2 minutes. Then, after lamination on a 100-micron PO film (OD-100, Riken Technos, Co., Ltd.) at 60℃, the UV-curable adhesive composition was subjected to aging at 40℃ for three days in an oven, thereby preparing an adhesive layer A-1.

2. Preparation of a first insulation bonding layer B-1

After preparing a mixture using 260g of acrylic resin WS-023 (hydroxyl value or acid value of 20 mgKOH/g, Tg of -5℃, average molecular weight of 500,000, OH or COOH content of 20, Nagasechemtech Co., Ltd.), 120g of cresol novolac epoxy resin YDCN-500-4P (molecular weight of 10,000 or less, Kukdo Chemical Co., Ltd.), 40g of cresol novolac curing agent MEH-7800SS (Maywa Plastic Industries Co., Ltd.), 0.1g of imidazole curing accelerator 2P4MZ (Shikoku Chemical Industries Co., Ltd.), 0.5g of mercapto-silane coupling agent KBM-803 (Shinetsu Chemical Co., Ltd.), 0.5g of epoxy silane coupling agent KBM-303 (Shinetsu Chemical Co., Ltd.), 20g of amorphous silica fillers OX-50 (Degussa), 8g of inherent adhesive binder CA-100, and 0.1g of IC-184 (Ciba-Geigy), the mixture was primarily dispersed at 500 rpm for about 2 hours, followed by milling the mixture.

After milling, the obtained reactant was coated to 10 microns on one side of a 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) using an applicator, and dried at 80℃ for 2 minutes. After lamination on the 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) at 80℃, the resultant was subjected to aging at room temperature for three days, thereby preparing a first insulation bonding layer B-1.

3. Preparation of a second insulation bonding layer C-1

After preparing a mixture using 150g of acrylic resin SG-80H (weight average molecular weight of 350,000, Tg of 7.5℃, Nagasechemtech Co., Ltd.), 150g of cresol

novolac epoxy resin YDCN-500-90P (molecular weight of 10,000 or less, Kukdo Chemical Co., Ltd.), 20g of cresol novolac curing agent MEH-7800SS (Maywa Plastic Industries Co., Ltd.), 0.8g of imidazole curing accelerator 2P4MZ (Shikoku Chemical Industries Co., Ltd.), 0.4g of epoxy silane coupling agent KBM-303 (Shinetsu Chemical Co., Ltd.), and 40g of amorphous silica fillers OX-50 (Degussa), the mixture was primarily dispersed at 500 rpm for about 2 hours, followed by milling the mixture.

After milling, the obtained reactant was coated to 10 microns on one side of a 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) using an applicator, and dried at 80℃ for 2 minutes. After lamination on the 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) at 80℃, the resultant was subjected to aging at room temperature for three days, thereby preparing a second insulation bonding layer C-1.

4. Preparation of a bonding film D-1

The prepared adhesive layer A-1, the first insulation bonding layer B-1, and the second insulation bonding layer C-1 were sequentially laminated using a laminator, thereby fabricating a bonding film D-1.

<Comparative Example 1>

1. Preparation of an adhesive layer a-1

After preparing a mixture with 100g of acrylic adhesive binder AT-2842 (weight average molecular weight of 600,000, Tg of -50℃, Samwon Chemicals Co., Ltd.) and 80g of 6 functional urethane acrylate U-324A (Shinnakamura Co., Ltd.), 1g of polyisocyanate curing agent L-45 (Nippon Polyurethane Co., Ltd.) and 1.8g of IC-184 (available from Ciba-Geigy Ltd.) were added to the mixture, thereby preparing a UV-curable adhesive composition. Then, the UV-curable adhesive composition was coated to 10 microns on one side of a 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) using an applicator, and dried at 80℃ for 2 minutes. Then, after lamination on a 100-micron PO film OD-100 (Riken Technos, Ltd.) at 60℃, the UV-curable adhesive composition was subjected to aging at 40℃ for three days in an oven, thereby preparing an adhesive layer a-1.

Except for the adhesive layer a-1, a first bonding film B-1 and a second bonding film C-1 were prepared by the same method as that of Example 1. Then, the prepared

adhesive layer a-1, the first insulation bonding layer B-1, and the second insulation bonding layer C-1 were sequentially laminated using a laminator, thereby fabricating a bonding film d-1.

<Comparative Example 2>

Comparative Example 2 was prepared by the same method as that of Example 1 except that Comparative Example 2 did not use the UV curing agent (photo initiator) IC-184 in preparation of the first bonding layer.

<Comparative Example 3>

1. Preparation of a second insulation bonding layer c-1

After preparing a mixture using 150g of acrylic resin KLS-1045 (weight average molecular weight of 750,000, Tg of 30℃, Huzikura Co., Ltd.), 150g of cresol novolac epoxy resin YDCN-500-90P (molecular weight of 10,000 or less, Kukdo Chemical Co., Ltd.), 20g of cresol novolac curing agent MEH-7800SS (Maywa Plastic Industries Co., Ltd.), 0.8g of imidazole curing accelerator 2P4MZ (Shikoku Chemical Industries Co., Ltd.), 0.4g of epoxy silane coupling agent KBM-303 (Shinetsu Chemical Co., Ltd.), and 40g of amorphous silica fillers OX-50 (Degussa), the mixture was primarily dispersed at 500 rpm for about 2 hours, followed by milling the mixture.

After milling, the obtained reactant was coated to 10 microns on one side of a 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) using an applicator, and dried at 80℃ for 2 minutes. After lamination on the 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) at 80℃, the resultant was subjected to aging at room temperature for three days, thereby preparing a second insulation bonding layer C-1.

Except for the second insulation bonding layer c-1, an adhesive layer A-1 and a first bonding film B-1 were prepared by the same method as that of Example 1. Then, the prepared adhesive layer A-1, the first insulation bonding layer B-1, and the second insulation bonding layer c-1 were sequentially laminated using a laminator, thereby fabricating a bonding film d-3.

<Comparative Example 4>

1. Preparation of a single bonding layer c-2

After preparing a mixture using 150g of acrylic resin WS-023 (hydroxyl value or acid value of 20 mgKOH/g, Tg of -5℃, average molecular weight of 500,000, OH or COOH content of 20, Nagasechemtech Co., Ltd.), 150g of cresol novolac epoxy resin YDCN-500-90P (molecular weight of 10,000 or less, Kukdo Chemical Co., Ltd.), 20g of cresol novolac curing agent MEH-7800SS (Maywa Plastic Industries Co., Ltd.), 0.8g of imidazole curing accelerator 2P4MZ (Shikoku Chemical Industries Co., Ltd.), 0.4g of epoxy silane coupling agent KBM-303 (Shinetsu Chemical Co., Ltd.), and 40g of amorphous silica fillers OX-50 (Degussa), the mixture was primarily dispersed at 500 rpm for about 2 hours, followed by milling the mixture.

After milling, the obtained reactant was coated to 10 microns on one side of a 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) using an applicator, and dried at 80℃ for 2 minutes. After lamination on the 38-micron PET release film SRD-T38 (Saehan Media Co., Ltd.) at 80℃, the resultant was subjected to aging at room temperature for three days, thereby preparing a single bonding layer c-2.

Except for the single bonding layer c-2, an adhesive layer A-1 was prepared by the same method as that of Example 1. Then, the prepared adhesive layer A-1 and the single bonding layer c-2 were sequentially laminated using a laminator, thereby fabricating a bonding film d-4.

Properties of the bonding films D1, d1, d2, d3 and d4 of Example 1 and Comparative Examples 1~4 were evaluated as follows.

<Test for evaluating properties of bonding films>

① Back grinding properties of wafer (BG)

With each of the bonding films of Example 1 and Comparative Examples 1~4 mounted on a 720-micron wafer by a back-lap device, the back sides of the base films were ground to a depth of 80 microns. Results of the test were determined as follows.

No damage and no micro crack on wafer O

Damage and micro crack on wafer X

② 180 degree average peeling force (PF) between adhesive layer and first insulation bonding layer (before and after UV curing)

A 180 degree average peel test was performed according to JIS Z0237.

After UV irradiation to samples obtained from the bonding films of Example 1 and Comparative Examples 1~4, each of the samples was cut to a size of 25mm x 150mm.

An interface between the adhesive layer and the first insulation bonding layer of each sample was separated using a pair of tweezers. Then, the sample was clamped between upper and lower jigs of Instron Series IX/s Automated Materials Tester-3343 with a 10N load cell, and was peeled off at a pulling rate of 300 mm/min to measure load for peeling.

UV irradiation was performed at an intensity of 300mJ/㎠ by irradiating UV rays from a high voltage mercury lamp having an illumination intensity of 70W/㎝ for 3 seconds using DS-MUV128-S1 (Daesung Engineering Co., Ltd.). The 180 degree average peeling forces of 5 samples were measured before and after the UV irradiation.

③ Peeling characteristics (PC) of adhesive layer and base film

After removing protective films from the bonding films of the inventive and comparative examples, each of the bonding films was mounted on one side of an 8-inch wafer at 60℃ using Mounter AR-08WM available from Aaron Co., Ltd.

Then, an acryl bonding tape (Seotong OPP Tape) of 25mm x 300mm was thermally compressed to a base film plane of the wafer, to which the bonding film was attached. (Here, only 200mm of the bonding tape having a length of 300mm was compressed.)

UV irradiation was performed at an intensity of 300mJ/㎠ by irradiating UV rays from a high voltage mercury lamp having an illumination intensity of 70W/㎝ for 3 seconds using DS-MUV128-S1 (Daesung Engineering Co., Ltd.).

Then, the wafer and the bonding tape were clamped between the upper and lower jigs of Instron Series IX/s Automated Materials Tester-3343 with a 10N load cell, and were peeled off at a pulling rate of 1500 mm/min. After peeling, a torn state or a released state of the first insulation bonding layer 4 was observed.

No tear, no release and no extension of the first insulation bonding layer - O

Tear, release or extension of the first insulation bonding layer - X

④ Mounting void, chipping, and chip crack

After mounting the bonding films of the inventive and comparative examples to

the surface of an 8-inch 80㎛ thick wafer having bumps thereon through thermal compression with Mounter AR-08WM available from Aaron Co., Ltd, a void state of the surface was observed using ME600L available from Nikon Co., Ltd.

Then, the wafer was cut into 100 chips having a size of 10.0mm x 10.0mm using DFD-650 (Disco Co., Ltd.), and chipping and chip cracks on the surfaces and cross-sections of the chips were observed.

No void, no chipping and no chip crack - O

Void, chipping or chip crack - X

⑤ Storage modulus (SM)

After cutting the second insulation bonding layer of each of the bonding films obtained from the inventive and comparative examples to a size of 200㎛ thickness x 7mm width x 14mm length, the storage modulus was measured while raising temperature at a rate of 4℃/min from -10℃ to 150℃. In this test, data of 60℃ was adopted.

⑥ Bonding force between chips (Die Shear Strength) (DSS)

After cutting a 525㎛ thick wafer coated with a dioxide layer to a size of 5mm x 5mm, only the first and second insulation layers were laminated to the wafer at 60℃ and were cut off except for bonded parts thereof.

After attaching the wafer pieces having the bonding parts laminated thereon to a wafer of 525㎛ thickness x 10mm width x 10mm length placed on a hot plate at 120℃, the wafer pieces were compressed onto the wafer for 20 seconds at 500gf, followed by curing at 125℃ for two hours and at 175℃ for four hours.

Then, the bonding force between chips were measured at 250℃ and a shear rate of 100 ㎛/sec using a shear strength tester Dage-100.

Table 1 shows test results of the inventive and comparative examples.

Table 1

Items	Unit	Example 1	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
BG	-	O	O	O	O	O

PF	Before UV	N/25mm	1.29	1.45	1.33	1.28	1.38
	After UV		0.04	0.87	0.18	0.06	0.20
PC		-	O	X	X	O	X
void, chipping, crack		-	O	O	O	X	O
SM		MPa	3.2	2.4	3.7	22.8	5.4
DSS		Kgf	12	11	13	12	11

The adhesive layer of Example 1 was prepared using the inherent adhesive binder to improve the peeling characteristics. Further, Example 1 had two bonding layers, in which the first insulation bonding layer contained the UV-curable polymer and had a peeling force of 0.1N/25mm with respect to the adhesive layer after UV irradiation. Therefore, it can be seen from Table 1 that the first insulation bonding layer was easily peeled from the adhesive layer by the reel-shaped bonding tape after back grinding.

Further, since the second insulation bonding layer of Example 1 was prepared using the acrylic binder having a glass transition temperature of -20~20℃, it had a storage modulus of 3.2 MPa at 60℃ and did not provide mounting voids, chipping, chip cracks, or the like.

When bonding the chips using the bonding tape of Example 1, the bonding force between the chips was about 12 kgf.

The adhesive layer of Comparative Example 1 was prepared using the mixture composition instead of the inherent adhesive binder. The peeling force between the adhesive layer and the first insulation bonding layer after UV irradiation was 0.87N/25mm. As a result, when peeling the first insulation bonding film from the adhesive layer using the reel-shaped bonding tape after back grinding, the first insulation bonding film was torn.

In Comparative Example 2, the adhesive layer and the second insulation bonding layer were the same as those of Example 1, but the first insulation bonding layer did not contain the UV-curable compound.

In Comparative Example 2, the peeling force between the adhesive layer and the first insulation bonding layer was decreased to 0.18N/25mm after UV irradiation. However, since this peeling force was not sufficient to allow the first insulation bonding layer to be peeled from the adhesive layer by the reel-shaped bonding tape after back grinding, the surface of the first insulation bonding film became released.

In Comparative Example 3, the adhesive layer and the first insulation bonding layer were the same as those of Example 1, but the second insulation bonding layer was prepared using the binder having a glass transition temperature of 30℃.

The second insulation bonding layer of Comparative Example 3 had a storage modulus of 22.8 MPa at 60℃ and did not completely fill up the roughness on the wafer, which had the bumps formed thereon. As a result, voids were formed on the wafer surface, thereby causing chipping and chip cracks near the voids during dicing.

Comparative Example 4 was prepared using a single bonding layer instead of double bonding layers. However, the peeling force between the adhesive layer and the bonding layer after UV irradiation was 0.20N/25mm, and thus, the bonding layer was not peeled from the adhesive layer by the reel-shaped bonding tape after back grinding.

According to the present invention, the multifunction tape for a semiconductor package is composed of the adhesive layer, the first insulation bonding layer, the second insulation bonding layer, and the protective film. In the multifunction tape of this invention, the adhesive layer comprises an adhesive binder where a UV-curable carbon-to-carbon double bond is provided to a side chain of a polymer adhesive binder.

The first insulation bonding layer is formed by mixing 0.1~10 parts by weight of a UV-curable polymer having the carbon-to-carbon double bond with 100 parts by weight of acrylic resin, epoxy resin and a curing accelerator. The first insulation bonding layer has a 180 degree average peeling force of 0.1N/25mm or less with respect to the adhesive layer after UV irradiation.

The second insulation bonding layer contains 30~70 parts by weight of acrylic resin with respect to 100 parts by weight of other components in the second insulation bonding layer, in which the acrylic resin has a glass transition temperature of -20~20℃. The multifunction tape comprising these components may be used for a semiconductor package. In particular, the multifunction tape of this invention enables a back grinding process and a die-attachment process to be consistently performed without a separate tape.

As apparent from the above description, according to this invention, the multifunction tape for a semiconductor package can be commonly applied to a rear-side grinding process, a dicing process and/or a pick-up/die-attachment process during the processes. Particularly, the multifunction tape includes a first bonding layer that is formed

between an adhesive layer and a second bonding layer and contains a UV-curable agent to be cured along with the adhesive layer by UV irradiation, thereby significantly enhancing peeling characteristics of the adhesive layer.

Further, the multifunction tape according to this invention enables the back grinding process and the pick-up/die-attachment process to be consistently performed without other bonding tapes. Furthermore, the back grinding process, the dicing process and the pick-up/die-attachment process can also be consistently performed only with the multifunction tape of the present invention.

Although the present invention has been described with reference to the embodiments, it will be apparent to those skilled in the art that the embodiments are given by way of illustration only, and that various modifications and changes can be made without departing from the spirit and scope of the present invention as defined by the accompanying claims and the equivalents thereof.

WHAT IS CLAIMED IS:

1. A multifunction tape for a semiconductor package, comprising:

a UV-curable adhesive layer on one side of a base film;

and first and second bonding layers on the adhesive layer,

wherein the multifunction tape is bonded to a device-formed side of a semiconductor substrate having a plurality of devices thereon while performing a process of grinding a side of the semiconductor substrate opposite to the device-formed side and a process of dicing the semiconductor substrate into individual chips with a dicing tape having a UV-curable adhesive layer bonded to the ground side of the semiconductor substrate, and the first and second bonding layers of the multifunction tape are bonded to the individual chips while the chips separated from each other by the dicing process are picked up and die-attached.

2. A multifunction tape for a semiconductor package, comprising:

a UV-curable adhesive layer on one side of a base film; and

first and second bonding layers on the adhesive layer,

wherein the multifunction tape is bonded to a device-formed side of a semiconductor substrate having a plurality of devices thereon while performing a process of grinding a side of the semiconductor substrate opposite to the device-formed side and a process of dicing the semiconductor substrate into individual chips, and the first and second bonding layers of the multifunction tape are bonded to the individual chips while the chips separated from each other by the dicing process are picked up and die-attached.

3. The multifunction tape according to claim 1 or 2, wherein the first bonding layer contains a UV-curable material interposed between the adhesive layer and the second bonding layer to improve peeling characteristics with respect to the adhesive layer and the second bonding layer after UV irradiation to the adhesive layer.

4. The multifunction tape according to claim 1 or 2, wherein the first bonding layer has a 180 degree average peeling force of 0.1N/25mm or less with respect to the adhesive layer after UV irradiation.

5. The multifunction tape according to claim 1 or 2, wherein the first and second bonding layers are thermosetting layers.

6. The multifunction tape according to claim 1 or 2, wherein the second bonding layer has a storage modulus of 0.1~10 MPa at 60℃.

7. A method of fabricating a semiconductor device, comprising:

bonding a multifunction tape to one side of a semiconductor substrate having bumps formed thereon, the multifunction tape comprising a UV-curable adhesive layer on one side of a base film, and first and second bonding layers on the adhesive layer;

grinding a back side of the semiconductor substrate;

bonding a dicing tape to the ground side of the semiconductor substrate;

dicing the semiconductor substrate into individual chips;

picking up the chips with the first and second bonding layers bonded thereto after removing the dicing tape; and

die-attaching the chips using the first and second bonding layers.

8. A method of fabricating a semiconductor device, comprising:

bonding a multifunction tape to one side of a semiconductor substrate having bumps formed thereon, the multifunction tape comprising a UV-curable adhesive layer on one side of a base film, and first and second bonding layers on the adhesive layer;

grinding a back side of the semiconductor substrate;

dicing the semiconductor substrate into individual chips;

picking up the chips with the first and second bonding layers bonded thereto; and

die-attaching the chips using the first and second bonding layers.

9. The method according to claim 7 or 8, further comprising:

irradiating UV rays to the tape after dicing the semiconductor substrate and before picking up the chips.

10. The method according to claim 7, further comprising:

expanding the dicing tape to increase a separation between the respective diced chips, before picking up the chips.

11. The method according to claim 8, further comprising:

expanding the dicing tape to increase a separation between the respective diced chips, before picking up the chips.

MULTI-FUNCTIONAL TAPE FOR SEMICONDUCTOR PACKAGE AND A METHOD FOR MANUFACTURING SEMICONDUCTOR DEVICE USING THE SAME

ABSTRACT OF THE DISCLOSURE

Provided is a multifunctional tape for semiconductor packaging that can be used for a back-grinding process, a dicing process, a pickup process, and a die-attaching process at the same time. In particular, the multifunctional tape for a semiconductor package includes an ultraviolet-curable agent on an interface between an adhesive layer and a second bonding layer to form a first bonding layer that is hardened when the adhesive layer is hardened through exposure to ultraviolet light. Therefore, the adhesive layer imparts better peeling performance to the multi-functional tape. The multi-functional tape for a semiconductor package disclosed in this invention includes: the ultraviolet-curable adhesive layer formed on the surface of a base film, and the first and second bonding layers formed on the ultraviolet-curable adhesive layer.

Fig. 2