【DESCRIPTION】

【Invention Title】

TAPE FOR PROCESSING SEMICONDUCTOR WAFER

【Technical Field】

The present invention relates to a tape for processing a semiconductor wafer, and more particularly, to a tape for processing a semiconductor wafer that has the functions for both dicing tape and die bonding film.

【Background Art】

Recently, a dicing die bonding tape has been developed, which has the functions for a dicing tape adapted to fix a semiconductor wafer thereon in a dicing step where the semiconductor wafer is cut into individual chips and for a die bonding film (which is also called 'die attach film') adapted to attach the cut semiconductor chips to a lead frame or a package substrate, or to stack the semiconductor chips to each other in a stack package.

The dicing die bonding tape is pre-cut in consideration of its workability such as the attachment to a semiconductor wafer, the attachment to a ring frame in the process of dicing, and the like. An example of the pre-cut dicing die bonding tape is disclosed in FIG.8 and FIGS.9a and 9b. FIG.8 shows the conventional dicing die bonding tape wound in a roll shape, FIG.9a is a plan view showing the conventional dicing die bonding tape, and FIG.9b is a sectional view taken along the line B-B of FIG.9a. As shown, the conventional dicing die bonding tape 50 includes a release film 51, an adhesive layer 52, and a pressure-sensitive adhesive film 53.

The adhesive layer 52 is formed to a round shape corresponding to the shape of the semiconductor wafer, such that it has a shape of a round label. The pressure-sensitive adhesive film 53 is formed by removing the surrounding area

of the round portion corresponding to the shape of a ring frame for dicing, and as shown, the pressure-sensitive adhesive film 53 includes a round label portion 53a and a surrounding portion 53b surrounding the outside edge of the round label portion 53a. The adhesive layer 52 and the round label portion 53a of the pressure-sensitive adhesive film 53 are stacked on each other, while having the same center as each other, and further, the round label portion 53a of the pressure-sensitive adhesive film 53 covers the adhesive layer 52 and comes into contact with the release film 51 on the surrounding thereof.

In the dicing step of the semiconductor wafer, the release film 51 is peeled off from the stack of the adhesive layer 52 and the pressure-sensitive adhesive film 53. As shown in FIG.10, the underside of the semiconductor wafer W is attached on the adhesive layer 52, and a dicing ring frame R is fixedly attached on the surrounding periphery of the round label portion 53a of the pressure-sensitive adhesive film 53. In this state, the dicing for the semiconductor wafer W is carried out, and after that, the pressure-sensitive adhesive film 53 is subjected to curing treatment like ultraviolet irradiation. Then, the semiconductor chips are picked up. At this time, since the adhesive force of the pressure-sensitive adhesive film 53 is decreased by the curing treatment, the pressure-sensitive adhesive film 53 is easily peeled off from the adhesive layer 52, and the semiconductor chip is picked up at the state of being attached on the underside thereof to the adhesive layer 52. The adhesive layer 52 which is attached to the underside of the semiconductor chip serves as a die bonding film at the time when the semiconductor chip is attached to the lead frame, the package substrate, or another semiconductor chip.

By the way, as shown in FIGS.8, 9a and 9b, according to the conventional dicing die boding tape 50, the area where the adhesive layer 52 and the round label portion 53a of the pressure-sensitive adhesive film 53 are stacked on each other is thicker than the surrounding portion 53b of the pressure-sensitive adhesive film 53. Thus, when the conventional dicing die bonding tape 50 is wound to a roll shape as a product, the area where the adhesive layer 52 and the round label portion 53a of the pressure-sensitive adhesive film 53 are stacked on each other and the surrounding portion 53b of the pressure-sensitive adhesive film 53 are placed on top of each other, thereby causing the step between the two different areas to be transferred on the soft surface of the adhesive layer 52, that is, thereby causing transfer marks (e.g., label marks, wrinkles, or winding marks) as shown in FIG.11. The formation of the transfer marks is remarkably increased especially when the adhesive layer 52 is formed of a soft resin and is relatively thick in thickness or when the number of times the dicing die bonding tape 50 is wound is large. If the transfer marks are formed, the adhesion defect between the adhesive layer 52 and the semiconductor wafer occurs to cause a bad quality of semiconductor wafer process.

To suppress the formation of the transfer marks, a substantially low pressure is applied when the dicing die bonding tape is wound, but in this case, the errors in the winding the product may occur. For instance, it is difficult to set the product to a tape mounter, and troubles are caused in the actual use of the tape.

To suppress the formation of the label marks, also, a first prior art document discloses an adhesive sheet which includes a support layer having an equal or thicker thickness to or than the added thickness of the adhesive layer and the

pressure-sensitive adhesive film, the support layer being disposed at the outside of the adhesive layer and the pressure-sensitive adhesive film on the peeled base material. According to the first prior art document, the formation of the support layer permits the winding pressure applied to the adhesive sheet to be distributed or to be collected to the support layer, thereby desirably prohibiting the step between the area where the adhesive layer and the pressure-sensitive adhesive film are stacked on each other and the area where only the pressure-sensitive adhesive film is formed from being transferred to another adhesive layer.

According to the adhesive sheet as disclosed in the first prior art document, however, since the support layer is formed on the area of the peeled substrate excepting the adhesive layer and the pressure-sensitive adhesive film, the peeled substrate being required for the manufacturing of the semiconductor device, the support layer is limited in defining the width thereof, and the width of the support layer is relatively narrow in the outside diameters of the adhesive layer and the pressure-sensitive adhesive film, thereby obtaining an insufficient effect of suppressing the formation of the transfer marks.

So as to enhance the effect of suppressing the formation of the transfer marks, a second prior art document discloses a laminating sheet used to lay a cover sheet on a light-receiving surface of an optical disc, wherein the laminating sheet includes a peeling sheet having a relatively long length, and an adhesive sheet and a protecting material (support member) laminated at a different position on the peeling sheet, the protecting material being formed at the both side portions of the underside of the release sheet in a width direction thereof (see FIG.11). According to the

structure wherein the support member is formed on the underside of the release sheet, the width of the support member is somewhat expanded, thereby effectively suppressing the formation of the transfer marks.

-First prior art document: Japanese Patent Laid-Open Publication No. 2007-2173

-Second prior art document: Japanese Patent Laid-Open Publication No. 2004-35836

However, the tape for processing the semiconductor wafer is under specific use environments where the changes of temperature are severely made. For example, the tape for processing the semiconductor wafer is under the environments where the state of a low temperature (having a range of -20℃ to 5℃) during keeping and delivery is changed to a state of a room temperature for the use or where heating is conducted for the attachment to the semiconductor wafer. In this case, however, only with the formation of the support member on the underside of the release film, the tape is not good for processing the semiconductor wafer.

That is, under the use environments where the changes of temperature are severely made, the size of the support member is expanded by the changes of temperature to cause air to enter the space between the release film and the pressure-sensitive adhesive film and the space between the adhesive layer and the pressure-sensitive adhesive film, thereby forming voids (empty spaces) and further causing the attaching defect to the semiconductor wafer. If the attaching defect occurs, the production yield may be decreased in the dicing process for the semiconductor wafer, in the expanding process of the tape, in the picking up process of the chip, and in the mounting process of the chip

which are carried out in the next steps.

Further, when the conventional tape for processing the semiconductor wafer is wound to a roll shape as a product, as shown in FIG.8, it is difficult to recognize the kind of the product. So as to solve this problem, for example, the name of the product is printed on the round label portion 53a of the dicing die bonding tape 50, but in order not to give any influence on the dicing process, the name of the product is desirably printed on the area where the round label portion 53a on which the adhesive layer 52 is not laminated, such that the printable space is limited and the size and number of characters are restricted. This causes the dicing die bonding tape to be erroneously selected. Further, in the state where the tape is wound to the roll shape, it is difficult to recognize the kind of the product when the side of the roll is seen (The roll type tape as shown in FIG.8 is viewed from the upper or lower direction on the ground). So as to solve this problem, the colors of the core to which the tape is wound to the roll shape are changed in accordance with the kinds of products, but the colored core causes the production cost to be raised. Further, there occurs a problem that a large number of cores are in stock.

【Disclosure】

【Technical Problem】

Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the prior art, and it is an object of the present invention to provide a tape for processing a semiconductor wafer that can sufficiently suppress the formation of transfer marks on an adhesive layer at the time when the tape for processing the semiconductor wafer is wound to a roll shape, the tape having the adhesive layer and a pressure-sensitive adhesive film

formed on a release film, and that can suppress the formation of voids caused by the changes of temperature.

It is another object of the present invention to provide a tape for processing a semiconductor wafer that can sufficiently suppress the formation of transfer marks on an adhesive layer at the time when the tape for processing the semiconductor wafer is wound to a roll shape, the tape having the adhesive layer and a pressure-sensitive adhesive film formed on a release film, and that can clearly recognize the kind of the tape.

【Technical Solution】

To achieve the above objects, according to an aspect of the present invention, there is provided a tape for processing a semiconductor wafer including: a release film having a relatively long length; an adhesive layer formed on a first surface of the release film and having a predetermined plane shape; a pressure-sensitive adhesive film having a label portion having a predetermined plane shape and formed to cover the adhesive layer in such a manner as to be brought into contact with the release film around the adhesive layer and a surrounding portion adapted to surround the outside of the label portion; and a support member formed at the both end portions of the release film in a short direction of the release film, on a second surface of the release film opposite to the first surface of the release film on which the adhesive layer and the pressure-sensitive adhesive film are formed, the support member having a coefficient of linear expansion of 300ppm/℃ or less.

According to the present invention, preferably, the difference between the coefficient of linear expansion of the support member and the coefficient of linear expansion of the release film is 250ppm/℃ or less, and the coefficient of

static friction between a base film constituting the pressure-sensitive adhesive film and the support member is in a range of 0.2 to 2.0.

According to the present invention, preferably, the support member is formed on the area corresponding to the outside of the adhesive layer formed on the first surface of the release film, on the second surface of the release film, and the support member is formed continuously along the lengthwise direction of the release film, the support member having a thicker thickness than the adhesive layer.

According to the present invention, preferably, the support member is a colored member, and the colored member is colored in accordance with the kinds or thicknesses of the tape for processing the semiconductor wafer.

According to the present invention, preferably, the support member has a two or more-layered structure.

According to the present invention, preferably, the support member is formed of a pressure-sensitive adhesive tape made by applying a pressure-sensitive adhesive on a base film, the base film being selected from the group consisting of polyethylene terephthalate, polypropylene, and high density polyethylene.

To achieve the above objects, according to another aspect of the present invention, there is provided a tape for processing a semiconductor wafer including: a release film having a relatively long length; an adhesive layer formed on a first surface of the release film and having a predetermined plane shape; a pressure-sensitive adhesive film having a label portion having a predetermined plane shape and formed to cover the adhesive layer in such a manner as to be brought into contact with the release film around the adhesive layer and a surrounding portion adapted to surround

the outside of the label portion; and a colored support member formed at the both end portions of the release film in a short direction of the release film having the relatively long length.

According to the present invention, preferably, the colored support member is formed on the first surface of the release film on which the adhesive layer and the pressure-sensitive adhesive film are formed, and more preferably, the colored support member is formed on a second surface of the release film opposite to the first surface of the release film.

According to the present invention, preferably, the colored support member is formed on the area corresponding to the outside of the adhesive layer formed on the first surface of the release film, on the second surface of the release film the second surface of the release film, and the colored support member is formed continuously along the lengthwise direction of the release film, the colored support member having a thicker thickness than the adhesive layer.

According to the present invention, preferably, the colored support member has a two or more-layered structure.

According to the present invention, preferably, the colored support member is formed of a pressure-sensitive adhesive tape made by applying a pressure-sensitive adhesive on a base film, the base film being selected from the group consisting of polyethylene terephthalate and polyester.

According to the present invention, preferably, the colored support member is colored in accordance with the kinds or thicknesses of the tape for processing the semiconductor wafer.

【Advantageous Effect】

According to the present invention, the tape for processing the semiconductor wafer includes the support member having specific physical properties and formed on the underside of the release film, thereby suppressing the formation of transfer marks on the adhesive layer, exhibiting small changes in the size of the support member even under the use environments where the changes of temperature are severely made, and reducing the formation of voids.

According to the present invention, moreover, the tape for processing the semiconductor wafer includes the colored support member formed on the surface or underside of the release film, thereby suppressing the formation of transfer marks on the adhesive layer and clearly recognizing the kind of the dicing die bonding tape.

【Description of Drawings】

FIG.1a is a plan view showing a tape for processing a semiconductor wafer according to a first embodiment of the present invention.

FIG.1b is a sectional view taken along the line A-A of FIG.1a.

FIG.2 is a sectional view showing a modified example of the tape for processing a semiconductor wafer of FIGS.1a and 1b.

FIG.3 is a sectional view showing another modified example of the tape for processing a semiconductor wafer of FIGS.1a and 1b.

FIG.4a is a plan view showing a tape for processing a semiconductor wafer according to a second embodiment of the present invention.

FIG.4b is a sectional view taken along the line A-A of FIG.4a.

FIG.5 is a sectional view showing a tape for processing a semiconductor wafer according to a third embodiment of the present invention.

FIG.6 is a sectional view showing a modified example of the tape for processing a semiconductor wafer of FIGS.4a and 4b.

FIG.7 is a sectional view showing another modified example of the tape for processing a semiconductor wafer of FIGS.4a and 4b.

FIG.8 is a perspective view showing a conventional tape for processing a semiconductor wafer.

FIG.9a is a plan view showing the conventional tape for processing a semiconductor wafer.

FIG.9b is a sectional view showing the conventional tape for processing a semiconductor wafer.

FIG.10 is a sectional view showing the conventional tape for processing a semiconductor wafer wherein a dicing ring frame is fixedly attached to the tape.

FIG.11 is a diagram showing a defect occurring on the conventional tape for processing a semiconductor wafer.

【Mode for Invention】

(First Embodiment)

An explanation on a tape for processing the semiconductor wafer copper according to a first embodiment of the present invention will be explained in detail with reference to the attached drawings.

FIG.1a is a plan view showing a tape for processing a semiconductor wafer according to a first embodiment of the present invention, and FIG.1b is a sectional view taken along the line A-A of FIG.1a.

As shown in FIGS.1a and 1b, a tape 10 for processing the semiconductor wafer according to the present invention

includes a release film 11 having a relatively long length, an adhesive layer 12, a pressure-sensitive adhesive film 13, and a support member 14.

The adhesive layer 12 is formed on a first surface 11a of the release film 11 and has a round label shape corresponding to the shape of the semiconductor wafer. The pressure-sensitive adhesive film 13 has a round label portion 13a adapted to cover the adhesive layer 12 in such a manner as to be brought into contact with the release film 11 around the adhesive layer 12 and a surrounding portion 13b adapted to surround the outside of the round label portion 13a. The surrounding portion 13b completely surrounds the outside of the round label portion 13a and alternatively incompletely surrounds the outside of the round label portion 13a, as shown in FIGS.1a and 1b. The round label portion 13a has a shape corresponding to the dicing ring frame. The support member 14 is formed at the both end portions of the release film 11 in a short direction of the release film 11, on a second surface 11b of the release film 11 opposite to the first surface 11a of the release film 11 on which the adhesive layer 12 and the pressure-sensitive adhesive film 13 are formed.

Hereinafter, each component of the tape 10 for processing the semiconductor wafer according to the first embodiment of the present invention will be in detail described.

(Release film)

Examples of the release film 11 used in the tape 10 for processing the semiconductor wafer are a polyethylene terephthalate (PET) film, a polypropylene film, and a film on which release coating is applied, as well known in this field.

The thickness of the release film 11 is not

specifically restricted, and it is appropriately set, desirably, in a range of 25 μm to 50 μm.

(Adhesive layer)

As noted above, the adhesive layer 12 is formed on the first surface 11a of the release film 11 and has a round label shape corresponding to the shape of the semiconductor wafer.

The adhesive layer 12 is used as an adhesive attached on the underside of the chip when the chip is picked up after the semiconductor wafer is attached and diced so as to fix the chip to a substrate or a lead frame. The adhesive layer 12 is desirably formed of a pressure-sensitive adhesive including at least one selected from the group consisting of an epoxy-based resin, an acrylic-based resin, and a phenol-based resin. Besides, the adhesive layer 12 may be formed of a pressure-sensitive adhesive including a polyimide-based resin or a silicone-based resin. The thickness of the adhesive layer 12 is appropriately set, desirably, in a range of 5 μm to 100 μm.

(Pressure-sensitive adhesive film)

As mentioned above, the pressure-sensitive adhesive film 13 has the round label portion 13a corresponding to the shape of the dicing ring frame and the surrounding portion 13b adapted to surround the outside of the round label portion 13a. The pressure-sensitive adhesive film 13 is formed by removing the surrounding area of the round label portion 13a from a film type pressure-sensitive adhesive by means of pre-cut processing.

The pressure-sensitive adhesive film 13 has a sufficiently high adhesive force at the time of dicing the semiconductor wafer so as not to peel off the semiconductor wafer therefrom and has a low adhesive force at the time of

picking up the chip after the dicing so as to easily peel the chip off from the adhesive layer. For example, the pressure-sensitive adhesive film 13 is formed by applying a pressure-sensitive adhesive layer on a base film.

The base film of the pressure-sensitive adhesive film 13 desirably has a radiolucent property, if the pressure-sensitive adhesive layer as will be discussed below is formed of a radiation-curing material.

Examples of the materials of the base film are polyethylene, polypropylene, an ethylene-propylene copolymer, polybutene-1, poly-4-methylepentene-1, an ethylene-vinyl acetate copolymer, an ethylene-acrylic acid copolymer, an α-olefin homopolymer or copolymer such as ionomer or the mixture thereof, polyurethane, a stylene-ethyline-butene and pentane-based copolymer, a thermoplastic elastomer such as a polyamide-polyol copolymer, and a mixture thereof. Also, the base film may be also a mixture of two or more materials selected from the above-mentioned group, and it may be single-layered or multi-layered.

The thickness of the pressure-sensitive adhesive film 13 is not specifically restricted, and it is appropriately set, desirably, in a range of 50 μm to 200 μm.

The resin used for the pressure-sensitive adhesive layer of the pressure-sensitive adhesive film 13 is not specifically restricted, and the examples of the resin are a chlorinated polypropylene resin, an acrylic resin, a polyester resin, a polyurethane resin, an epoxy resin, and the like, which are generally used for the pressure-sensitive adhesive.

The resin of the adhesive layer is mixed appropriately with an acrylic-based pressure-sensitive adhesive, a radiation polymerization compound, an initiator of

photopolymerization, a curing agent, and the like, thereby making the pressure-sensitive adhesive. The thickness of the pressure-sensitive adhesive layer is not specifically restricted, and it is appropriately set, desirably, in a range of 5 ㎛ to 30 ㎛.

The radiation polymerization compound is added to the pressure-sensitive adhesive layer, and the pressure-sensitive adhesive layer is easily peeled off from the adhesive layer by means of radiation curing. For example, the radiation polymerization compound is formed of a low molecular weight compound having at least two or more photopolymerization carbon-carbon double bonds in a molecule having a three-dimensional net-shaped structure by means of light irradiation.

In more detail, the examples of the radiation polymerization compound are trimethylolpropane triacrylate, pentaerythritol triacrylate, pentaerythritol tetra acrylate, dipentaerythritol monohydroxy penta acrylate, dipentaerythritol hexa acrylate, 1,4-butyleneglycol diacrylate, 1,6-hexandiol deacrylate, polyethyleneglycol deacrylate, oligoester acrylate, and the like. In addition to the acrylate-based compounds as mentioned above, an example of the radiation polymerization compound is urethane acrylated oligomer. The urethane acrylated oligomer is obtained by reacting acrylate or methacrylate containing the hydroxyl group (for example, 2-hydroxy ethylacrylate, 2-hydroxy ethylmethacrylate, 2-hydroxy propylacrylate, 2-hydroxy propylmethacrylate, polyethylene glycol acrylate, polyethylene glycol methacrylate, and the like) to a terminated isocyanator urethane prepolymer that is obtained by reacting a polyol compound such as polyester or polyether to a polyhyfric isocyanato compound (for example, 2,4-trilene

diisocyanator, 2,6-trilene diisocyanator, 1,3-xylylenediisocyanator, 1,4-xylylenediisocyanator, diphenylmethane 4,4-diisocyanator, and the like). The pressure-sensitive adhesive layer is formed of a mixture of two or more resins selected from the above-mentioned resins.

Examples of the initiator of photopolymerization are isopropylbenzoinether, isobutylbezoinether, benzophenone, michler's ketone, chlorothioxanthone, dodecylthioxanthone, dimethyloxanthone, diethyloxanthone, benzyldimethylketal, α-hydroxy cyclo hexylphenylketon, 2-hydroxymethylphenylpropane, and the like. An amount of the initiator of photopolymerization added is preferably from 0.01 to 5 parts by weight, to 100 parts by weight of an acrylic copolymer.

(Support member)

The support member 14 is formed at the both end portions of the release film 11 in a short direction of the release film 11, on a second surface 11b of the release film 11 opposite to the first surface 11a on which the adhesive layer 12 and the pressure-sensitive adhesive film 13 are formed. Like this, the formation of the support member 14 enables the winding pressure applied to the tape when the tape 10 for processing the semiconductor wafer is wound to a roll shape to be distributed or collected to the support member 14, thereby suppressing the formation of the transfer marks on the adhesive layer 12.

Also, if the support member 14 is formed on the first surface 11a on which the adhesive layer 12 and the pressure-sensitive adhesive film 13 are formed, the support member 14 has the limitation in the width thereof, but according to the present invention, the support member 14 is extended in the width thereof, thereby more effectively suppressing the formation of the transfer marks on the adhesive layer 12.

Further, the support member 14 is formed on the second surface 11b of the release film 11, thereby advantageously enabling the allowance of the position error of the support member 14 to be large.

The support member 14 is formed on the area corresponding to the outside of the adhesive layer 12 formed on the first surface 11a of the release film 11, on the second surface 11b of the release film 11, that is, on an area R occupied from the end portion of the release film 11 to the adhesive layer 12 on the second surface 11b of the release film 11. According to this structure, the adhesive layer 12 and the support member 14 formed on the second surface 11b of the release film 11 are not overlapped at the time when the tape 10 is wound, thereby preventing the transfer marks from being formed on the adhesive layer 12.

The support member 14 is formed intermittently or continuously along the lengthwise direction of the release film 11, but from the viewpoint of more effectively suppressing the formation of the transfer marks, preferably, the support member 14 is formed continuously along the lengthwise direction of the release film 11.

The support member 14 has a thickness corresponding to the step between the area where the adhesive layer 12 and the round label portion 13a of the pressure-sensitive adhesive film 13 are stacked on each other and the surrounding portion 13b of the pressure-sensitive adhesive film 13, that is, equal to the adhesive layer 12 or thicker than the adhesive layer 12. FIG.2 is a sectional view showing the example of a support member 14′ having a thicker thickness than the adhesive layer 12.

At the time of winding the tape 10, the formation of the support member 14′ having the equal or thicker thickness to

or than the adhesive layer 12 enables the pressure-sensitive adhesive film 13 to be brought into contact with the second surface 11b of the release film 11 or enables the space between the pressure-sensitive adhesive film 13 and the second surface 11b to be formed without any contact with each other, thereby preventing the second surface 11b of the release film 11 from strongly pressurizing the soft adhesive layer 12, while interposing the pressure-sensitive adhesive film 13 therebetween. Accordingly, the formation of the transfer marks can be more effectively suppressed.

The support member 14 of the present invention has a coefficient of linear expansion of 300ppm/℃ or less. The tape for processing the semiconductor wafer is under specific environments where the changes of temperature are severely made. For example, the tape for processing the semiconductor wafer is under the environments wherein the low temperature (having a range of -20℃ to 5℃) is kept during keeping and delivery and wherein the heating attachment in a range of 70℃ to 80℃ on a heater table is conducted to allow the adhesive to be heated and soft, thereby enhancing the adhesive force, at the time of attaching the adhesive layer of the tape to the semiconductor wafer. If the size of the support member 14 is varied by the changes of the temperature, air may enter the space between the release film 11 and the pressure-sensitive adhesive film 13 and the space between the adhesive layer 12 and the pressure-sensitive adhesive film 13, thereby forming voids therebetween and further causing the attachment defect to the semiconductor wafer. If the attachment defect occurs, the production yield is decreased in the dicing process for the semiconductor wafer, in the expanding process of the tape, in the picking up process of

the chip, and in the mounting process of the chip that are carried out in the next steps. According to the present invention, since the support member having a low coefficient of linear expansion of 300ppm/℃ or less is used, the formation of the transfer marks can be more effectively suppressed, and further, since the variations of the size of the support member are small under the use environments where the changes of the temperature are severely made, the formation of the voids can be more effectively suppressed.

So as to more effectively suppress the formation of the transfer marks and voids, the coefficient of linear expansion of the support member 14 is desirably 150ppm/℃ or less, and more desirably 70ppm/℃ or less. The lowest limit of the coefficient of linear expansion of the support member 14 is not specially defined, but generally, it is 0.1ppm/℃.

Further, the difference between the coefficient of linear expansion of the support member 14 and the coefficient of linear expansion of the release film 11 is preferably 250ppm/℃ or less. If the difference therebetween is more than 250ppm/℃, the difference between the sizes of the support member 14 and the release film 11 occurs by the changes of the temperature from the low temperature state during keeping and delivery to the room temperature state while in use, thereby causing a variety of defects as will be discussed below.

First, if the difference between the sizes of the support member 14 and the release film 11 occurs by the changes of the temperature, as mentioned above, the voids are formed between the release film 11 and the pressure-sensitive adhesive film 13 and between the adhesive layer 12 and the pressure-sensitive adhesive film 13.

Second, when the tape is handled to a roll shape by a user, it is very likely to stop the winding. In more detail, even though the tape is normally wound at the time of manufacturing and shipping, the difference between the sizes of the support member 14 and the release film 11 occurs when the tape is used at a room temperature after drawn from a refrigerator or when it is kept to the refrigerator after the use at the room temperature, thereby increasing the possibility where the winding stops.

Third, since the gap between the sheets wound to the roll shape occurs by the difference of sizes, foreign materials may enter the lateral surface of the roll.

Fourth, if the number of times the tape for processing the semiconductor wafer is wound is large or if the width of the product is large, the cooling speeds between the core of the roll and the outer periphery of the roll are different from each other when the roll of product is kept to the refrigerator after the use at the room temperature. Accordingly, the difference of the sizes between the support member 14 and the release film 11 is made by the difference of the linear expansion between the core of the roll and the outer periphery of the roll, thereby raising the possibility where the shape of the entire roll is varied.

According to the present invention, the coefficient of linear expansion is an increasing rate of spatial expansion of an object when a temperature is changed at a static pressure. If it is assumed that a temperature is T and the length of a solid is L, the coefficient α of linear expansion thereof is given by the following expression.

$$\alpha = (1/L)\cdot(\partial L/\partial T)$$

The measurement of the coefficient of linear expansion according to the present invention is based upon the test

method of linear expansion rate through thermomechanical analysis of plastic defined in JIS K7197, and while using a thermomechanical analyzer TMA, the sample cut to a length of 15mm, a width of 5mm, and a distance between zippers of 10mm is measured under the conditions of the tensile load of 10g, a temperature raising speed of 5℃/min, a N_2 gas atmosphere, and a measuring temperature range of -20℃ to 50℃.

The coefficient of static friction between the support member 14 and the base film constituting the pressure-sensitive adhesive film 13 is preferably in a range of 0.2 to 2.0 and more preferably in a range of 0.6 to 1.6. In a case where the tape for processing the semiconductor wafer is wound to the roll shape, the surrounding portion 13b of the pressure-sensitive adhesive film 13 formed on the first surface 11a of the release film 11 comes into close contact with the support member 14 formed on the second surface 11b of the release film 11, such that if the coefficient of static friction between the support member 14 and the base film constituting the pressure-sensitive adhesive film 13 is less than 0.2, it is easy to generate the error in winding during the manufacturing or use, thereby causing a bad handling result. On the other hand, if the coefficient of static friction between the support member 14 and the base film constituting the pressure-sensitive adhesive film 13 is 2.0 or more, a resistance between the base film of the pressure-sensitive adhesive film 13 and the support member 14 is very high, the handling in the manufacturing process becomes bad or the tape is wound to a zigzag shape when it wound at a high speed. Accordingly, as the coefficient of static friction between the support member 14 and the base film constituting the pressure-sensitive adhesive film 13 is in a range of 0.2 to 2.0, the error in winding of the tape 10

can be prevented, the high speed winding can be achieved, and the winding number can be increased.

According to the present invention, the coefficient of static friction between the support member 14 and the base film constituting the pressure-sensitive adhesive film 13 is measured by the following method defined in JIS K7125.

Samples of the base film of the pressure-sensitive adhesive film 13 and the support member 14 cut to 25mm (width) x 100mm (length) are laminated to each other, while the lower side film being fixed. Next, a weight of 200g is disposed on the laminated films, thereby applying load W to the laminated films, and the upper side film is pulled at a speed of 200mm/min, thereby measuring a force Fd(g) at the time of sliding. Thus, the coefficient of static friction μd is obtained by the following expression.

$$\mu d = Fd/W$$

The support member 14 is formed of, for example, a pressure-sensitive adhesive tape made by applying a pressure-sensitive adhesive to a resin base film. The pressure-sensitive adhesive tape is attached at a predetermined position on the both end portions of the second surface 11b of the release film 11, thereby forming the tape 10 for processing the semiconductor wafer according to the present invention. The pressure-sensitive adhesive tape is formed of a single layered, and as shown in FIG.3, it may be formed of laminated thin films.

If the resin of the base film of the pressure-sensitive adhesive tape satisfies the range of the coefficient of linear expansion as mentioned above and resists the winding pressure, it does not have any limitation in the selection of the material. When it is considered that the base film should have heat resistance and smoothness and also should be

easy to be purchased, the base film is desirably selected from the group consisting of polyethylene terephthalate, polypropylene, and high density polyethylene.

The pressure-sensitive adhesive of the pressure-sensitive adhesive tape does not have any limitation in the composition and physical properties, if the pressure-sensitive adhesive is not peeled off from the release film 11 during the winding and keeping processes of the tape 10.

Also, the support member 14 may be formed of a colored support member. When the tape 10 of the present invention is wound to the roll shape, the kind of the tape can be clearly recognized through the colored support member. For instance, as the colors of the colored support member 14 are different in accordance with the kinds and thicknesses of the tape 10 for processing the semiconductor wafer, the kinds and thicknesses of the tape 10 can be easily identified, thereby suppressing and preventing the generation of artificial errors.

(Second Embodiment)

An explanation on a tape for processing the semiconductor wafer copper according to a second embodiment of the present invention will be explained in detail with reference to the attached drawings.

FIG.4a is a plan view showing a tape for processing a semiconductor wafer according to a second embodiment of the present invention, and FIG.4b is a sectional view taken along the line A-A of FIG.4a.

As shown in FIGS.4a and 4b, a tape 20 for processing the semiconductor wafer according to the present invention includes a release film 21 having a relatively long length, an adhesive layer 22, a pressure-sensitive adhesive film 23, and a colored support member 24.

The adhesive layer 22 is formed on a first surface 21a of the release film 21 and has a round label shape corresponding to the shape of the semiconductor wafer. The pressure-sensitive adhesive film 23 has a round label portion 23a adapted to cover the adhesive layer 22 in such a manner as to be brought into contact with the release film 21 around the adhesive layer 22 and a surrounding portion 23b adapted to surround the outside of the round label portion 23a. The surrounding portion 23b completely surrounds the outside of the round label portion 23a and alternatively incompletely surrounds the outside of the round label portion 23a, as shown in FIGS.4a and 4b. The round label portion 23a has a shape corresponding to the dicing ring frame. The colored support member 24 is formed at the both end portions of the release film 21 in a short direction of the release film 21, on a second surface 21b of the release film 21 opposite to the first surface 21a on which the adhesive layer 22 and the pressure-sensitive adhesive film 23 are formed.

Hereinafter, each component of the tape 20 for processing the semiconductor wafer according to the second embodiment of the present invention will be in detail described.

(Release film)

Examples of the release film 21 used in the tape 20 for processing the semiconductor wafer are a polyethylene terephthalate (PET)-based film, a polypropylene-based film, and a film on which release coating is applied, as well know in this field.

The thickness of the release film 21 is not specifically restricted, and it is appropriately set, desirably, in a range of 25 ㎛ to 50 ㎛.

(Adhesive layer)

As noted above, the adhesive layer 22 is formed on the first surface 21a of the release film 21 and has a round label shape corresponding to the shape of the semiconductor wafer.

The adhesive layer 22 is used as adhesive attached on the underside of the chip when the chip is picked up after the semiconductor wafer is attached and diced so as to fix the chip to a substrate or a lead frame. The adhesive layer 22 is desirably formed of a pressure-sensitive adhesive including at least one selected from the group consisting of an epoxy-based resin, an acrylic-based resin, and a phenol-based resin. Besides, an example of the adhesive layer 22 is a polyimide-based resin or a silicone-based resin. The thickness of the adhesive layer 22 is appropriately set, desirably, in a range of 5 μm to 100 μm.

(Pressure-sensitive adhesive film)

As mentioned above, the pressure-sensitive adhesive film 23 has the round label portion 23a corresponding to the shape of the dicing ring frame and the surrounding portion 23b adapted to surround the outside of the round label portion 23a. The pressure-sensitive adhesive film 23 is formed by removing the surrounding area of the round label portion 23a from a film type pressure-sensitive adhesive by means of pre-cut processing.

The pressure-sensitive adhesive film 23 has a sufficiently high adhesive force at the time of dicing the semiconductor wafer so as not to peel off the semiconductor wafer therefrom and has a low adhesive force at the time of picking up the chips after the dicing so as to easily peel the chip off from the adhesive layer. For example, the adhesive film 23 is formed by applying a pressure-sensitive adhesive layer on a base film.

The base film of the adhesive film 23 is formed of a conventional known material, and it desirably has a radiolucent property, if the pressure-sensitive adhesive layer as will be discussed below is formed of a radiation-curing material.

Examples of the materials of the base film are polyethylene, polypropylene, an ethylene-propylene copolymer, polybutene-1, poly-4-methylepentene-1, an ethylene-vinyl acetate copolymer, an ethylene-acrylic acid copolymer, an α-olefin homopolymer or copolymer such as ionomer or the mixture thereof, polyurethane, a stylene-ethyline-butene and pentane-based copolymer, a thermoplastic elastomer such as a polyamide-polyol copolymer, and a mixture thereof. Also, the base film may be also a mixture of two or more materials selected from the above-mentioned group, and it may be single-layered or multi-layered.

The thickness of the adhesive film 23 is not specifically restricted, and it is appropriately set, desirably, in a range of 50 μm to 200 μm.

The resin used for the adhesive layer of the adhesive film 23 is not specifically restricted, and examples of the resin are a chlorinated polypropylene resin, an acrylic resin, a polyester resin, a polyurethane resin, an epoxy resin, and the like, which are generally used for the pressure-sensitive adhesive.

Desirably, the resin of the pressure-sensitive adhesive layer is mixed appropriately with an acrylic-based pressure-sensitive adhesive, a radiation polymerization compound, an initiator of photopolymerization, a curing agent, and the like, thereby making the pressure-sensitive adhesive. The thickness of the pressure-sensitive adhesive layer is not specifically restricted, and it is appropriately set,

desirably, in a range of 5 ㎛ to 30 ㎛.

The radiation polymerization compound is added to the pressure-sensitive adhesive layer, and the pressure-sensitive adhesive layer is easily peeled off from the adhesive layer by means of radiation curing. For example, the radiation polymerization compound is formed of a low molecular weight compound having at least two or more photopolymerization carbon-carbon double bonds in a molecule having a three-dimensional net-shaped structure by means of light irradiation.

In more detail, examples of the radiation polymerization compound are trimethylolpropane triacrylate, pentaerythritol triacrylate, pentaerythritol tetra acrylate, dipentaerythritol monohydroxy penta acrylate, dipentaerythritol hexa acrylate, 1,4-butyleneglycol diacrylate, 1,6-hexandiol deacrylate, polyethyleneglycol deacrylate, oligoester acrylate, and the like. In addition to the acrylate-based compounds as mentioned above, an example of the radiation polymerization compound is urethane acrylated oligomer. The urethane acrylated oligomer is obtained by reacting acrylate or methacrylate containing the hydroxyl group (for example, 2-hydroxy ethylacrylate, 2-hydroxy ethylmethacrylate, 2-hydroxy propylacrylate, 2-hydroxy propylmethacrylate, polyethylene glycol acrylate, polyethylene glycol methacrylate, and the like) to a terminated isocyanator urethane prepolymer that is obtained by reacting polyol compounds like polyester or polyether and polyhyfric isocyanato compounds (for example, 2,4-trilene diisocyanator, 2,6-trilene diisocyanator, 1,3-xylylenediisocyanator, 1,4-xylylenediisocyanator, diphenylmethane 4,4-diisocyanator, and the like).

The pressure-sensitive adhesive layer may be also a mixture of two or more resins selected from the above-mentioned resins.

Examples of the initiator of photopolymerization are isopropylbenzoinether, isobutylbezoinether, benzophenone, michler's ketone, chlorothioxanthone, dodecylthioxanthone, dimethyloxanthone, diethyloxanthone, benzyldimethylketal, α-hydroxy cyclo hexylphenylketon, 2-hydroxymethylphenylpropane, and the like. An amount of the initiator of photopolymerization added is preferably from 0.01 to 5 parts by weight, to 100 parts by weight of an acrylic copolymer.

(Colored support member)

Since the colored support member 24 is formed at the both end portions of the release film 21 in a short direction of the release film 21, the kind of the tape can be clearly recognized when the tape 20 for processing the semiconductor wafer is wound to the roll shape.

For instance, as the colors of the colored support member 24 are different in accordance with the kinds and thicknesses of the tape 20 for processing the semiconductor wafer, the kinds and thicknesses of the tape 20 can be easily identified, thereby suppressing and preventing the generation of artificial errors.

The tape 20 for processing the semiconductor wafer is wound to a shape of a roll having a user's desired length as a product, and alternatively, the tape 20 is wound and shipped to the number of sheets corresponding to the number of the user's desired dicing die bonding tapes. However, since the length of the tape after the manufacturing of the product and the lengths of the raw materials such as the release film 21, the adhesive layer 22 and the pressure-sensitive adhesive film 23 used for the product are different

from each other, the rest of the raw materials or the intermediate products is necessarily formed, thereby decreasing the production yield. The production yield is improved by connecting the products, but if the colors of the connected products are different from each other, the different colors are remarkably seen when viewed from the side of the roll (when viewed from the upper or lower direction on the ground as shown in FIG.8), which makes the outer appearance of the product look bad in quality, thereby causing the roll tape to be returned in some cases.

Accordingly, the formation of the colored support member 24 allows somewhat different colors on the roll sides to be absorbed to the color of the colored support member 24, thereby improving the outer appearance of the product.

Also, as shown in FIG.4b, the area where the adhesive layer 22 and the round label portion 23a of the pressure-sensitive adhesive film 23 are stacked on each other is thicker than the surrounding portion 23b of the pressure-sensitive adhesive film 23. Thus, when the tape 20 is wound to a roll shape as a product, the area where the adhesive layer 22 and the round label portion 23a of the pressure-sensitive adhesive film 23 are stacked on each other and the surrounding portion 23b of the pressure-sensitive adhesive film 23 are overlapped to each other, thereby causing the step between the two different areas to be transferred on the soft surface of the adhesive layer 22, that is, thereby causing transfer marks (for example, label marks, wrinkles, or winding marks) as shown in FIG.11. The formation of the transfer marks is remarkably increased especially when the adhesive layer 22 is formed of a soft resin and is relatively thick in thickness or when the number of times the tape 20 is wound is large.

If the transfer marks are formed, the adhesion defect between the adhesive layer 22 and the semiconductor wafer is made to cause a bad quality of semiconductor wafer process.

In this case, the formation of the colored support member 24 enables the winding pressure applied to the tape 20 when the tape 20 for processing the semiconductor wafer is wound to a roll shape to be distributed or collected to the colored support member 24, thereby suppressing the formation of the transfer marks on the adhesive layer 22.

The colored support member 24 is formed on the second surface 21b of the release film 21, as shown in FIGS.4a and 4b, but from the viewpoint of improving the recognition of the kind of the tape, the colored support member 24 may be formed on the first surface 21a of the release film 21. As shown in FIG.5, for instance, the colored support member 24 may be formed on the surrounding portion 23b of the pressure-sensitive adhesive film 23.

On the other hand, so as to suppress the formation of the transfer marks on the adhesive layer 22, the colored support member 24 is desirably formed on the second surface 21b of the release film 21. In this case, if the colored support member 24 is formed on the first surface 21a on which the adhesive layer 22 and the pressure-sensitive adhesive film 23 are formed, the colored support member 24 has the limitation in the width thereof. According to the present invention, however, if the colored support member 24 is formed at the both end portions of the release film 21 in a short direction of the release film 21, on the second film 21b of the release film 21, the colored support member 24 is extended in the width thereof, thereby more effectively suppressing the formation of the transfer marks on the adhesive layer 22. Further, the colored support member 24 is

formed on the second surface 21b of the release film 21, thereby advantageously enabling the allowance of the position error of the colored support member 24 to be large.

The colored support member 24 is desirably formed on the area corresponding to the outside of the adhesive layer 22 formed on the first surface 21a of the release film 21 on the second surface 21b of the release film 21, that is, on an area R occupied from the end portion of the release film 21 to the adhesive layer 22 on the second surface 21b of the release film 21, as shown in FIG.4a. According to this structure, the round label portion 23a of the pressure-sensitive adhesive film 23 formed on the first surface 21a of the release film 21 is not overlapped to the colored support member 24 formed on the second surface 21b of the release film 21 at the time when the tape 20 is wound, thereby preventing the transfer marks of the colored support member 24 from being formed on the adhesive layer 22.

The colored support member 24 is formed intermittently or continuously along the lengthwise direction of the release film 21, but from the viewpoint of more effectively suppressing the formation of the transfer marks, preferably, the colored support member 24 is formed continuously along the lengthwise direction of the release film 11.

The colored support member 24 has a thickness corresponding to the step between the area where the adhesive layer 22 and the round label portion 23a of the pressure-sensitive adhesive film 23 are stacked on each other and the surrounding portion 23b of the pressure-sensitive adhesive film 23, that is, equal to the adhesive layer 22 or thicker than the adhesive layer 22. FIG.6 is a sectional view showing the example of a colored support member 24' having a thicker thickness than the adhesive layer 22.

At the time of winding the tape 20, the formation of the support member 24' having the equal or thicker thickness to or than the adhesive layer 22 enables the adhesive film 23 to come into contact with the second surface 21b of the release film 21 or enables the space between the pressure-sensitive adhesive film 23 and the second surface 21b to be formed without any contact with each other, thereby preventing the second surface 21b of the release film 21 from strongly pressurizing the soft adhesive layer 22, while interposing the pressure-sensitive adhesive film 23 therebetween. Accordingly, the formation of the transfer marks can be more effectively suppressed.

The colored support member 24 of the present invention has a coefficient of linear expansion of 300ppm/℃ or less. If the coefficient of linear expansion of the colored support member 24 is more than 300ppm/℃, the variation of the size becomes high under the environments of the changes of temperature wherein heating is conducted in a next process or the keeping and delivery states at a low temperature (having a range of -20℃ to 5℃) are changed to the use state at a room temperature.

From the viewpoint of preventing the winding error of the tape 20 for processing the semiconductor wafer, moreover, the colored support member 24 is desirably formed of a material having a predetermined friction coefficient. Accordingly, the winding error of the tape 20 is prevented, thereby performing the winding operation at a high speed and increasing the number of winding times.

The colored support member 24 is formed of, for example, a pressure-sensitive adhesive tape made by applying pressure-sensitive adhesive to a colored resin base film. The

pressure-sensitive adhesive tape is attached at a predetermined position on the both end portions of the second surface 21b of the release film 21 or on the surrounding portion 23b of the pressure-sensitive adhesive film 23 of the first surface 21a of the release film 21, thereby forming the tape 20 for processing the semiconductor wafer according to the present invention. The pressure-sensitive adhesive tape is formed of a single layered, and as shown in FIG.7, it may be formed of laminated thin films.

If the resin of the colored base film of the pressure-sensitive adhesive tape has a predetermined friction coefficient for the adhesive film 23 as mentioned above and resists the winding pressure, it does not have any limitation in the selection of the material. When it is considered that the colored base film should have heat resistance and smoothness and also should be easy to be purchased, examples of the colored base film are polyethylene terephthalate PET and polyester.

The pressure-sensitive adhesive of the pressure-sensitive adhesive tape does not have any limitation in the composition and physical properties, if the pressure-sensitive adhesive is not peeled off from the release film 21 during the winding and keeping processes of the tape 20.

Next, the present invention will be in more detail described below with reference to examples. On the other hand, the present invention is not limited to the following examples set out below.

(1) Manufacturing of pressure-sensitive adhesive film

(Pressure-sensitive adhesive film 1A)

A mixture having 128g of n-butylacrylate, 307g of 2-ethylhexylacrylate, 67g of methymethacrylate, 1.5g of methacrylic acid, and benzoyl peroxide as a polymerization

initiator was added appropriately to 400g of toluene as a solvent, and the reaction temperature and reaction time were adjusted to produce a compound 1 having a functional group.

Next, to the polymer solution thus obtained was then added a compound 2 having radiation curing carbon-carbon double bonds and functional group, which was produced by adding 2.5g of 2-hydroxyethylmetacrylate that was synthesized from separate methacrylic acid and ethylglicol and a hydroquinone as a polymerization inhibitor, and the reaction temperature and reaction time were adjusted to produce a compound A having radiation curing carbon-carbon double bonds. After that, 1 parts by weight of Colonate L (manufactured by Japan Polyurethane Industry Co., Ltd.) as the polyisocyanate B, 0.5 parts by weight of Irgacure 184 (manufactured by Ciba-Geigy Industry Co., Ltd.) as the initiator of photopolymerization, and 150 parts by weight of ethyl acetate as a solvent, to 100 parts by weight of the compound A were added and mixed to the compound A, thereby producing a radiation curing pressure-sensitive adhesive layer composition.

Next, the pressure-sensitive adhesive layer composition thus obtained was applied to an ethylene-vinyl acetate copolymer base film having a thickness of 100 μm so as to have a dry film having a thickness of 20 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the pressure-sensitive adhesive film 1A.

(Pressure-sensitive adhesive film 1B)

The processing was carried out in the same manner as in the pressure-sensitive adhesive film 1A, except that the ethylene-vinyl acetate copolymer base film having a thickness of 100 μm was subjected to blast cleaning on one side surface thereof.

(Pressure-sensitive adhesive film 1C)

The processing was carried out in the same manner as in the pressure-sensitive adhesive film 1A, except that the ethylene-vinyl acetate copolymer base film having a thickness of 100 μm was subjected to release coating on one side surface thereof.

(2) Release film

Release films 2A and 2B as mentioned below were used.

Release film 2A: a polyethylene terephthalate film having a thickness of 25 μm and subjected to release coating

Release film 2B: a polypropylene film having a thickness of 25 μm and subjected to release coating

The coefficients of linear expansion of the release films 2A and 2B were 60ppm/℃ and 120ppm/℃ through the measurement by a thermomechanical analyzer (manufactured by Rigakudenki Corp.).

3. Formation of adhesive layer 3A

A composition having 50 parts by weight of a cresol novolak epoxy resin (having an epoxide equivalent weight of 197, a molecular weight of 1200, and a softening point of 70℃) as an epoxy resin, and 1.5 parts by weight of γ-mercatopropyl trimethoxysilane, 3 parts by weight of γ-ureidepropyl triethoxysilane, and 30 parts by weight of a silica filler having an average grain diameter of 16nm as a silane coupling agent, was added and mixed with cyclohexanone, and next, the mixture was mixed again by means of a bead mill for 90 minutes.

To the composition thus obtained was added and mixed 100 parts by weight of an acrylic resin (having a weight average molecular weight of 800,000 and a glass transition temperature of -17 ℃), 5 parts by weight of

dipentaerythritol hexa acrylate as 6-functional acrylatemonomer, 0.5 parts by weight of an adduct of hexamethylene diisocyanate as a curing agent, and 2.5 parts by weight of Curezol 2PZ (manufactured by Shikoku Kasei Corp.) 2-phenylimidazole. At a subsequent step, the mixture was vacuumed and de-aerated, thereby producing an adhesive.

The adhesive was applied to the release films 2A and 2B and heated and dried at 110 ℃ for 1 minutes, thereby forming a film having a thickness of 20 μm at a state of B stage (which is an intermediate state in the curing of the thermosetting resin). Thus, the adhesive layer 3A was formed on the release films 2A and 2B and was kept at a refrigerator

(4) Manufacturing of Support member

(Support member 4A)

100 parts by weight of an acrylic resin (having a weight average molecular weight of 600,000 and a glass transition temperature of -20 ℃) was mixed with 10 parts by weight of Colonate L (manufactured by Japan Polyurethane Industry Co., Ltd.) which is a polyisocyanate compound as a curing agent, thereby producing a pressure-sensitive adhesive composition.

Next, the pressure-sensitive adhesive composition thus obtained was applied to a polyethylene terephthalate film having a thickness of 75 μm so as to have a dry film having a thickness of 25 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4A.

The coefficient of linear expansion of the support member 4A was 60ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Support member 4B)

The pressure-sensitive adhesive composition thus obtained was applied to a polypropylene film having a

thickness of 75 μm so as to have a dry film having a thickness of 25 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4B.

The coefficient of linear expansion of the support member 4B was 120ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Support member 4C)

The pressure-sensitive adhesive composition thus obtained was applied to a high density polyethylene film having a thickness of 50 μm so as to have a dry film having a thickness of 50 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4C.

The coefficient of linear expansion of the support member 4C was 300ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Support member 4D)

The pressure-sensitive adhesive composition thus obtained was applied to a low density polyethylene film having a thickness of 50 μm so as to have a dry film having a thickness of 50 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4D.

The coefficient of linear expansion of the support member 4D was 350ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Support member 4E)

The pressure-sensitive adhesive composition thus obtained was applied to a ultrahigh molecular weight polyethylene film having a thickness of 50 μm so as to have a dry film having a thickness of 50 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4E.

The coefficient of linear expansion of the support member 4E was 400ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Support member 4F)

The pressure-sensitive adhesive composition thus obtained was applied to a polypropylene film having a thickness of 75 μm and being subjected to blasting cleaning on one side surface thereof so as to have a dry film having a thickness of 25 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4F.

The coefficient of linear expansion of the support member 4F was 120ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Support member 4G)

The pressure-sensitive adhesive composition thus obtained was applied to a high density polyethylene film having a thickness of 50 μm and being subjected to release coating on one side surface thereof so as to have a dry film having a thickness of 50 μm and was then dried at 110 ℃ for 3 minutes, thereby producing the support member 4G.

The coefficient of linear expansion of the support member 4G was 300ppm/℃ through the measurement by the thermomechanical analyzer (manufactured by Rigakudenki Corp.).

(Example 1)

The release film 2A on which the adhesive layer 3A is formed was moved from the refrigerator and was placed at a room temperature. Pre-cut processing for the adhesive layer 3A was carried out to a shape of a round having a diameter of 220mm, while having a cut depth of 10 μm or less to the release film 2A. After that, the unnecessary portion on the adhesive layer 3A was removed, and so as to make the

pressure-sensitive adhesive layer of the pressure-sensitive adhesive film 1A come into contact with the adhesive layer 3A, the release film 2A was laminated on the pressure-sensitive adhesive film 1A at a room temperature. Pre-cut processing for the pressure-sensitive adhesive film 1A was carried out to a shape of a round having a diameter of 290mm in a concentric circle to the adhesive layer 3A, while having a cut depth of 10 μm or less to the release film 2A. Next, the support member 4A was attached at the both end portions of the release film 2A in a short direction of the release film 2A on a second surface opposite to a first surface of the release film 2A on which the adhesive layer 3A and the pressure-sensitive adhesive film 1A were formed, thereby manufacturing the tape for processing the semiconductor wafer according to the first embodiment of the present invention as shown in FIG.1.

(Example 2)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the support member 4A was replaced by the support member 4B.

(Example 3)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the release film 2A was replaced by the release film 2B and the support member 4A was replaced by the support member 4C.

(Example 4)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the support member 4A was replaced by the support member 4C.

(Example 5)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the pressure-sensitive adhesive film 1A was replaced by the pressure-sensitive adhesive film 1B and the support member 4A was replaced by the support member 4C.

(Example 6)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the pressure-sensitive adhesive film 1A was replaced by the pressure-sensitive adhesive film 1C and the support member 4A was replaced by the support member 4B.

(Example 7)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the pressure-sensitive adhesive film 1A was replaced by the pressure-sensitive adhesive film 1B and the support member 4A was replaced by the support member 4G.

(Example 8)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the pressure-sensitive adhesive film 1A was replaced by the pressure-sensitive adhesive film 1C and the support member 4A was replaced by the support member 4F.

Also, the coefficients of static friction between the support members and the base films of the pressure-sensitive adhesive films for the tapes for processing the semiconductor

wafer in Examples 1 to 8 were measured. The results of the measurement are set forth in Table 1.

(Comparative Example 1)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the release film 2A was replaced by the release film 2B and the support member 4A was replaced by the support member 4D.

(Comparative Example 2)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the support member 4A was replaced by the support member 4D.

(Comparative Example 3)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that the support member 4A was replaced by the support member 4E.

(Comparative Example 4)

The processing for manufacturing the tape for processing the semiconductor wafer was carried out in the same manner as in Example 1, except that no support member was formed.

Also, the coefficients of static friction between the support members and the base films of the pressure-sensitive adhesive films for the tapes for processing the semiconductor wafer in Comparative examples 1 to 3 were measured. The results of the measurement were set forth in Table 2.

[Estimation of the suppression property of the formation of transfer marks (label marks, wrinkles, or winding marks) and voids]

The tapes for processing the semiconductor wafer according to Examples 1 to 8 and Comparative examples 1 to 4 were wound to a roll having 300 sheets of round pressure-sensitive adhesive films, thereby producing the rolls of the tapes for processing the semiconductor wafer. The rolls of the tapes were kept at a refrigerator (at 5℃) for one month. After that, the rolls of the tapes were placed to a room temperature and were then unwound. Thus, it was checked whether the transfer marks exist or not, and the suppression property of the formation of the transfer marks and voids was evaluated in accordance with the following criterion of three steps ○, △, and ×. The results of the estimation are set forth in Tables 1 and 2.

○: No transfer marks or voids are checked from every angle when viewed through eyes.

△: Some transfer marks or voids are checked in accordance with viewing angles.

×: Transfer marks or voids are checked from every angle when viewed through eyes.

[Existence of the generation of winding error]

It was checked whether the winding error occurs or not while being manufactured, while being kept at the refrigerator, and while being in use at a room temperature, for the tapes for processing the semiconductor wafer according to Examples 1 to 8 and Comparative examples 1 to 4. The checking results are set forth in Tables 1 and 2.

[Estimation of handling and productivity]

It was checked that the handling and productivity were evaluated while being manufactured, while being kept at the refrigerator, and while being in use at a room temperature, for the tapes for processing the semiconductor wafer according to Examples 1 to 8 and Comparative examples 1 to 4,

in accordance with the following criterion of three steps of ◎, ○, and ×. The results are set forth in Tables 1 and 2.

◎: Handing and productivity are excellent.

○: Handing and productivity are good.

×: Handing and productivity are a little bad.

[Table 1]

	1st Embo-diment	2nd Embo-ment	3rd Embo-diment	4th Embo-diment	5th Embo-diment	6th Embo-diment	7th Embo-diment	8th Embo-diment
Support member	4A	4B	4C	4C	4C	4B	4G	4F
Coefficient of linear expansion of support member (ppm/℃)	60	120	300	300	300	120	300	120
Pressure-sensitive adhesive film	1A	1A	1A	1A	1B	1C	1B	1C
Release film	2A	2A	2B	2A	2A	2A	2A	2A
Coefficient of linear expansion of release film(ppm/℃)	60	60	120	60	60	60	60	60
Adhesive layer	3A							
Difference between coefficients of linear expansion of support member and release film (ppm/℃)	0	60	180	240	240	60	240	60

Coefficients of static friction between support member and base film of pressure-sensitive adhesive film (-)	0.9	0.9	0.6	0.6	0.4	1.8	0.1	2.5
	1st Embo-diment	2nd Embo-diment	3rd Embo-diment	4th Embo-diment	5th Embo-diment	6th Embo-diment	7th Embo-diment	8th Embo-diment
Transfer mark formation-suppressing effect	o	o	o	o	o	o	o	o
Void formation-suppressing effect	o	o	o	o	o	o	o	o
Generation of winding error	no	no	no	no	no	no	no	no
Handling and productivity	◎	◎	◎	◎	o	o	×	×

[Table 2]

	Comparative example 1	Comparative example 2	Comparative example 3	Comparative example 4
Support member	4D	4D	4E	-
Coefficient of linear expansion of support member (ppm/℃)	350	350	400	-
Pressure-sensitive adhesive film	1A	1A	1A	1A
Release film	2B	2A	2A	2A

Coefficient of linear expansion of release film (ppm/℃)	120	60	60	60
Adhesive layer	3A			
Difference between coefficients of linear expansion of support member and release film (ppm/℃)	230	290	340	-
Coefficients of static friction between support member and base film of pressure-sensitive adhesive film (-)	1.1	1.1	1.8	-
	Comparative example 1	Comparative example 2	Comparative example 3	Comparative example 4
Transfer mark formation-suppressing effect	o	o	o	×
Void formation-suppressing effect	△	×	×	o
Generation of winding error	no	no	no	no
Handling and productivity	◎	◎	◎	◎

It was found that no transfer marks were formed in Examples 1 to 8 and Comparative examples 1 to 3 wherein the

support member was formed on the underside of the tape for processing the semiconductor wafer, whereas the transfer marks were formed in Comparative example 4 wherein no support member was formed. Accordingly, it could be understood that the formation of the transfer marks was suppressed by the formation of the support member.

Further, no voids were formed in Examples 1 to 8 wherein the coefficients of linear expansion of the support members were 300ppm/℃ or less, whereas voids were formed in Comparative examples 1 to 3 wherein the coefficients of linear expansion of the support members were more than 300ppm/℃. Accordingly, it could be understood that the formation of the support member caused by the changes of temperature was suppressed by the formation of the support member having the coefficient of linear expansion of the support member of 300ppm/℃ or less.

In Comparative examples 1 to 3 wherein the formation of voids were checked, especially, the formation of voids were absolutely checked in Comparative examples 2 and 3 wherein the difference between the coefficients of linear expansion of the support member and the release film was 250ppm/℃ or more. Accordingly, it could be understood that the voids were likely to be more easily formed when the difference between the coefficients of linear expansion of the support member and the release film was relatively big.

Further, it was checked that the handling and productivity were good in Examples 1 to 6 and Comparative examples 1 to 3 wherein the coefficients of static friction between the base film of the pressure-sensitive adhesive film and the support member is in a range of 0.2 to 2.0, whereas the handling and productivity were very bad in Example 7 wherein the coefficient of static friction between the base

film of the pressure-sensitive adhesive film and the support member was less than 0.2 and in Example 8 wherein the coefficient of static friction between the base film of the pressure-sensitive adhesive film and the support member was more than 2.0. Especially, the winding error was generated in Example 7 wherein the coefficient of static friction between the base film of the pressure-sensitive adhesive film and the support member was less than 0.2.

As apparent from the foregoing, it was checked that when the tapes for processing the semiconductor wafer according to the present invention in Examples 1 to 8 were wound to the rolls, the formation of transfer marks was sufficiently suppressed and the generation of voids caused by the changes of temperature was also sufficiently suppressed.

【CLAIMS】

【Claim 1】

A tape for processing a semiconductor wafer comprising:

a release film having a relatively long length;

an adhesive layer formed on a first surface of the release film and having a predetermined plane shape;

a pressure-sensitive adhesive film having a label portion having a predetermined plane shape and formed to cover the adhesive layer in such a manner as to be brought into contact with the release film around the adhesive layer and a surrounding portion adapted to surround the outside of the label portion; and

a support member formed at the both end portions of the release film in a short direction of the release film, on a second surface of the release film opposite to the first surface of the release film on which the adhesive layer and the pressure-sensitive adhesive film are formed, the support member having a coefficient of linear expansion of 300ppm/℃ or less.

【Claim 2】

The tape for processing a semiconductor wafer according to claim 1, wherein the difference between the coefficient of linear expansion of the support member and the coefficient of linear expansion of the release film is 250ppm/℃ or less.

【Claim 3】

The tape for processing a semiconductor wafer according to claim 1 or 2, wherein the pressure-sensitive adhesive film includes a pressure-sensitive adhesive layer and a base film, and the coefficient of static friction between the base film of the pressure-sensitive adhesive film and the support member is in a range of 0.2 to 2.0.

【Claim 4】

The tape for processing a semiconductor wafer according to any one of claims 1 to 3, wherein the support member is formed on the area corresponding to the outside of the adhesive layer formed on the first surface of the release film, on the second surface of the release film.

【Claim 5】

The tape for processing a semiconductor wafer according to any one of claims 1 to 4, wherein the support member is formed continuously along the lengthwise direction of the release film.

【Claim 6】

The tape for processing a semiconductor wafer according to any one of claims 1 to 5, wherein the support member has a thicker thickness than the adhesive layer.

【Claim 7】

The tape for processing a semiconductor wafer according to any one of claims 1 to 6, wherein the support member is a colored member.

【Claim 8】

The tape for processing a semiconductor wafer according to claim 7, wherein the colored member is colored in accordance with the kinds of the tape for processing the semiconductor wafer.

【Claim 9】

The tape for processing a semiconductor wafer according to claim 7, wherein the colored member is colored in accordance with the thicknesses of the tape for processing the semiconductor wafer.

【Claim 10】

The tape for processing a semiconductor wafer according to any one of claims 1 to 9, wherein the support member has a two or more-layered structure.

【Claim 11】

The tape for processing a semiconductor wafer according to any one of claims 1 to 10, wherein the support member is formed of a pressure-sensitive adhesive tape made by applying a pressure-sensitive adhesive on a base film, the base film being selected from the group consisting of polyethylene terephthalate, polypropylene, and high density polyethylene.

【Claim 12】

A tape for processing a semiconductor wafer comprising:

a release film having a relatively long length;

an adhesive layer formed on a first surface of the release film and having a predetermined plane shape;

a pressure-sensitive adhesive film having a label portion having a predetermined plane shape and formed to cover the adhesive layer in such a manner as to be brought into contact with the release film around the adhesive layer and a surrounding portion adapted to surround the outside of the label portion; and

a colored support member formed at the both end portions of the release film in a short direction of the release film having the relatively long length.

【Claim 13】

The tape for processing a semiconductor wafer according to claim 12, wherein the colored support member is formed on a second surface of the release film opposite to the first surface of the release film on which the adhesive layer and the pressure-sensitive adhesive film are formed.

【Claim 14】

The tape for processing a semiconductor wafer according to claim 13, wherein the colored support member is formed on the area corresponding to the outside of the adhesive layer formed on the first surface of the release film, on the second surface of the release film.

【Claim 15】

The tape for processing a semiconductor wafer according to any one of claims 12 to 14, wherein the colored support member is formed continuously along the lengthwise direction of the release film.

【Claim 16】

The tape for processing a semiconductor wafer according to any one of claims 12 to 15, wherein the colored support member has a thicker thickness than the adhesive layer.

【Claim 17】

The tape for processing a semiconductor wafer according to any one of claims 12 to 16, wherein the colored support member has a two or more-layered structure.

【Claim 18】

The tape for processing a semiconductor wafer according to any one of claims 12 to 17, wherein the colored support member is formed of a pressure-sensitive adhesive tape made by applying a pressure-sensitive adhesive on a base film, the base film being selected from the group consisting of polyethylene terephthalate and polyester.

【Claim 19】

The tape for processing a semiconductor wafer according to any one of claims 12 to 18, wherein the colors of the colored support member are different in accordance with the kinds of the tape for processing the semiconductor wafer.

【Claim 20】

The tape for processing a semiconductor wafer according to any one of claims 12 to 19, wherein the colors of the colored support member are different in accordance with the thicknesses of the tape for processing the semiconductor wafer.