

DESCRIPTION

DIE-SORTING SHEET AND METHOD FOR TRANSPORTING
CHIPS HAVING ADHESIVE LAYER

5 FIELD OF THE INVENTION

[0001]

The present invention relates to die-sorting sheets and methods for transporting chips having an adhesive layer. In more detail, the invention relates to die-sorting sheets on which
10 chips having an adhesive layer may be temporarily attached, and methods for transporting chips having an adhesive layer with the die-sorting sheets.

[0002]

The manufacturing of semiconductor devices involves a
15 dicing step in which a semiconductor wafer provided with circuits through necessary preprocessing is cut and separated into chips. In this step, a dicing sheet for fixing the semiconductor wafer is attached to a circular or square frame called a ring frame; and the semiconductor wafer is attached to the dicing sheet and
20 diced with respect to each circuit to manufacture semiconductor chips. The dicing step is followed by an expanding step with a bonding machine and a die-bonding step wherein a die-bonding adhesive such as an epoxy resin is applied to pads on substrates and the semiconductor chips are bonded onto the substrates.

Further, the chips are subjected to a wire-bonding step and an inspection step and are finally encapsulated with a resin in a molding step, whereby semiconductor devices are manufactured.

[0003]

5 Meanwhile, individualized semiconductor chips are often accommodated and transported without being die-bonded. In this case, the die-bonding step is performed off line.

[0004]

10 For the accommodation and transportation of semiconductor chips, a reeled embossed carrier tape or chip tray produced by embossing a thermoplastic resin sheet with recessed pockets is used. The semiconductor chips are placed in the recessed pockets and covered with a cover sheet, and the chips are stored and transported until they are mounted on electronic devices.

15 The use of such embossed carrier tapes permits selective shipment of non-defective products after the dicing step, or allows semiconductor chips from a single wafer to be shipped to separate factories.

[0005]

20 Since dusts and contamination can cause failures in semiconductor devices, semiconductor chips transported to facilities are often cleaned with water before use. To perform cleaning, it is necessary that the chips collected from the embossed carrier tapes should be re-fixed on a dicing tape or

the like, and this causes significant inefficiency.

[0006]

Patent Document 1 discloses a technique wherein semiconductor chips are accommodated and transported while being mounted on a pressure-sensitive adhesive tape such as a heat-removable tape or a general dicing tape. In this case, the semiconductor chips are attached to a pressure-sensitive adhesive layer of the adhesive tape.

[0007]

As described hereinabove, the embossed carrier tapes or general dicing tapes are used to accommodate and transport semiconductor chips before the die-bonding step, that is, the semiconductor chips do not have an adhesive on the back surface thereof yet.

[0008]

Because applying an adhesive at the time of die-bonding increases complexity, Patent Document 2 discloses a dicing sheet that has an adhesive layer functioning as both a wafer-fixing pressure-sensitive adhesive and a die-bonding adhesive. The adhesive layer is applied to a back surface of a wafer prior to the dicing step and is diced to a chip size together with the wafer. When the chip is picked up, the adhesive layer is held on the back surface of the chip.

Patent Document 1: JP-A-2000-95291

Patent Document 2: JP-A-H02-32181

SUMMARY OF THE INVENTION

5 [0009]

The above adhesive layer has a certain level of tackiness (adhesion) required to fix the wafer (chips) during the dicing step. When the semiconductor chips with tackiness on the back surface are accommodated in the embossed carrier, they adhere
10 to the embossed carrier because of the tackiness. It is therefore difficult to collect the semiconductor chips from the recessed pockets in the subsequent step. Further, collecting the chips results in deformation of the adhesive layer on the back surface. Such semiconductor chips reduce the reliability
15 of the obtainable semiconductor devices.

[0010]

Further, when the above semiconductor chips are accommodated on a general dicing tape, the adhesive layer of the semiconductor chips firmly attaches to the
20 pressure-sensitive adhesive of the dicing tape to make the picking up in the subsequent step difficult. Further, when the chips are picked up, the adhesive layer on the chip back surface can be contaminated by the pressure-sensitive adhesive of the dicing tape that remains attached thereto. This contamination

also reduces the reliability of the obtainable semiconductor devices.

[0011]

The problems mentioned above are not limited to chips from
5 semiconductor wafers but are also probable with any chip products
such as optical chips.

[0012]

It is therefore an object of the present invention to
provide die-sorting sheets whereby even chips having a tacky
10 adhesive layer on the back surface can be stably accommodated
and transported, and methods for stably accommodating and
transporting such chips having an adhesive layer by the use of
the die-sorting sheets.

[0013]

15 The present inventors diligently studied and have invented
specific die-sorting sheets that can solve the above problems.
The present invention has been thus completed.

[0014]

A die-sorting sheet according to the present invention on
20 which a chip having an adhesive layer is temporarily attached
comprises a pressure-sensitive adhesive layer exposed on an
outer periphery of the die-sorting sheet, and a base film exposed
on a central area that is inside the outer periphery.

[0015]

In the die-sorting sheet, the pressure-sensitive adhesive layer is preferably laminated on an outer periphery of the base film.

[0016]

5 Preferably, the pressure-sensitive adhesive layer is laminated on a support film and is shaped identically with the support film, and the base film is laminated on a central area of the pressure-sensitive adhesive layer.

[0017]

10 A method for transporting a chip having an adhesive layer according to the present invention comprises:

 applying a dicing and die-bonding adhesive sheet to a surface of a substrate, the adhesive sheet comprising an adhesive layer and a base material;

15 full-cut dicing the substrate with respect to chips together with the adhesive layer;

 picking up a chip having the adhesive layer on the back surface thereof, from the base material;

 providing the die-sorting sheet of the invention that is
20 fixed with a frame through the pressure-sensitive adhesive layer on the outer periphery;

 temporarily attaching the picked up chip through the adhesive layer thereof onto the base film exposed on the die-sorting sheet; and

transporting the die-sorting sheet to a subsequent step while the chip is temporarily attached on the sheet through the adhesive layer.

[0018]

5 In a preferred embodiment of the method for transporting a chip having an adhesive layer, a plurality of the chips are temporarily attached to the base film exposed on the die-sorting sheet while the respective adhesive layers are separate from one another.

10

ADVANTAGES OF THE INVENTION

[0019]

According to the methods of the present invention, even chips having an adhesive layer can be stably accommodated and
15 transported on the die-sorting sheets. In subsequent steps after the accommodation and transportation, the chips that are temporarily attached on the die-sorting sheets can be picked up without contamination or deformation of the adhesive layer of the chips. Accordingly, highly reliable semiconductor
20 devices may be manufactured using the chips that are picked up.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a perspective view of a die-sorting sheet

according to the present invention.

Fig. 2 is a cross sectional view taken on line X-X of Fig. 1.

Fig. 3 is a cross sectional view of a die-sorting sheet according to the present invention.

Fig. 4 is a perspective view of a die-sorting sheet of the present invention.

Fig. 5 is a cross sectional view taken on line Y-Y of Fig. 4.

Fig. 6 is a perspective view of a ring frame.

Fig. 7 is a view for explaining a method for transporting a chip having an adhesive layer according to the present invention.

Fig. 8 is a view for explaining a method for transporting a chip having an adhesive layer according to the present invention.

Fig. 9 is a view for explaining a method for transporting a chip having an adhesive layer according to the present invention.

Fig. 10 is a view for explaining a method for transporting a chip having an adhesive layer according to the present invention.

Fig. 11 is a view for explaining a method for transporting a chip having an adhesive layer according to the present

invention.

Fig. 12 is a view for explaining a method for transporting a chip having an adhesive layer according to the present invention.

5

DESCRIPTION OF NUMERALS

[0021]

- 10: die-sorting sheet
- 11: pressure-sensitive adhesive layer
- 10 11a: pressure-sensitive adhesive layer
- 11b: core film
- 11c: pressure-sensitive adhesive layer
- 12: base film
- 13: outer periphery
- 15 14: central area
- 20: die-sorting sheet
- 21: pressure-sensitive adhesive layer
- 21a: pressure-sensitive adhesive layer
- 21b: core film
- 20 21c: pressure-sensitive adhesive layer
- 22: base film
- 23: outer periphery
- 24: central area
- 40: die-sorting sheet

- 41: base film
- 42a: pressure-sensitive adhesive layer
- 42b: support film
- 42: general dicing sheet
- 5 43: outer periphery
- 44: central area
- 50: ring frame
- 51: opening
- 52: flat notch
- 10 53: planned surface that is to be attached to the
die-sorting sheet
- 60: dicing and die-bonding adhesive sheet
- 61: adhesive layer
- 62: base material
- 15 70: semiconductor wafer
- 80: semiconductor chip
- 81: separated adhesive layer

PREFERRED EMBODIMENTS OF THE INVENTION

20 [0022]

The present invention will be described in detail
hereinbelow.

[0023]

[Die-sorting sheets]

Die-sorting sheets according to the present invention are used to temporarily attach thereon a chip having an adhesive layer for the purpose of transportation or the like. A pressure-sensitive adhesive layer is exposed on an outer periphery of the die-sorting sheet, and a base film is exposed on a central area that is inside the outer periphery.

[0024]

A preferred embodiment of the die-sorting sheets is illustrated in a perspective view and a cross sectional view in Figs. 1 and 2, respectively, wherein a die-sorting sheet 10 has a pressure-sensitive adhesive layer 11 laminated on an outer periphery of a base film 12. As shown, the pressure-sensitive adhesive layer 11 is exposed on an outer periphery 13 of the die-sorting sheet 10, and the base film 12 is exposed on a central area 14 that is inside the outer periphery.

[0025]

The base films 12 are not particularly limited, but resin films may be used with examples including polyethylene films, polypropylene films, polyvinyl chloride films, ethylene/vinyl acetate copolymer films, ethylene/(meth)acrylic acid copolymer films, ethylene/(meth)acrylate copolymer films, polyethylene terephthalate films and polyurethane films.

[0026]

The thickness of the base film 12 is preferably 10 to 1000

μm , and more preferably 20 to 800 μm .

[0027]

The surface tension on the surface of the base film 12 on which chips will be mounted is preferably not more than 40 mN/m, and more preferably not more than 35 mN/m. The surface tension is preferably not less than 20 mN/m. In the use of the die-sorting sheet 10, a chip having an adhesive layer is temporarily attached to the base film through the adhesive layer. The base films having the above surface tension permit stable accommodation and transportation of the chips. Further, the base films permit high releasability of the adhesive layer of the semiconductor chips therefrom, and the chips may be easily picked up in the subsequent step. Furthermore, the base film covers the entire surface of the adhesive layer to prevent the adhesive layer from any contamination, and the enhanced releasability prevents the adhesive layer from being deformed in a removing operation. Accordingly, semiconductor devices with high reliability may be manufactured.

[0028]

The above surface tension of the base films 12 may be achieved by appropriately selecting materials or by release treatments such as coating the surface of resin films with agents such as silicone resins.

[0029]

The pressure-sensitive adhesive layer 11 may be a double-sided pressure-sensitive adhesive sheet as illustrated in Fig. 2 wherein pressure-sensitive adhesive layers 11a and 11c are provided on both surfaces of a core film 11b. The
5 double-sided pressure-sensitive adhesive sheet is attached and fixed to a ring frame 50 through the pressure-sensitive adhesive layer 11a, and is bonded and integrated with the base film 12 through the pressure-sensitive adhesive layer 11c. Because the
10 levels of adhesion required for accommodation, transportation or picking up of the chips are varied, the use of the double-sided pressure-sensitive adhesive sheet provides an advantage that pressure-sensitive adhesive layers (11a and 11c) each having appropriate adhesion may be selected.

[0030]

15 The pressure-sensitive adhesive layer 11 has such a size that it may be fixed to a ring frame 50 used in the transporting methods of the present invention. The ring frame 50 is generally a metal or plastic shaped product. Needless to say, an opening
20 51 of the ring frame 50 has an inner diameter that is somewhat larger than the exposed central area of the base film on which semiconductor chips will be temporarily attached. (See Fig. 6.) Part of the outer periphery of the ring frame 50 is cut away to provide a flat notch 52 for a guide. In the transporting methods of the invention as will be described later, the under

surface of the ring frame 50 is attached to the pressure-sensitive adhesive layer 11 of the die-sorting sheet 10 (Fig. 10). In the present specification, the surface that is to be attached to the pressure-sensitive adhesive layer 11 is referred to as the "planned surface that is to be attached to the die-sorting sheet". Back to the description of the size of the pressure-sensitive adhesive layer 11, the pressure-sensitive adhesive layer 11 has such a size that it may be fixed to the planned surface 53 that is to be attached to the die-sorting sheet, of the ring frame 50. In detail, the outer diameter of the pressure-sensitive adhesive layer 11 should be larger than the diameter of the opening 51.

[0031]

The core films 11b may be resin films similar to the base films 12. The use of relatively rigid films such as polyethylene terephthalate films provides good dimensional stability during the production of the die-sorting sheets 10.

[0032]

The thickness of the core films 11b is preferably 10 to 500 μm , and more preferably 30 to 200 μm .

[0033]

The pressure-sensitive adhesive layers 11a and 11c may be formed from acrylic pressure-sensitive adhesives, rubber based pressure-sensitive adhesives, silicone based

pressure-sensitive adhesives or emulsion pressure-sensitive adhesives. Of these, acrylic pressure-sensitive adhesives are preferred. The pressure-sensitive adhesive layers 11a and 11c may be formed from an identical pressure-sensitive adhesive.

5 In a preferred embodiment, the pressure-sensitive adhesive layer 11c that faces to the base film 12 is formed from a pressure-sensitive adhesive having stronger adhesion, and the pressure-sensitive adhesive layer 11a that attaches to the ring frame 50 is made of a removable pressure-sensitive adhesive.

10 [0034]

The pressure-sensitive adhesive layers 11a and 11c each preferably range in thickness from 1 to 100 μm , and more preferably 3 to 80 μm .

[0035]

15 The die-sorting sheets 10 of the present invention may be produced as follows.

[0036]

20 A double-sided pressure-sensitive adhesive sheet as a pressure-sensitive adhesive layer 11 is provided while release films treated with a silicone releasing agent or the like are disposed on both surfaces of the adhesive sheet. When pressure-sensitive adhesive layers 11a and 11c of the double-sided pressure-sensitive adhesive sheet are formed from differing pressure-sensitive adhesives, a lightly removable

release film is disposed on the pressure-sensitive adhesive layer 11c that laminates to a base film 12 and a release film of heavy release type is disposed on the pressure-sensitive adhesive layer 11a that adherers to a ring frame 50. The lightly
5 removable release film is released first. Such differing levels of removability of the lightly and heavily removable release films enhance workability during the production of the die-sorting sheets 10.

[0037]

10 Before the pressure-sensitive adhesive layer 11 is laminated on the base film 12, it is cut to an approximately circular shape by punching or the like. In an embodiment, the pressure-sensitive adhesive layer 11 and the lightly removable
15 removable release film are selectively punched out but the heavily removable release film is not completely punched out, whereby the heavily removable release film is used as a carrier of the pressure-sensitive adhesive layer 11 and the subsequent processing may be carried out continuously roll to roll.

[0038]

20 Next, the remaining lightly removable release film and the punched-out inner circular part of the pressure-sensitive adhesive layer 11 are released and removed, and the pressure-sensitive adhesive layer is laminated on the base film 12.

[0039]

Subsequently, an outer peripheral portion of the pressure-sensitive adhesive layer 11 is punched out substantially concentrically with the inner circular part of the layer 11 that has been cut away and so as to meet the diameter of the ring frame 50 that will be attached thereto. In this case too, it is preferable that the heavily removable release film is not punched out. In detail, referring to Figs. 1 and 2, outer peripheral portions of the base film 12 and the pressure-sensitive adhesive layer 11 are cut and removed beforehand to meet the diameter of the ring frame 50. This preliminary cutting to the shape of the ring frame 50 enables eliminating a step of cutting the die-sorting sheet 10 when the die-sorting sheet 10 is attached to the ring frame 50. The die-sorting sheets 10 may be manufactured as described above.

[0040]

In the transporting methods of the present invention as will be described later, the frames are not limited to the ring frame 50 shown in Fig. 6 and conventional frames with various shapes may be used. Therefore, the die-sorting sheets of the present invention are not limited to the shapes as illustrated in Figs. 1 and 2 and may have shapes corresponding to the frames. For example, when the frame is square, the die-sorting sheet may be square too. Further, the shape of the central area 14

of the die-sorting sheet 10 may have any optional shape, in other words, the shape of the adhesive layer 11 to be removed may have any optional shape.

[0041]

5 The pressure-sensitive adhesive layer may be composed of a single or two adhesive layers without a core film. The absence of the core films leads to smaller thickness of the pressure-sensitive adhesive layer and reduces the step height in the die-sorting sheets. It is accordingly less likely that
10 imprinted marks are caused during storage of rolled die-sorting sheets.

[0042]

Fig. 3 shows another embodiment that corresponds to a reversed structure of the die-sorting sheet 10 of Fig. 2. In
15 a die-sorting sheet 20 illustrated in the figure, a pressure-sensitive adhesive layer 21 is laminated on the under surface of a base film 22. In detail, the pressure-sensitive adhesive layer 21 is exposed on outer periphery 23 of the under surface of the die-sorting sheet 20, and the base film 22 is
20 exposed on a central area 24 of the upper surface of the die-sorting sheet (Fig. 3). In this case, a semiconductor chip 80 is temporarily attached and accommodated on the upper surface of the base film 24 as will be described later (Fig. 11).

[0043]

The pressure-sensitive adhesive layer 21 is a double-sided pressure-sensitive adhesive sheet wherein pressure-sensitive adhesive layers 21a and 21c are provided on both surfaces of a core film 21b. Similar to the pressure-sensitive adhesive layer in the die-sorting sheet 10, the pressure-sensitive adhesive layer has such a size that it may be fixed to a ring frame 50 used in the transporting methods of the present invention. The core film 21b is similar to that in the pressure-sensitive adhesive layer 11b, and the pressure-sensitive adhesive layers 21a and 21c are similar to the pressure-sensitive adhesive layers 11a and 11c.

[0044]

In the die-sorting sheets 20, the surface on which chips are temporarily attached is different from the surface on which the pressure-sensitive adhesive layer for the fixing to the ring frame is provided. It is therefore possible to optimally control the keying (interlayer adhesion) between the pressure-sensitive adhesive layer 21 and the base film 22, and surface properties required for the temporal attaching of chips.

[0045]

Another preferred embodiment of the die-sorting sheets is illustrated in a perspective view and a cross sectional view in Figs. 4 and 5, respectively, wherein a die-sorting sheet 40 is a laminate in which a support film 42 is laminated with a

pressure-sensitive adhesive layer 42a that is shaped identically with the support film, and a base film 41 is laminated on a central area of the pressure-sensitive adhesive layer. The pressure-sensitive adhesive layer 42a is exposed on an outer periphery 43 of the die-sorting sheet 40, and the base film 41 is exposed on a central area 44 that is inside the outer periphery. It is preferable structure that is similar to the laminate order of the structure shown in Fig. 5, the pressure-sensitive adhesive layer 42a and the base film 41 may have larger diameters than the support film 42b and the pressure-sensitive adhesive layer 42a may be exposed on an outer periphery of the under surface of the base film 41.

[0046]

A general dicing tape 42 may be used as a unit of the support film 42b and the pressure-sensitive adhesive layer 42a, but the scope of the invention is not limited thereto.

[0047]

The base film 41 and the support film 42b may be appropriately selected from the resin films described with respect to the base film 12. The thickness of the base film 41 is preferably 1 to 200 μm , and more preferably 5 to 100 μm , and the thickness of the support film 42b is preferably 10 to 500 μm , and more preferably 30 to 300 μm . The surface tension on the surface of the base film 41 on which chips will be mounted

is the same as that of the base film 12.

[0048]

The pressure-sensitive adhesive layer 42a may be formed from a pressure-sensitive adhesive similar to that of the pressure-sensitive adhesive layer 11a. The thickness of the pressure-sensitive adhesive layer 42a is preferably 1 to 100 μm , and more preferably 3 to 80 μm .

[0049]

The pressure-sensitive adhesive layer 42a has such a size that an exposed portion thereof is large enough to be attached to the ring frame 50. In detail, the exposed portion of the pressure-sensitive adhesive layer 42a should have such a size that the pressure-sensitive adhesive layer 42a may be fixed to a planned surface 53 of the ring frame 50 that is to be attached to the die-sorting sheet. In more detail, the outer diameter of the pressure-sensitive adhesive layer 42a should be larger than the diameter of the opening 51. The base film 41 on which semiconductor chips will be temporarily attached is somewhat smaller than the inner diameter of the opening 51 of the ring frame 50.

[0050]

The production of the die-sorting sheet 40 starts with providing a pressure-sensitive adhesive sheet that has a support film 42b and a pressure-sensitive adhesive layer 42a. A base

film 41 cut to a predetermined shape is attached on the pressure-sensitive adhesive layer 42a. A release film is disposed to cover the surfaces of the base film 41 and the pressure-sensitive adhesive layer 42a. Thereafter, the support
5 film 42b and the pressure-sensitive adhesive layer 42a are punched from the support film 42b into a predetermined profile while avoiding punching out the release film.

[0051]

Alternatively, a die-sorting sheet 40 may be fabricated
10 as follows. A base film 41 is laminated on a pressure-sensitive adhesive layer 42a of a pressure-sensitive adhesive sheet that has a support film 42b and the pressure-sensitive adhesive layer 42a. The base film 41 is punched to a predetermined shape and an outer peripheral portion thereof is removed while avoiding
15 punching out the pressure-sensitive adhesive layer 42a. A release film is disposed and the laminate is punched out to a predetermined profile in the same manner as described above.

[0052]

[Methods for transporting chips with adhesive layer]

20 The methods for transporting chips having an adhesive layer according to the present invention will be described hereinbelow based on embodiments wherein the substrate is a semiconductor wafer. That is, the methods described below address the transporting of semiconductor chips having an

adhesive layer. The transporting methods of the present invention are not limited to the transportation of semiconductor wafers and may be used for other substrates such as glass substrates. In the following embodiments, the die-sorting
5 sheets are die-sorting sheets 10 as illustrated in Fig. 2. In the methods for transporting chips having an adhesive layer according to the present invention, however, any of the die-sorting sheets as described above may be used.

[0053]

10 In a method for transporting a semiconductor chip having an adhesive layer, a dicing and die-bonding adhesive sheet that has an adhesive layer and a base material is applied to a back surface of a semiconductor wafer.

The semiconductor wafer is then full-cut diced with
15 respect to chips together with the adhesive layer.

A semiconductor chip having the adhesive layer on the back surface thereof is picked up from the base material.

[0054]

In detail, as shown in Fig. 7, a dicing and die-bonding
20 adhesive sheet 60 having an adhesive layer 61 and a base material 62 is provided. In the dicing and die-bonding adhesive sheet 60, the adhesive layer 61 is releasably laminated on the base material 62. To protect the adhesive layer 61, a release film may be disposed on the upper surface of the adhesive layer 61

until the adhesive sheet is used. The release films may be general release films such as polyethylene terephthalate films that are release treated with releasing agents such as silicone resins.

5 [0055]

The dicing and die-bonding adhesive sheet 60 may be produced by any methods without limitation. For example, a composition for forming an adhesive layer 61 may be applied and dried on a base material 62. Alternatively, an adhesive layer
10 61 may be formed on a release film and may be transferred onto a base material 62. An outer peripheral portion of the surface of the adhesive layer 61 may be provided with a ring frame-fixing pressure-sensitive adhesive sheet to immobilize a ring frame.
[0056]

15 Thereafter, as shown in Fig. 8, the dicing and die-bonding adhesive sheet 60 is fixed on a dicing apparatus via a ring frame 50; a surface of a semiconductor wafer 70 is placed on the adhesive layer 61 of the dicing and die-bonding adhesive sheet 60, and the semiconductor wafer 70 is fixed thereto by light
20 pressing against the adhesive layer.
[0057]

In the case where the adhesive layer 61 has energy ray curability, an energy ray is applied through the base material 62 and thereby the cohesion of the adhesive layer 61 is increased

to lower the adhesion between the adhesive layer 61 and the base material 62. The energy ray may be applied after dicing or after the expanding step described below.

[0058]

5 Thereafter, as shown in Fig. 9, the semiconductor wafer 70 is cut with respect to circuits by cutting means such as a dicing saw, and semiconductor chips 80 are obtained. The cutting is effected to an appropriate depth in consideration of the total thickness of the semiconductor wafer 70 and adhesive
10 layer 61 and the abrasion of the dicing saw, while ensuring that the semiconductor wafer 70 and the adhesive layer 61 are cut completely.

[0059]

Subsequently, the dicing and die-bonding adhesive sheet
15 60 may be expanded as required, whereby the distance between neighboring semiconductor chips is increased to further facilitate the picking up of the semiconductor chips 80. The expansion causes the adhesive layer 61 and the base material 62 to slide past each other, and the adhesion between the adhesive
20 layer 61 and the base material 62 is reduced to permit the semiconductor chips 80 to be picked up easily.

[0060]

By picking up the semiconductor chips 80, the separated adhesive layer 81 is separated from the base material 62 and

remains attached to the back surface of the semiconductor chips 80. That is, the semiconductor chips 80 are picked up while having the adhesive layer 81 on the back surface thereof.

[0061]

5 Thereafter, a die-sorting sheet 10 is provided in another process to the above which is fixed to a ring frame 50 through a pressure-sensitive adhesive layer 11 on an outer periphery 13.

[0062]

10 Next, the semiconductor chips 80 that are picked up are temporarily attached through the adhesive layer 81 onto a base film 12 exposed on a central area 14 of the die-sorting sheet 10 (Fig. 10). A usual die-bonding apparatus may be used to temporarily attach the semiconductor chips. The adhesive layer 15 81 has tackiness such that the chips can be die-bonded.

Accordingly, the semiconductor chips 80 that are (temporarily) attached to the base film 12 exposed on the die-sorting sheet 10 will be prevented from dropping off. If the temporary attaching is unstable, it may be stabilized by controlling 20 temporary attaching conditions (e.g., temperature, pressure). According to the present invention, any number of semiconductor chips 80 may be temporarily attached and accommodated, and therefore desired numbers of semiconductor chips may be transported to different places. The semiconductor chips 80 are

temporarily attached to the base film 12 exposed on the die-sorting sheet 10, and are therefore stably accommodated and transported.

[0063]

5 Next, the die-sorting sheet 10 is transported to a subsequent step while the semiconductor chips 80 are temporarily attached on the sheet through the adhesive layer 81.

[0064]

10 The subsequent steps include a die-bonding step. Unlike pressure-sensitive adhesive tapes such as general dicing tapes, the sheets according to the present invention do not have any pressure-sensitive adhesive layer in a region where chips are accommodated. Accordingly, even the semiconductor chips 80 having the adhesive layer 81 on the back surface may be easily
15 picked up in the die-bonding step without the adhesive layer 81 being deformed. Furthermore, the adhesive layer 81 is prevented from any contamination with a pressure-sensitive adhesive of a pressure-sensitive adhesive tape, and therefore highly reliable semiconductor devices may be manufactured.

20 [0065]

 The die-sorting sheets are not limited to the die-sorting sheets 10, and the die-sorting sheets 20 and 40 may be used. In the use of the die-sorting sheet 20 as illustrated in Fig. 11, the sheet is fixed to the ring frame 50 through the

pressure-sensitive adhesive layer 21 on the outer periphery 23, and the semiconductor chips 80 that are picked up are temporarily attached to the base film 22 exposed on the central area 24 of the die-sorting sheet 20 and are transported to the subsequent
5 step. In the use of the die-sorting sheet 40 as illustrated in Fig. 12, the sheet is fixed to the ring frame 50 through the pressure-sensitive adhesive layer 42a at the outer periphery 43, and the semiconductor chips 80 that are picked up are temporarily attached to the base film 41 exposed on the central
10 area 44 of the die-sorting sheet 40 and are transported to the subsequent step.

[0066]

In another embodiment, an inspection process in which a performance of the semiconductor chips 80 is tested may be
15 carried out before the semiconductor chips 80 are temporarily attached to the die-sorting sheet. In this embodiment, semiconductor chips 80 that are verified to be non-defective may be only picked up together with the adhesive layer 81 and be temporarily attached and accommodated on the die-sorting
20 sheet, whereby the non-defective chips may be selectively transported to the subsequent steps.

[0067]

In a still another embodiment, a plurality of the semiconductor chips 80 that are picked up may be temporarily

attached to the base film 12 exposed on the die-sorting sheet 10 so that the respective adhesive layers 81 are separate from one another with a distance such that a chip-detecting camera of a pick-up device can identify each chip. In this case, it is not necessary to carry out the expanding step for separating the chips, and the chips can be next picked up more easily. The distance between neighboring chips depends on the chip size and the precision or magnification of the camera, but is preferably about 50 μm to 1 mm.

10 [0068]

In the subsequent steps, a cleaning step may be performed prior to the die-bonding step or the like in order to remove dusts (contamination) attached during the accommodation or transportation. Since the semiconductor chips 80 are temporarily attached to the die-sorting sheet 10 in the present invention, the chips may be cleaned as they are.

[0069]

[Examples]

The present invention will be described based on Examples hereinbelow without limiting the scope of the invention.

[0070]

(Example 1)

[Production of die-sorting sheet]

100 Parts by weight of an acrylic copolymer based on butyl

acrylate (COPONYL N-3327 manufactured by Nippon Synthetic Chemical Industry Co., Ltd.) was mixed with 2 parts of an aromatic polyisocyanate (CORONATE L manufactured by NIPPON POLYURETHANE INDUSTRY CO., LTD.) and 50 parts of toluene to give a
5 pressure-sensitive adhesive solution (a).

[0071]

100 Parts by weight of an acrylic copolymer based on butyl acrylate (SK Dyne 1811 L manufactured by Soken Chemical & Engineering Co., Ltd.) was mixed with 5 parts of an aromatic
10 polyisocyanate (TD-75 manufactured by Soken Chemical & Engineering Co., Ltd.) and 30 parts of toluene to give a pressure-sensitive adhesive solution (b).

[0072]

The pressure-sensitive adhesive solution (a) was applied
15 to a silicone-treated release film (SP-PET 3811 (S) manufactured by LINTEC CORPORATION) and was dried (in an oven at 100°C for 1 minute) to form a pressure-sensitive adhesive layer A in a thickness of 10 μm . The pressure-sensitive adhesive solution (b) was applied to a similar release film and treated as described
20 above to form a pressure-sensitive adhesive layer B in a thickness of 10 μm .

[0073]

A core film was an ethylene/methacrylic acid copolymer film (thickness: 90 μm). The pressure-sensitive adhesive layer

A was transferred to a surface of the core film, and the pressure-sensitive adhesive layer B was transferred to the other surface, thereby preparing a double-sided pressure-sensitive adhesive sheet. The double-sided pressure-sensitive adhesive sheet was punched to remove an inner area thereof 165 mm in diameter.

[0074]

A base film was a low-density polyethylene film (thickness: 100 μ m, surface tensions: 31 mN/m and 40 mN/m). The pressure-sensitive adhesive layer B of the double-sided pressure-sensitive adhesive sheet was attached to the lower surface tension side of the base film. The laminate was then punched to remove an outer area larger than a diameter of 207 mm. Here, the outer area was punched out concentrically with the inner circular part that had been created by the punching out of the inner area. The resultant die-sorting sheet was as illustrated in Fig. 2.

[Transportation of semiconductor chips]

A semiconductor wafer (a dummy wafer, diameter: 200 mm) was attached to a dicing and die-bonding adhesive sheet having a tacky adhesive layer (Adwill LE 5000 manufactured by LINTEC CORPORATION). The wafer was diced together with the adhesive layer, and semiconductor chips (5 mm x 5 mm) having an adhesive layer on the back surface were prepared. The semiconductor

chips with an adhesive layer were picked up with a die-bonding apparatus. Separately, the die-sorting sheet was fixed to a ring frame through the pressure-sensitive adhesive layer on the outer periphery. The semiconductor chips that were picked up
5 were temporarily attached through the adhesive layer to the base film exposed on the die-sorting sheet (Fig. 10). A total of one hundred (100) semiconductor chips were temporarily attached in lattice patterns with a distance of about 300 μm between neighboring chips.

10 [0075]

The chips were then stored at 25°C for 12 hours and were cleaned with water by use of a spin washer (a unit built in wafer grinding device; DFD 651 manufactured by DISCO Corporation) at 3000 rpm for 1 minute. The chips were inspected to find if any
15 chips had dropped. Thereafter, ten (10) semiconductor chips with the adhesive layer were picked up from the die-sorting sheet by use of a die-bonding apparatus and with the lifting by four needles. The picking up was evaluated as a failure if the suction collet could not hold the semiconductor chip and the chip
20 remained on the die-sorting sheet or fell, and the number of pick-up failures was counted. Further, any separation of the die-sorting sheet from the ring frame was checked during the operations from the temporary attaching to the picking up. The results are shown in Table 1.

[0076]

(Example 2)

A die-sorting sheet was prepared in the same manner as in Example 1 except that the base film was an ethylene/methyl
5 methacrylate copolymer film (thickness: 80 μm , surface tensions: 33 mN/m and 40 mN/m).

[0077]

Semiconductor chips were transported and the evaluations such as chip dropping were carried out in the same manner as
10 in Example 1 except that the die-sorting sheet obtained above was used. The results are shown in Table 1.

[0078]

(Example 3)

A die-sorting sheet of the type as illustrated in Fig. 2
15 was prepared in the same manner as in Example 1 except that the double-sided pressure-sensitive adhesive sheet was attached to the higher surface tension side of the base film.

[0079]

Semiconductor chips were transported and the evaluations
20 such as chip dropping were carried out in the same manner as in Example 1 except that the die-sorting sheet obtained above was used. The results are shown in Table 1.

[0080]

(Example 4)

The pressure-sensitive adhesive solution (a) was applied to a silicone-treated release film (SP-PET 3811 (S) manufactured by LINTEC CORPORATION) and was dried (in an oven at 100°C for 1 minute) to form a pressure-sensitive adhesive layer A in a thickness of 10 μm . A support film was an ethylene/methacrylic acid copolymer film (thickness: 90 μm). The pressure-sensitive adhesive layer A was transferred to a surface of the support film to give a pressure-sensitive adhesive tape.

[0081]

A base film was an ethylene/methyl methacrylate copolymer film (thickness: 100 μm , surface tensions: 33 mN/m and 40 mN/m). The pressure-sensitive adhesive layer A of the pressure-sensitive adhesive tape was attached to the higher surface tension side of the base film. The base film alone was selectively punched to remove an outer peripheral portion thereof larger than a diameter of 165 mm. Subsequently, a release film was disposed on the exposed pressure-sensitive adhesive layer A and the base film. The support film and the pressure-sensitive adhesive layer A were punched to remove outer areas thereof larger than a diameter of 207 mm. Here, the outer areas were punched out concentrically with the inner circular part that had been created by the punching out of the outer peripheral portion. The resultant die-sorting sheet was as illustrated in Fig. 5.

[0082]

Semiconductor chips were transported (Fig. 11) and the evaluations such as chip dropping were carried out in the same manner as in Example 1 except that the die-sorting sheet obtained
5 above was used. The results are shown in Table 1.

[0083]

(Comparative Example 1)

Semiconductor chips were transported in the same manner as in Example 1 except that the die-sorting sheet was replaced
10 by a general removable and rebondable dicing tape (Adwill G-19 manufactured by LINTEC CORPORATION).

[0084]

The evaluations such as chip dropping were carried out in the same manner as in Example 1. The results are shown in Table
15 1.

[0085]

(Comparative Example 2)

Instead of the die-sorting sheet, a general UV-curable pressure-sensitive adhesive dicing tape (Adwill D-175
20 manufactured by LINTEC CORPORATION) was attached to the ring frame and the pressure-sensitive adhesive layer was cured with UV rays.

[0086]

Semiconductor chips were transported and the evaluations

such as chip dropping were carried out in the same manner as in Example 1 except that the UV-cured general dicing tape was used. The results are shown in Table 1.

[0087]

[Table 1]

	Chip dropping	Pick-up failures	Separation from ring frame
Ex. 1	None	0/10	No
Ex. 2	None	0/10	No
Ex. 3	None	0/10	No
Ex. 4	None	0/10	No
Comp. Ex. 1	None	10/10	No
Comp. Ex. 2	None	8/10	Partial separation

CLAIMS

1. A die-sorting sheet on which a chip having an
5 adhesive layer is temporarily attached, which sheet comprises
a pressure-sensitive adhesive layer exposed on an outer
periphery of the die-sorting sheet, and a base film exposed on
a central area that is inside the outer periphery.
- 10 2. The die-sorting sheet according to claim 1, wherein
the pressure-sensitive adhesive layer is laminated on an outer
periphery of the base film.
- 15 3. The die-sorting sheet according to claim 1, wherein
the pressure-sensitive adhesive layer is laminated on a support
film and is shaped identically with the support film, and the
base film is laminated on a central area of the
pressure-sensitive adhesive layer.
- 20 4. A method for transporting a chip having an adhesive
layer, which method comprises:
applying a dicing and die-bonding adhesive sheet to a
surface of a substrate, the adhesive sheet comprising an adhesive
layer and a base material;

full-cut dicing the substrate with respect to chips
together with the adhesive layer;

picking up a chip having the adhesive layer on the back
surface thereof, from the base material;

5 providing the die-sorting sheet of any one of claims 1 to
3 that is fixed with a frame through the pressure-sensitive
adhesive layer on the outer periphery;

temporarily attaching the picked up chip through the
adhesive layer thereof onto the base film exposed on the
10 die-sorting sheet; and

transporting the die-sorting sheet to a subsequent step
while the chip is temporarily attached on the sheet through the
adhesive layer.

15 5. The method according to claim 4, wherein a plurality
of the chips are temporarily attached to the base film exposed
on the die-sorting sheet while the respective adhesive layers
are separate from one another.