DESCRIPTION

SHEET STICKING APPARATUS AND STICKING METHOD

TECHNICAL FIELD

[0001]

The present invention relates to a sheet sticking apparatus and a sticking method, further in particular, to a sheet sticking apparatus and a sticking method, which forms a precut in a laminated sticking sheet provided on one surface of a strip-shaped base sheet, and an area to be stuck (hereinafter, simply referred to as sticking area) obtained in this manner can be stuck precisely on an object to be stuck (hereinafter, simply referred to as object) such as semiconductor wafer.

BACKGROUND ART

[0002]

Conventionally, after separating a semiconductor wafer (hereinafter, simply referred to as "wafer") on which a circuit plane is formed into individual chips, each chip is picked up and bonded to a lead frame (die bonding). The die bonding is carried out in the following manner. That is, in a wafer-processing step, a heat sensitive adhesive die bonding sheet laminated on one surface of a base sheet is cut and stuck on the

wafer.

[0003]

A sticking apparatus of the sheet as described above has been disclosed in, for example, patent document 1 proposed by the applicant of the present invention. The sheet sticking apparatus disclosed in the patent document 1 comprises: a sticking table that supports a wafer; a cutting means that cuts a die bonding sheet in accordance with a plane shape of the wafer to form an area to be stuck (hereinafter, simply referred to as sticking area) to the wafer, and at the same time, cuts the die bonding sheet in the width direction having a predetermined distance away toward the upstream side of the sheet pay-out direction; a first peeling means that peels off the peripheral redundant area of the die bonding sheet enclosing the sticking area; a press roll that presses the sticking area against the wafer to stick the same to the wafer; and a second peeling means that peels off the base sheet.

[0004]

[Patent document 1] Japanese Patent Application Laid-Open No. 2002-367931

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005]

In the structure disclosed in the patent document 1, however, it is arranged so that the outside part of the die bonding sheet excluding the sticking area is to be peeled off by a first peeling means, therefore there reside the following disadvantages. That is, in addition to the fact that the external size of die bonding sheet area to be peeled off becomes large and the peeling operation requires a complicated structure, motion area of a device necessary for peeling off becomes too large resulting in a complicated positional relationship with other devices. Such disadvantages become more obvious as the size of the wafer gets larger.

[0006]

Also, the cutting blade constituting a cutting means comprises a Thomson blade which is structured by forming a single blade with a closed loop shape and attached to a base plate. Naturally, junction portion of edge profiles along the extending direction of the blade forms a joint. Damage such as crack apt to be generated on the blade in the joint area. Therefore, there resides such a disadvantage that satisfactory cutting is hardly obtained in the joint area in consequence of repetitive and continuous usage.

[0007]

Recently, semiconductor devices have been

manufactured employing a mounting manner so-called face down. In this face down method, projecting portions, which are called bumps for ensuring electrical conductivity, are formed at the circuit plane side of a chip.

Such projecting portions are formed up to the extremely close area to the peripheral edge of the wafer. Accordingly, since the sticking table disclosed in the patent document 1 has such a structure that the area along the peripheral edge of the wafer is sucked, there resides a disadvantage that the wafers with bumps are hardly handled as objects.

[0008]

[OBJECT OF THE INVENTION]

The present invention has been proposed in view of the above disadvantages. An object of the present invention is to provide a sheet sticking apparatus and a sticking method, in which cutting, sticking, peeling off and the like are carried out at a work center, which is a common processing position; and each of units that performs the above operations moves away from and close to the processing position one after another.

[0009]

Also, the object of the present invention is to provide a sheet sticking apparatus and a sticking method enabling to minimize an area to be peeled off

(hereinafter, simply referred to as peeling area) for achieving a simple structure of peeling device as well as to minimize the required moving area of each device element for peeling operation, in the occasion of peeling off the laminated sheet area enclosing the sticking area after forming the sticking area in accordance with the plane shape of the object.

[0010]

Another object of the present invention is to provide a sheet sticking apparatus and a sticking method that enables reliable cutting of the laminated sheet to be stuck including no joint line, and prevents the sticking area from being attached to the enclosing laminated sheet area outside thereof, when sticking the sticking area to the object.

[0011]

Further, still another object of the present invention is to provide a sheet sticking apparatus and a sticking method capable of supporting the object even when projecting portions or the like exist in an area close to the outer periphery on the surface of the object on the opposite side of the sticking face of the sticking sheet; and thus, widening the applicable range thereof.

MEANS FOR SOLVING THE PROBLEMS

[0012]

To achieve the object, the present invention is

arranged so that a sheet sticking apparatus that uses a sheet material including a base sheet continuing in a strip-shape and a sticking laminated sheet formed on one surface of the base sheet, cuts the laminated sheet into a plane shape of an object to form a sticking area in a process of paying out of the sheet material and sticks the sticking area to the object, includes a conveyance means that takes out the objects one by one from a storing means of the objects and conveys the same; a cutting means that cuts the laminated sheet in accordance with a plane shape of the object to form the sticking area, and cuts the laminated sheet in the width direction thereof at front and behind positions along the paying out direction of the laminated sheet to form a peeling area adjacent to the sticking area; a first peeling means that peels off the peeling area; a sticking means including a sticking table that supports the object and sticks the sticking area to the object; and a second peeling means that peels off the base sheet from the sticking area, wherein the conveyance means, cutting means, sticking means, first and second peeling means are arranged so as to be movable without interfering with each other, having a predetermined common processing position as a work center with respect to sequentially paid out sheet materials.

[0013]

The present invention may be arranged so that the cutting means includes a first cutting blade formed in an endless shape along the peripheral edge of the object, a second cutting blade for cutting the laminated sheet in the width direction at a position away from the first cutting blade to the upstream side in the paying out direction of the sheet material, and a third cutting blade, which continues to the first cutting blade and is disposed substantially parallel to the second cutting blade at the downstream side of the second cutting blade in the paying out direction, the sticking area is formed by the first cutting blade, the peeling area is formed by a part of the first cutting blade and the second and the third cutting blades, and after peeling off the peeling area with the first peeling means, the sticking area is stuck to the object.

[0014]

Also, the first cutting blade and the third cutting blade may be arranged so as to continue to each other without any joint.

[0015]

Further, such an arrangement is adopted that the cutting means further includes a table, and the first, second and third cutting blades are formed integrally

with the table at the upper face side.

[0016]

Furthermore, the first, second and third cutting blades may be preferably formed by etching the upper face side of the table.

[0017]

Still further, such an arrangement is adopted that the first peeling means includes a peeling head that supports a peeling tape allowing to run around in the width direction of the sheet material crossing its paying out direction, and peels off the peeling area from the base sheet by bonding the peeling tape to the peeling area and allowing the peeling tape to run around.

[0018]

Still furthermore, the first peeling head is arranged so as to include a heat block, and the heat block adheres the peeling tape to the peeling area with heat adhesion.

[0019]

The heat block is disposed at a plurality of points along the width direction of the peeling area.

[0020]

Still further, such an arrangement is adopted that the object is a semiconductor wafer formed with bumps on the front surface thereof, and the sticking

table includes a protruded ring portion having a closed loop shape along the outer edge of the wafer, which does not interfere with the bumps, when the semiconductor wafer is supported so that the surface of the semiconductor wafer formed with the bumps comes to the bottom face side.

[0021]

The height of the projecting portion of the protruded ring portion may be preferably set to a height substantially equal to the height of the bumps.

[0022]

Still further, the sticking table may be structured so that the inside of the protruded ring portion is a suction space for the semiconductor wafer, and formed using an elastic material as the forming material.

[0023]

Still further, the object may be a semiconductor wafer and the laminated sheet may be a heat-adhesive die-bonding sheet.

[0024]

Still further, the present invention adopts such a sheet sticking method that uses a sheet material including a base sheet continuing in a strip-shape and a sticking laminated sheet formed on one surface of the base sheet, cuts the laminated sheet into a

plane shape of an object to form a sticking area in a process of paying out the sheet material and sticks the sticking area to the object, comprising the steps of:

taking out the objects one by one with a conveyance means;

cutting the laminated sheet to form a sticking area and a peeling area therein;

first peeling off to peel off the peeling area;

sticking the sticking area to the object; and

second peeling off to peel off the base sheet from the sticking area, wherein

the cutting step is achieved by simultaneously carrying out a first cutting of the laminated sheet to form the sticking area without any joint along the peripheral edge of the object, a second cutting of the laminated sheet in a width direction at a position away from the first cutting position to an upstream side in a paying out direction of the sheet material and a third cutting of the laminated sheet along a continuous line with the first cutting line as well as substantially parallel to the second cutting at the downstream side from the second cutting position in the paying out direction, wherein

the sticking area is formed by the first cutting, and the peeling area is formed by a part of the first

cutting and the second and third cuttings,

after peeling off the peeling area with a first peeling means, the sticking area is stuck to the object,

the sheet material is peeled off from the sticking area leaving the sticking area on the object.

[0025]

In the sheet sticking method, it is arranged so that the first and third cuts continue to each other without any joint.

[0026]

Further, the methods described above are arranged in such a way that the cutting, sticking of the sticking area, first and second peeling off are carried out sequentially at a predetermined common processing position as a work center in a state that pay-out of the base sheet is halted.

EFFECT OF THE INVENTION

[0027]

According to the present invention, the following center work system is adopted. That is, each of the units constituting the sheet sticking apparatus performs a predetermined operation at a preset position under a state that the sheet material is suspended from paying out. Accordingly, a paying out means and the like for holding the sheet material can

be maintained at a fixed position. Therefore, tension changes that may happen in the sheet material side in each of the cutting step, peeling step, sticking step, can be effectively prevented, resulting in a highly precise sheet sticking.

[0028]

Also, the peeling area is not formed in the entire periphery of the sticking area but only in a portion formed at the upstream side along the paying out direction. Accordingly, compared to a conventional peeling structure, the peeling structure can be arranged in a simple way. Here, the peeling area can be formed as a piece-like shape along the width direction of the laminated sheet. Accordingly, the peeling-off can be achieved by using a peeling head capable to move away and close to along the width direction; thus such a structure can be employed that positional interference with the other neighboring units hardly occurs.

[0029]

Further, since the cutting blade forming the sticking area has such a structure as having no joint line, cutting is also performed with no joint. Since partial damages on the cutting blade caused from a joint line also hardly occur, satisfactory cutting accuracy can be maintained for long-term.

[0030]

Furthermore, cutting blades can be formed by etching the upper face of the table. A stable accuracy can be maintained by controlling the masking accuracy at a specific constant level. That is, it is possible to prevent variation in accuracy, which occasionally occurs when a single blade with an endless shape is attached to the table in accordance with the peripheral edge of the object.

[0031]

Still further, a sticking table has such a structure as applicable to wafers including bumps, which enables to provide a multi-purpose sheet sticking apparatus, and moreover the various kinds of objects and sheets can be adopted.

BRIEF DESCRIPTION OF DRAWINGS

[0032]

[Fig. 1]

Fig. 1 is a plan view schematically showing the entire constitution of a sheet sticking apparatus in accordance with an embodiment of the present invention.

[Fig. 2]

Fig. 2 is a sectional view of a sheet material.

[Fig. 3]

Fig. 3 is a perspective view schematically showing

the transition in the process of the sheet material viewed from the bottom face side.

[Fig. 4]

Fig. 4 is a perspective view schematically showing the entire constitution of the system.

[Fig. 5]

Fig. 5 is a schematic front elevation view taken along the line A-A in Fig. 1.

[Fig. 6]

Fig. 6 is a schematic left side elevation view of Fig. 1.

[Fig. 7]

Fig. 7(A) is a perspective view schematically showing a table of a cutting means; Fig. 7(B) is an enlarged sectional view taken along the line B-B in Fig. 7(C); and Fig. 7(C) is a partially enlarged plan view in Fig. 7(A).

[Fig. 8]

Fig. 8 is a schematic side elevation view of a first peeling means.

[Fig. 9]

Fig. 9 is a schematic plan view of a principal portion of a first peeling means.

[Fig. 10]

Fig. 10 is a schematic perspective view of a sticking table constituting a sticking means.

[Fig. 11]

Fig. 11 is an explanatory diagram illustrating the operation to stick a die-bonding sheet to a wafer.

[Fig. 12]

Fig. 12 is an explanatory diagram illustrating the operation to peel off a base sheet.

[Fig. 13]

Fig s. 13(A) to (C) are explanatory diagrams illustrating the operation to cut a die-bonding sheet.

[Fig. 14]

Fig. 14 is an explanatory diagram illustrating the operation of an initial step to peel off a peeling area.

[Fig. 15]

Fig. 15 is an explanatory diagram illustrating the operation to adhere a peeling tape to the peeling area with heat adhesion.

[Fig. 16]

Fig. 16 is an explanatory diagram illustrating the operation to peel off the peeling area.

[Fig. 17]

Fig. 17 is a plan view of the sheet material after the peeling area has been peeled off therefrom viewed from the bottom face side thereof.

[Fig. 18]

Fig. 18 is an explanatory diagram minutely

illustrating the operation to stick the die-bonding sheet to a wafer.

EXPLANATION OF CODES

[0033]

10...sheet sticking apparatus

11...storing means

12...conveyance means

13...alignment means

15...cutting means

17...first peeling means

19...sticking means

20...second peeling means

27...alignment table

30...table

31...cutting blade

31A...first cutting blade

31B...second cutting blade

31C...third cutting blade

33...peeling head

A1...sticking area

A2...peeling area

C...work center

W...semiconductor wafer (object)

S...sheet material

T...peeling tape

BS...base sheet

DS...die bonding sheet

PS...cover sheet

BEST MODE FOR CARRYING OUT THE INVENTION

[0034]

Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

[0035]

Fig. 1 is a plan view schematically showing a sheet sticking apparatus according to an embodiment of the present invention. In Fig. 1, a sheet sticking apparatus 10 is arranged for handling a sheet material S shown in Fig. 2 and a semiconductor wafer W as an object to be stuck. Here, as shown in Fig. 3 in an inversed way, upside down (front and rear), the sheet material S is continuous in a strip shape and includes a base sheet BS, of which upper face side (bottom face side in Fig. 3) has peel-off treatment, a heat sensitive adhesive die bonding sheet DS formed as a laminated sheet for sticking provided on the other surface of the base sheet BS, and a cover sheet PS, which sandwiches the die bonding sheet DS together with the base sheet BS and is formed of a sheet substantially identical to the base sheet BS. Here, such an arrangement is

adopted that the die-bonding sheet DS is cut to form a sticking area A1 having a closed loop shape corresponding to the peripheral shape and size of the wafer W, which is stuck to the wafer W, and a strip shape peeling area A2, which is formed by cutting the upstream side area adjacent to the sticking area A1 in the paying out direction is peeled off.

[0036]

As shown in Fig. 1, Fig. 4 and Fig. 6, the sheet sticking apparatus 10 comprises a storing means 11 of wafers W, a conveyance means 12 that takes out the wafers W one by one and carries the same, an alignment means 13 that positions the wafer W, a cutting means 15 that cuts the die bonding sheet DS, a first peeling means 17 that peels off the peeling area A2 formed by the above cutting, a sticking means 19 that sticks the sticking area A1 to the wafer W that has been aligned, and a second peeling means 20 that, after the sticking area A1 has been stuck to the wafer W, peels off the base sheet BS from the sticking area A1.

[0037]

As shown in Fig. 6, the storing means 11 includes two-step carrier 22 with upper and lower part, a drive motor 23 that drives the carrier 22 to move up and down, and a ball screw shaft 24. The carrier 22 accommodates wafers in multi-steps style along the vertical

direction leaving a predetermined space between the wafers. It is arranged so that the position of the carrier 22 in the vertical direction can be detected by unshown sensor and the position in each step and number of the wafers W can be detected.

[0038]

The conveyance means 12 comprises a robot equipped with a multi-joint type arm 25. The robot body 26 is installed capable to move up and down. The arm 25 is fitted to be rotatable in the horizontal direction. Owing to this, the conveyance means 12 is arranged so as to move among a position where wafers W are taken out from the carrier 22 one by one, a position of the alignment means 13 to which wafers W are transferred to, and a common processing position that will be described later. At the top end of the arm 25, suction holes 25A are formed. A wafer W is sucked to be supported at its central position by the suction holes 25A. The arm 25 is provided with a function to invert the surface of the sucked wafer W upside down.

[0039]

The alignment means 13 is structured including an alignment table 27 and a sensor 28. The alignment table 27 has a rotary section 27A, which is rotatable in a substantially horizontal plane. The sensor 28 detects the position of the orientation flat W1 formed

in the wafer W to position the wafer W.

[0040]

As shown in Fig. 4 and Fig. 7, the cutting means 15 is structured at a position above the sheet material S paid out in a substantially horizontal position, including a cutting force imparting roller 29 of which axial direction is disposed substantially identical to the paying off direction of the sheet material S (direction of the arrowhead D in Fig. 4), a cutting table 30 disposed below the sheet material S, a cutting blade 31 provided at the upper face side of the cutting table 30 and a drive unit 32 (refer to Fig. 5) that drives the cutting table 30 to move in the vertical direction. A cooling plate 105, which will be described later, supports the cutting force imparting roller 29. In this embodiment, a virtual vertical line C (refer to Fig. 4) passing through substantially the center of the cutting table 30 is allocated as a work center, which is substantially the center of the common processing position. The cutting means 15 is arranged to be capable of rising along the line C up to a position immediately below the sheet material S, having a position shown in Fig. 4 as a waiting position.

[0041]

The cutting blade 31 comprises a first cutting blade 31A formed in an endless shape (closed loop)

corresponding to a peripheral shape of the wafer W, a second cutting blade 31B that cuts the die bonding sheet DS in the width direction at a position away from the first cutting blade 31A in the upper stream side position of paying out direction D of the sheet material S, and a pair of right and left third cutting blades 31C, 31C, which continue to the first cutting blade 31A and are disposed substantially parallel to the second cutting blade 31B in a position at the lower stream side from the second cutting blade 31B in the paying out direction. The first cutting blade 31A is disposed so that the straight portion thereof corresponding to the orientation flat W1 of the wafer W is positioned at the upstream side in the paying out direction D and extends in the width direction crossing the sheet material S. In this manner, the sticking area A1 is formed by the first cutting blade 31A. The peeling area A2 is formed by a part of the first cutting blade 31A (a part at the upstream side in paying out direction) including the straight portion, and the second and the third cutting blades 31B, 31C.

[0042]

As shown in Fig. 7(B), the top end portion of the cutting blade 31 is shaped in a form of the apex of substantially isosceles right triangles in its

sectional configuration. The cutting blade 31 is formed integrally with the cutting table 30 by subjecting the upper face side of the cutting table 30 to an etching processing. Accordingly, as shown in Fig. 7(C), the first cutting blade 31A, which has an endless configuration though, has not any joint that would appear in the case where the single blade is bent to form an endless configuration. Also, the third cutting blades 31C, 31C continue with the first cutting blade 31A in a state having no joint. In the present invention, by forming the third cutting blades 31C, the sticking area A1 can be stuck to the wafer W by only peeling off the peeling area A2 that is formed in a part, without peeling off the entire outside area excluding the sticking area A1.

[0043]

The first peeling means 17 is a device for peeling off the peeling area A2. As shown in Fig. 1, Fig. 8 and Fig. 9, the first peeling means 17, comprises a peeling head 33 that supports a peeling tape T allowing the same to run in the width direction crossing the paying out direction of the sheet material S, a peeling tape supply unit 34, a peeling tape winding section 35 and a peeling head base 36. The peeling head 33 includes a case 37 of which upper portion is opened, upper guide rollers 38, 38, which are provided

rotatably within the case 37 and are disposed in a pair of front-rear relationship as shown in Fig. 9 so that the axial direction thereof agrees with the paying out direction D of the sheet material S, a bracket 39 positioned between these upper guide rollers 38 and 38, a cylinder 40 that supports the bracket 39 movably in the vertical direction, a pair of front-rear heat blocks 42 and 42, which are positioned immediately close inside to the upper guide rollers 38 and 38 movably in the vertical direction along with the bracket 39. It is arranged that, when the heat blocks 42 and 42 goes up, the surface position of the peeling tape T laid around between the upper guide rollers 38 and 38 is lifted up to bring the peeling tape T to come into contact with the peeling area A2. Thereby, heat-sticking portions 41 (refer to Fig. 15) are formed at two areas in the width direction of the sheet material S.

[0044]

The peeling tape supply unit 34 comprises a tape holding roller 44, a drive roller 45 provided between the tape holding roller 44 and the peeling head 33, a pinch roller 46 that pinches the peeling tape T between the drive roller 45 and the same and a motor M that imparts a rotary drive force to the drive roller 45. On the other hand, the tape winding section 35 comprises

a plurality of rollers 49 through 53 provided between the winding roller 48, which is driven to rotate in the winding direction by an unshown motor, and the upper guide roller 38 of the peeling head 33. The peeling head base 36 comprises guide rails 55 that guide the tape holding roller 44 and a frame F supporting the peeling head 33 in the vertical direction, an up/down lift unit 57 including a cylinder 56 for lifting up/down the frame F and an uniaxial robot mechanism 58 that moves the frame F in the front/rear direction (in the right/left direction in Fig. 8) to move the peeling head 33 forward/backward with respect to the work center C.

[0045]

The peeling head 33 stands by at a waiting position lower than the surface of the die bonding sheet DS on the sheet material S, while in a non-operation position. When peeling off the peeling area A2, the peeling head 33 advances to the bottom face side of the die bonding sheet DS and raises the heat blocks 42 to the surface of the peeling area A2.

[0046]

As shown in Fig. 4 and Fig. 5, the sticking means 19 comprises a paying out unit 60 of the sheet material S, a winding unit 61 that winds cover sheet PS of the sheet material S, a sticking table 62 supporting the

wafer W and a pressurizing unit 63 that presses the sticking area A1 of the die bonding sheet DS to the rear surface of the wafer W.

[0047]

The feeder unit 60 comprises a support roller 65 supporting the sheet material S wound in a roll shape, an upstream side drive roller 66 that imparts a feed out force to the sheet material S, a pinch roller 67 pinching the sheet material S between the drive roller 66 and the same, two guide rollers 68 and 69 disposed between the drive roller 66 and the support roller 65, and a position adjusting roller 70 that is disposed at a position lower than that of the axial line of the pinch roller 67 and holds the sheet material S at a preset height. The winding unit 61 of the cover sheet PS comprises a winding roller 72, a winding drive roller 73 and two guide rollers 74 and 75. It is arranged that, in a state that the cover sheet PS has been peeled off, the sheet material S is peeled off at the position of the pinch roller 67 and wound by the winding roller 72. Accordingly, the sheet material S, which has passed through the position of the pinch roller 67, is paid out towards the direction for passing through the work center C in a state that the base sheet BS and the die bonding sheet DS form a double layer sheet.

[0048]

As shown in Fig. 10 and Fig. 11, the sticking table 62 comprises a table body 77, a cylinder 78 moving the table body 77 in the vertical direction, an intermediate table 79 supporting the cylinder 78, a base table 80 supporting the intermediate table 79, guide rails 81 and 82 moving the intermediate table 79 and the base table 80 back and forth along the paying out direction D of the sheet material S, and an unshown cylinder unit imparting a drive force to the intermediate table 79 and the base table 80 along the guide rails 81 and 82. As shown in Fig. 11, at bottom face side of the table bodies 77, a heating unit 84 is provided. The heating unit 84 is a device for controlling the table body 77 to a predetermined temperature to stick the sticking area A1 to the wafer W. It is arranged so that the temperature is variably selectable arbitrarily in accordance with the characteristics of the die bonding sheet DS.

[0049]

As shown in Fig. 11, the table body 77 is provided with a protruded ring portion 86 having a closed loop shape along the periphery thereof, when the wafer W is supported so that the front surface (circuit forming surface) of the wafer W comes to the bottom face side. It is arranged so that the recessed space inside the protruded ring portion 86 forms a suction space 87

for the wafer W. In the bottom of the suction space 87, suction holes 87A are formed, and the suction holes 87A are arranged to be connected to an unshown decompression pump. The table body 77 according to this embodiment is formed of an elastic material such as rubber as a forming material. The width W2 (refer to Fig. 11) of the projecting portion of the protruded ring portion 86 is set to approximately 2 mm or so. The protruded ring portion 86 can suck to support the wafer W in a state that the periphery edge of the projecting portion substantially agree with the periphery edge of the wafer W. Accordingly, even when bumps are formed on the front surface of the wafer W immediately close to the periphery edge of the wafer W, the wafer W can be supported without interference with the bumps. The height H of the projecting portion of the protruded ring portion 86 is set to a height substantially identical to the height of the bumps. According to this embodiment, the height is set to approximately 0.45 mm. Accordingly, when the wafer W is sucked and supported, the bottom end of the bumps come into contact lightly with the bottom of the suction space 87. Thus, even when the suction force is applied, since the elasticity of the table body 77 absorbs the force, the bumps are hardly damaged. The width W2 and the height H of the projecting portion are selectable

in accordance with the related wafer W.

[0050]

As shown in Fig. 4 and Fig. 5, the pressurizing unit 63, which interacts with the sticking table 62, comprises a fixing roller 89 and a press roller 90. These fixing roller 89 and press roller 90 are positioned movably in the vertical direction at the upper face side of the base sheet BS. The press roller 90 is arranged to have a built-in heater, and to be movable along the length direction (paying out direction D) of the base sheet BS. And it is arranged so that, while maintaining the sticking area A1 to a predetermined temperature by the movement of the press roller 90, the sticking pressure is imparted. Thus, the sticking area A1 is stuck to the surface of the wafer W.

[0051]

The second peeling means 20 comprises a cooling unit 93 supporting the cutting force imparting roller 29, a peeling table 94 positioned at the lower face side than the sheet material S below the cooling unit 93, a pair of peeling rollers 96, 97 peeling the base sheet BS of the sheet material S from the sticking area A1, a guide roller 98 guiding the base sheet BS peeled by the peeling rollers 96, 97, a drive roller 99 rotated by a motor M1, a pinch roller 100 pinching the sheet material S, a guide roller 101 and a winding roller

102 winding the base sheet BS. Here, the drive roller 66 at the upstream side and the drive roller 99 at the downstream side are controlled to maintain the sheet material S under a predetermined tension.

[0052]

The cooling unit 93 functions as a temperature control unit that lowers the temperature of the sticking area A1 relative to the temperature when the sticking area A1 is stuck to the wafer W. The cooling unit 93 comprises a cooling plate 105 of which bottom face side is formed as a suction face and a temperature controller 106 disposed on the cooling plate 105. A lift cylinder 108 supports the cooling unit 93 movably in the vertical direction along rails 107 disposed behind the sheet material S in the width direction, and the cooling unit 93 is arranged so as to be movable in the width direction of the sheet material S by a cylinder 109 disposed behind the rails 107. The cooling unit 93 is arranged so as to move in the vertical direction in a state that the substantial center of the cooling plate 105 is set to the work center C.

[0053]

As shown in Fig. 4, the peeling table 94 is arranged to stay at a position retreated to the downstream side in the paying out direction of the sheet material S while non-operation, and to move to the position where

the center thereof is positioned at the work center C, while in operation. The peeling table 94 is structured so that the upper face side thereof has a structure substantially identical to that of the table body 77 of the sticking table 62, and is arranged so as to suck and support the wafer W positioned on the peeling table 94. As shown in Fig. 5, the peeling table 94 is arranged so as to be movable in the vertical direction by a lifting mechanism 110.

[0054]

The peeling rollers 96, 97 are arranged to be movable toward the upstream side in the paying out direction of the base sheet BS in a state that the base sheet BS passes through between the rollers 96 and 97. Accordingly, the peeling rollers 96, 97 are arranged to move rightward in Fig. 12 in the state that the peeling table 94 sucks the wafer W, and hence the sticking area A1 is left on the surface of the wafer W, and the base sheet BS is peeled off from the sticking area A1 and wound by the winding roller 99 in order. The die bonding sheet DS excluding the peeling area A2 and the sticking area A1 is then wound along with the base sheet BS.

[0055]

Next, the entire operation of the sheet sticking apparatus 10 will be described with reference to Fig. 13 through Fig. 18.

[0056]

As the initial setting, the sheet material S is pulled out, and the cover sheet PS is peeled off from the die bonding sheet DS. Then, the lead end of the cover sheet PS is fixed to the winding roller 72. The lead end of the sheet material S from which the cover sheet PS has been peeled off is fixed to the winding roller 102 constituting the second peeling means 20.

[0057]

Before starting the operation, the sticking table 62 and the peeling table 94 are at the respective waiting positions shown with solid lines in Fig. 4. The cooling unit 93 is at its waiting position above the sheet material S at the work center C. And the table 30 of the cutting means 15 is at its waiting position below the sheet material S at the work center C.

[0058]

When unshown power supply is turned ON, the conveyance means 12 is activated. A piece of the wafers W is sucked and taken out from the carrier 22 of the storing means 11 and transferred onto the alignment table 27. The alignment table 27 rotates the wafer in a flat plane to detect the orientation flat W1 with the sensor 28; thus the position or orientation of the wafer W is determined.

[0059]

The center of the table body 77 on the sticking table 62 moves to the work center C, to which the aligned wafer W is transferred by the conveyance means 12. Then, the table body 77 moves to its waiting position and heats the wafer W for a predetermined time at the waiting position.

[0060]

As shown in Fig. 13, while the wafer W is heated at the waiting position, the table 30 of the cutting means 15 rises, and the cutting blade 31 rises up to a position where the same comes into contact substantially with the bottom surface of the sheet material S (die bonding sheet DS). At the same time, the cooling unit 93 is moved forward by the cylinder 109, and then lowered by the lift cylinder 108. Thus, the cutting force imparting roller 29, which is supported at the rear bottom face side of the cooling unit 93, moves to a position where the roller comes into contact with the front edge of the upper face side of the sheet material S. In this state, when the entire cooling unit 93 is moved backward in the substantially horizontal direction by cylinder 109; i.e., in the width direction crossing the paying out direction of the sheet material S, the sheet material S is cut (half cut) in the area sandwiched by the cutting blade 31 and the cutting force imparting roller 29. Thus, the cutting

lines corresponding to the first to third cutting blades 31A, 31B and 31C constituting cutting blade 31 are formed in the die bonding sheet DS (refer to Fig. 3). Owing to this arrangement, in the area of the die bonding sheet DS, the sticking area A1 corresponding to the plane shape of the wafer W and the strip-shape peeling area A2 neighboring the rear side thereof in the paying out direction (upstream side) are formed.

[0061]

When the cutting has terminated, the cutting force imparting roller 29 returns to its initial waiting position along with the cooling unit 93, and the table 30 of the cutting means 15 also returns to its waiting position.

[0062]

Then, as shown in Fig. 14 to Fig. 17, the first peeling means 17 is activated, the peeling head 33 moves to the area immediately below the peeling area A2 from its waiting position, and the cooling plate 105 of the cooling unit 93 sucks the upper face of the base sheet BS. Then, the heat block 42 rises and the peeling tape T is partially stuck to the peeling area A2 of the die bonding sheet DS with heat adhesion. After the peeling tape T is stuck to the peeling area A2 with heat adhesion as described above, the peeling head 33 lowers and winds the peeling tape T. Thus, a specific amount of the

rear area neighboring the sticking area A1 in the die bonding sheet DS in the paying out direction is peeled off as shown in Fig. 17. After the peeling-off has completed, the peeling head 33 returns backward to its waiting position.

[0063]

In the state that the peeling area A2 has been peeled off, the wafer W heated at the waiting position is conveyed to the position of the work center C in the state being placed on the sticking table 62 as shown in Fig. 18. Then, when the table body 77 rises (refer to Fig. 18(A)), the fixing roller 89 and the press roller 90 constituting the press unit 63 lowers down to the upper face position of the base sheet BS (refer to Fig. 18(B)). The fixing roller 89 is fixed in the state that the press force is imparted downward to the base sheet BS. On the other hand, the press roller 90 moves to the downstream side while rotating in the paying out direction (refer to Fig. 18(C)). Thus, the press force is imparted to the base sheet BS, the sticking area A1 is stuck to the surface of the wafer W. And the press roller 90 slightly rises and returns to the upstream side in the paying out direction. The drive roller 66 at the upstream side and the drive roller 99 at the downstream side control to maintain the tension of the sheet material S to a predetermined level during

the sticking operation.

[0064]

When the sticking area A1 has been stuck, the cooling unit 93 lowers to suck the wafer W being interposed by the sheet material S, and the table body 77 releases the suction and lowers to return to its waiting position. Here, since the wafer W is stuck to the sticking area A1 of the die bonding sheet DS, the wafer W remains at the bottom face side of the die bonding sheet DS. During the above operation, the wafer W and the base sheet S are cooled down to a preset temperature.

[0065]

To the bottom face side of the wafer W, which is stuck on the bottom surface of the die bonding sheet DS and left at the work center, the peeling table 94 constituting the second peeling means 20 moves from its waiting position to the position of the work center C and rises. When the peeling table 94 sucks the wafer W, as shown in Fig. 12, the peeling rollers 96, 97 move to the upstream side in the paying out direction of the base sheet BS, the base sheet BS is peeled off from the sticking area A1 and wound by the winding roller 102 in order. The remaining area of the die bonding sheet DS, from which the sticking area A1 and the peeling area A2 have been removed, is wound along with the base

sheet BS.

[0066]

Then, the conveyance means 12 sucks the upper face side of the wafer W, inverts the wafer W upside down, and stores the wafer W into the carrier 22 of the storing means 11. Thus, a series of sheet sticking steps is completed.

[0067]

As described above, the best constitution and method or the like for carrying out the present invention have been disclosed in the foregoing depiction. However, the present invention is not limited to the above.

That is, although the present invention has been mainly illustrated and described about particular embodiments, it is possible for one skilled in the art, if necessary, to add various modifications to configuration, position, disposition or the like with respect to the above-described embodiments without departing from the scope of the technical idea and object of the present invention.

[0068]

For example, the first peeling means 17 is not limited to the illustrated example of the configuration, but if the peeling area A2 can be peeled off, any configuration is acceptable. In particular,

the peeling area A2 may be peeled off at an acute angle using a peel plate. Also, as for the length along the paying out direction of the peeling area A2, any length is acceptable that extends from the intermediate point of the sticking area A1 to a position with a predetermined distance away from the rear end of the sticking area A1 along the paying out direction toward the upstream side in the paying out direction.

[0069]

Also, in the embodiment, the wafer W has the configuration including the orientation flat W1. Such a wafer may be employed that has a V-notch in the peripheral edge. In this case, it is enough to form such an area in the blade as corresponding to the V-notch in the first cutting blade 31A. Further, the object is not limited to the wafer W, but a plate-like object other than wafer may be adapted as an object.

[0070]

Furthermore, the sheet material S is not limited to the one including the die bonding sheet DS, but any heat-adhesive sheet is applicable. For example, a heat-adhesive protection sheet for protecting the surface of the object may be employed. Or, a sheet for forming protection film, which is disclosed in Japanese Patent Application Laid-Open No. 2002-280329 or a dry resist film may be employed.

[0071]

Still further, in the above embodiments, an example of the heat-adhesive die-bonding sheet has been demonstrated. Accordingly, the sheet sticking apparatus including the heating unit and the cooling unit has been described. When other sheets with no heat-adhesive are employed, the heating unit and the cooling unit are not required.

[0072]

Still further, the peeling area A2 is formed at the upstream side in the paying out direction of the sticking area A1. However, when the sticking area A1 is stuck to the wafer W in such an arrangement that the press roller 90 moves from the downstream side to the upstream side in the paying out direction, the peeling area A2 is formed at the downstream side in the paying out direction. The reason of this is found by experiments on the basis of the following facts. That is, in the case where the die bonding sheet DS exists at the area enclosing the sticking start side of the sticking area A1, even after being cut with the cutting blade 31, the die bonding sheet is apt to be adhere again. On the other hand, even when the die bonding sheet DS enclosing the side of the sticking area A1, which is the ending side of sticking operation, is not peeled off, the die bonding sheet is not adhered

again. An estimated cause of such tendency is understood as described below. That is, as shown in Fig. 18(B), in an initial stage of the sticking operation in which the press roller 90 has lowered, the time duration when the wafer W and the end of the sticking area A1 at the upstream side in the paying out direction are in contact with each other is somewhat longer relatively. That is, in the present invention, when imparting the press force from one end to the other end of the wafer W along the surface of the sticking area A1 to stick the same, when the peeling area A2 is formed in the area at the starting side of the press force imparting and peeled off, the problem of re-adhesion will not occur, and only a minimum area is to be peeled off for the purpose.

[0073]

Further, in the embodiment, such structure is adopted that the sticking table 62 includes the intermediate table 79, the base table 80, the guide rails 81, 82 and the heating unit 84 and the like. However, the present invention is not limited to the above. If the table body 79 is arranged to be movable between the waiting position and the work center C, various modifications can be implemented.

CLAIMS

1. A sheet sticking apparatus that uses a sheet material including a base sheet continuing in a strip-shape and a sticking laminated sheet formed on one surface of the base sheet, cuts the laminated sheet into a plane shape of an object to be stuck to form a sticking area in a process of paying out the sheet material and sticks the sticking area to said object, comprising:

a conveyance means that takes out said objects one by one from a storing means of the objects and conveys the same;

a cutting means that cuts said laminated sheet in accordance with a plane shape of the object to form said sticking area, and cuts said laminated sheet in the width direction thereof at front and behind positions along the paying out direction of said laminated sheet neighboring the sticking area to form a peeling area;

a first peeling means that peels off said peeling area;

a sticking means including a sticking table that supports the object and sticks said sticking area to the object; and

a second peeling means that peels off said base

sheet from the sticking area, wherein

said conveyance means, cutting means, sticking means, first and second peeling means are arranged so as to be movable without interfering with each other having a predetermined common processing position as a work center with respect to sequentially paid out sheet materials.

2. The sheet sticking apparatus according to claim 1, wherein

said cutting means includes a first cutting blade formed in an endless shape along the peripheral edge of the object, a second cutting blade for cutting said laminated sheet in the width direction at a position away from the first cutting blade to the upstream side in the paying out direction of the sheet material, and a third cutting blade, which continues to said first cutting blade and is disposed substantially parallel to the second cutting blade at the downstream side of said second cutting blade in the paying out direction,

said sticking area is formed by said first cutting blade, said peeling area is formed by a part of the first cutting blade and said second and the third cutting blades, and after peeling off the peeling area with the first peeling means, said sticking area is

stuck to the object.

3. The sheet sticking apparatus according to claim 2, wherein said first cutting blade and said third cutting blade are continuous with each other without any joint.

4. The sheet sticking apparatus according to claim 2, wherein said cutting means further includes a table, and said first, second and third cutting blades are formed integrally with said table at the upper face side thereof.

5. The sheet sticking apparatus according to claim 4, wherein said first, second and third cutting blades are formed by etching the upper face side of said table.

6. The sheet sticking apparatus according to claim 1, wherein said first peeling means includes a peeling head that supports a peeling tape allowing to run around in the width direction of the sheet material crossing its paying out direction, and peels off said peeling area from said base sheet by bonding said peeling tape to said peeling area and allowing said peeling tape to run around.

7. The sheet sticking apparatus according to claim 6, wherein said first peeling head includes a heat block, and the heat block adheres said peeling tape to the peeling area with heat adhesion.

8. The sheet sticking apparatus according to claim 7, wherein said heat blocks are disposed at a plurality of points along the width direction of said peeling area.

9. The sheet sticking apparatus according to claim 1, wherein

said object is a semiconductor wafer formed with bumps on the front surface thereof,

said sticking table includes a protruded ring portion having a closed loop shape along the outer edge of the wafer, which does not interfere with said bumps, when the semiconductor wafer is supported so that the surface of the semiconductor wafer formed with the bumps comes to the bottom face side thereof.

10. The sheet sticking apparatus according to claim 9, wherein the height of the projecting portion of said protruded ring portion is set to a height substantially equal to the height of the bumps.

11. The sheet sticking apparatus according to claims 9 or 10, wherein said sticking table is arranged so that the inside of said protruded ring portion forms a suction space for the semiconductor wafer, and is formed of an elastic material as a forming material.

12. The sheet sticking apparatus according to claim 1, wherein said object is a semiconductor wafer and said laminated sheet is a heat-adhesive die-bonding sheet.

13. A sheet sticking method that uses a sheet material including a base sheet continuing in a strip-shape and a sticking laminated sheet formed on one surface of the base sheet, cuts the laminated sheet into a plane shape of an object to form a sticking area in a process of paying out the sheet material and sticks the sticking area to said object, comprising the steps of:

taking out said objects one by one with a conveyance means;

cutting said laminated sheet to form a sticking area and a peeling area therein;

first peeling off to peel off said peeling area;

sticking the sticking area to the object; and

second peeling off to peel off said base sheet

from the sticking area, wherein

said cutting step is achieved by simultaneously carrying out a first cutting of the laminated sheet to form the sticking area without any joint along the peripheral edge of the object, a second cutting of said laminated sheet in a width direction at a position away from the first cutting position to an upstream side in a paying out direction of the sheet material and a third cutting of the laminated sheet along a continuous line with said first cutting line as well as substantially parallel to the second cutting at the downstream side from said second cutting position in the paying out direction, wherein

the sticking area is formed by said first cutting, and the peeling area is formed by a part of the first cutting and said second and third cuttings,

after peeling off said peeling area with a first peeling means, said sticking area is stuck to the object,

said sheet material is peeled off from the sticking area leaving said sticking area on the object.

14. The sheet sticking method according to claim 13, wherein said first cutting and third cutting are continuous without any joint.

15. The sheet sticking method according to claims 13 or 14, wherein said cutting, sticking of the sticking area, first and second peeling off are carried out sequentially at a predetermined common processing position as a work center in a state that paying out of said base sheet is halted.