

CHIP DETACHING APPARATUS AND CHIP DETACHING METHOD

TECHNICAL FIELD

[0001] The present disclosure relates to a chip detaching apparatus and a chip detaching method, and more particularly, to a chip detaching apparatus and a chip detaching method for detaching a semiconductor chip attached to a tape and supplying the semiconductor chip to be mounted on a package or a substrate.

BACKGROUND ART

[0002] A semiconductor chip formed on a wafer is attached to a thin adhesive tape and transferred to a next process in this state.

[0003] FIG. 1 illustrates an example of a semiconductor chip that is attached to a tape to be supplied. A wafer on which a plurality of semiconductor chips are formed is attached to a thin tape and then sawed in units of semiconductor chips. When the tape T is tensioned and uniformly pulled in this state, a plurality of semiconductor chips C are attached to the tape T at uniform distances as illustrated in FIG. 1.

[0004] The plurality of semiconductor chips C attached to the tape T as illustrated in FIG. 1 are sequentially detached from the tape T one by one to be attached to a substrate. Semiconductor chips C that have recently been manufactured have often a very small thickness. If a semiconductor chip C is thin, the semiconductor chip C is likely to be damaged during a process of detaching the semiconductor chip C from the tape T. In particular, if the semiconductor chip C has a relatively large area compared to the thickness of the semiconductor chip C, the semiconductor chip C is easily broken during a process of detaching the semiconductor chip C from the tape T due to an adhesive force between the tape T and the semiconductor chip C.

[0005] According to the conventional art, the tape T is fixed and then the tape T is pushed up from a bottom side of the tape T by using a pin to thereby detach edges of the semiconductor chip C from the tape T. The semiconductor chip C whose edges are detached from the tape T as described above is lifted up using a pick-up head and transferred and attached to a substrate. In the case of pushing up the tape

T using a pin, there is a problem that the semiconductor chip C is damaged due to an impact of the pin hitting the semiconductor chip C. If the area of the semiconductor chip C is relatively large compared to the thickness of the semiconductor chip C as described above, even if the tape T is pushed up using a pin, the tape T may be elastically deformed or torn but the semiconductor chip C might not be detached from the tape T.

DESCRIPTION OF EMBODIMENTS

TECHNICAL PROBLEM

[0006] The present disclosure relates to a chip detaching apparatus and a chip detaching method, in which a semiconductor chip may be effectively detached from a tape while minimizing an impact transferred to the semiconductor chip.

[0007] According to an aspect of the present disclosure, there is provided a chip detaching apparatus for detaching a semiconductor chip adhered to a thin tape, the chip detaching apparatus including: an ejection hood including a supporting body supporting a lower surface of the tape on an outer circumference of the semiconductor chip to be detached from the tape, an vacuum clamping hole formed in an upper surface of the supporting body to clamp a portion of the lower surface of the tape that is in contact with the supporting body, and a push hole formed to vertically pass through a center portion of the upper surface of the supporting body; a lifting member including a lifting body that is inserted into the push hole of the ejection hood and liftably mounted so as to upwardly push up, through the push hole, the tape clamped via vacuum transferred through the vacuum clamping hole of the ejection hood, a through hole formed to vertically pass through a center portion of an upper surface of the lifting body, and a cavity formed in the lifting body to communicate with the through hole; an elastic member that is filled in the cavity of the lifting member such that the elastic member is elastically deformed in a convex shape through the through hole so as to push up the tape with the semiconductor chip; a pressing member mounted in the lifting body to move forward and backward with respect to the cavity, the pressing member being formed to correspond to an inner circumferential shape of the cavity of the lifting member so as to elastically deform the elastic member by applying pressure to the elastic member; and a

pick-up head placed above the ejection hood to clamp the semiconductor chip by vacuum and lift up the semiconductor chip to be pushed up by the elastic member so as to detach the semiconductor chip.

[0008] According to another aspect of the present disclosure, there is provided a chip detaching method of detaching a semiconductor chip adhered to a thin tape, the chip detaching method including: (a) while the tape is disposed on the ejection hood, clamping a lower surface of the tape by vacuum on an outer circumference of the semiconductor chip that is to be detached from the tape, through a plurality of vacuum clamping holes formed in an upper surface of an ejection hood; (b) pushing up the tape that is in contact with the lifting member by lifting up the lifting member inserted into a push hole formed in a center portion of the ejection hood; (c) detaching the tape in a portion around the semiconductor chip, from the semiconductor chip by elastically deforming an elastic member in an upwardly convex shape by applying pressure to the elastic member that is filled in the cavity formed to communicate with a through hole formed in a center portion of the lifting member, by using a pressing member formed to correspond to an inner circumferential shape of the cavity and installed to move forward or backward with respect to the cavity; (d) clamping an upper surface of the semiconductor chip by vacuum by lowering the pick-up head placed above the ejection hood; and (e) lifting the pick-up head that has clamped the semiconductor chip in (d) to detach the semiconductor chip from the tape.

ADVANTAGEOUS EFFECTS OF DISCLOSURE

[0009] According to the chip detaching apparatus and the chip detaching method as described above, a semiconductor chip attached to a tape may be effectively detached while preventing damage to the semiconductor chip.

BRIEF DESCRIPTION OF DRAWINGS

[0010] FIG. 1 is a plan view illustrating a state in which semiconductor chips are adhered to a tape.

[0011] FIG. 2 is a plan view illustrating a state in which a tape to which a

semiconductor chips are adhered is disposed in a chip detaching apparatus according to an embodiment of the present disclosure.

[0012] FIGS. 3 through 7 are cross-sectional views taken along line II-II of FIG. 2 to explain a process of detaching a semiconductor chip by using the chip detaching apparatus illustrated in FIG. 2.

[0013] FIG. 8 is a flowchart of a chip detaching method according to an embodiment of the present disclosure, in which a semiconductor chip is detached using the chip detaching apparatus illustrated in FIG. 2.

BEST MODE

[0014] Hereinafter, a chip detaching apparatus according to the present disclosure will be described in detail with reference to the drawings.

[0015] FIG. 2 is a plan view illustrating a state in which a tape to which semiconductor chips are adhered is disposed in a chip detaching apparatus according to an embodiment of the present disclosure, and FIG. 3 is a cross-sectional view of the chip detaching apparatus illustrated in FIG. 2 taken along line II-II.

[0016] Referring to FIGS. 2 through 7, the chip detaching apparatus according to the present embodiment includes an ejection hood 10, a lifting member 20, an elastic member 30, a pressing member 40, and a pick-up head 50.

[0017] Referring to FIG. 2, the ejection hood 10 includes a supporting body 11, an vacuum clamping hole 12, and a push hole 13. The supporting body 11 is formed in a shape similar to a vertically extending square tube. An outer circumference of an upper surface of the supporting body 11 is formed in a quadrangle shape. The outer circumference of the upper surface of the supporting body 11 is formed to be larger than a size of an outer edge of a semiconductor chip C to be detached from a tape T. A plurality of vacuum clamping holes 12 are formed in the upper surface of the supporting body 11. The ejection hood 10 produces a vacuum through the vacuum clamping holes 12 to thereby clamp a portion of a lower surface of the tape T that is in contact with the vacuum clamping holes 12. Referring to FIG. 2, the vacuum clamping holes 12 are arranged along the outer circumference of the semiconductor chip C. The vacuum clamping holes 12 may preferably be disposed at positions

between the semiconductor chips C adhered to the tape T to clamp the tape T by vacuum. The push hole 13 vertically passing through the supporting body 11 is formed in a center portion of the upper surface of the supporting body 11. As a result, the vacuum clamping holes 12 are arranged along an outer circumference of the push hole 13. The push hole 13 is formed in a quadrangle shape. The push hole 13 may preferably have a slightly smaller size than the semiconductor chip C.

[0018] Referring to FIG. 3, the lifting member 20 includes a lifting body 21, a through hole 22, a cavity 23, and an engaging portion 24. An upper portion of the lifting body 21 is liftably inserted into the push hole 13 of the ejection hood 10. An outer circumference of an upper surface of the lifting body 21 is formed in a quadrangle shape so as to fit the size of the push hole 13. A size of the outer circumference of the upper surface of the lifting body 21 may preferably be smaller than the size of the semiconductor chip C. The through hole 22 is formed in a center portion of the upper surface of the lifting body 21. The through hole 22 is formed to vertically pass through the center portion of the upper surface of the lifting body 21. A shape of an outer edge of the through hole 22 is formed in a quadrangle shape. The cavity 23 is formed in the lifting body 21. The cavity 23 is formed to communicate with the through hole 22. A space accommodating the elastic member 30 is formed in the cavity 23. The engaging portion 24 is formed in an upper portion of the through hole 22. The engaging portion 24 is formed to protrude towards an inner portion of the through hole 22. When the elastic member 30 elastically deforms to protrude toward an upper portion of the through hole 22, the engaging portion 24 prevents the elastic member 30 from deviating to the outside.

[0019] The elastic member 30 is filled in the cavity 23 and the through hole 22 of the lifting member 20 to be installed. To this end, the elastic member 30 is formed to fit inner circumferential shapes of the cavity 23 and the through hole 22. Referring to FIG. 3, the elastic member 30 includes a step that fits the shape of the engaging portion 24 so that the elastic member 30 is filled in the through hole 22. A contact surface 31 is formed on an upper surface of the elastic member 30. The contact surface 31 of the elastic member 30 is exposed through the through hole 22. The contact surface 31 of the elastic member 30 is concavely formed so as not to contact the tape T. The contact surface 31 is formed of an adhesive material. Accordingly, the contact surface 31 of the elastic member 30 repeats adhering to

and detaching from the tape T via an operation of the pressing member 40. The elastic member 30 is formed of a highly elastic material such as rubber or gel. The elastic member 30 may preferably be formed of a material that has no voids and that does not decrease in volume due to compression caused by an external force.

[0020] The pressing member 40 is inserted into the cavity 23 of the lifting body 21 to be placed under the elastic member 30. The pressing member 40 is formed to correspond to an inner circumferential shape of the cavity 23. The pressing member 40 may elastically deform the elastic member 30 by applying a pressure to the elastic member 30. To this end, the pressing member 40 is raised or lowered along the cavity 23, thereby providing a pressure to a lower surface of the elastic member 30.

[0021] The pick-up head 50 is disposed on above the ejection hood 10. The pick-up head 50 has an suction plate 51 formed of porous ceramic. The pick-up head 50 is configured to raise or lower the suction plate 51. The pick-up head 50 clamps the semiconductor chip C by bringing the suction plate 51 into contact with an upper surface of the semiconductor chip C and raises the semiconductor chip C in this state, thereby detaching the semiconductor chip C from the tape T.

[0022] Meanwhile, FIG. 8 is a flowchart of a chip detaching method according to an embodiment of the present disclosure, in which a semiconductor chip is detached using the chip detaching apparatus illustrated in FIG. 2.

[0023] Hereinafter, a process of detaching the semiconductor chip C by using the chip detaching apparatus configured as described above with reference to FIGS. 2 through 8 will be described.

[0024] First, as illustrated in FIGS. 2 and 3, from among semiconductor chips C adhered to the tape T, a semiconductor chip C to be detached is placed on upper surfaces of the ejection hood 10 and the lifting member 20. In this state, a vacuum is transferred through the vacuum clamping holes 12 of the ejection hood 10 to clamp a lower surface of the tape T onto the upper surface of the ejection hood 10 (step (a); S110). Here, as the contact surface 31 of the elastic member 30 is formed concavely, the contact surface 31 does not contact the tape T.

[0025] Next, as illustrated in FIG. 4, the pick-up head 50 disposed above the ejection hood 10 is lowered to be brought into contact with an upper surface of the semiconductor chip C to thereby clamp the semiconductor chip C by vacuum (step

(d); S120). As described above, vacuum is transferred through the suction plate 51 of the pick-up head 50, thereby clamping the upper surface of the semiconductor chip C by vacuum.

[0026] Next, as illustrated in FIG. 5, the lifting member 20 is lifted up such that an edge portion of the semiconductor chip C is detached from the tape T (step (b); S130). When the outer portion of the upper surface of the lifting member 20 is smaller than the outer portion of the semiconductor chip C as described above, detaching of the tape T starts from the edge portion of the semiconductor chip C as illustrated in FIG. 5. The tape T in portions outside the semiconductor chip C is fixed via the vacuum clamping holes 12 as described above, and thus, when the semiconductor chip C and the tape T under the semiconductor chip C are lifted up by the lifting member 20, the tape T around the outer circumference of the semiconductor chip C is detached from the semiconductor chip C accordingly.

[0027] Meanwhile, when the semiconductor chip C is lifted up using the lifting member 20, the pick-up head 50 is also lifted up in synchronization with movement of the lifting member 20 (step (e); step S140). As described above, as the pick-up head 50 is lifted up in synchronization with the movement of the lifting member 20, damage to the semiconductor chip C is prevented.

[0028] The pressing member 40 is partially lifted up when the semiconductor chip C is lifted by the lifting member 20 to thereby adhere the contact surface 31 of the elastic member 30 to the lower surface of the tape T. A process of detaching the semiconductor chip C from the tape T is performed while supporting the lower surface of the semiconductor chip C by using the elastic member 30 by bringing the contact surface 31 of the elastic member 30 into contact with the tape T as described above.

[0029] Next, as illustrated in FIG. 6, a pressure is applied to a lower portion of the elastic member 30 by lifting the pressing member 40 up. By elastically deforming the elastic member 30 in an upwardly convex shape, the tape T and the semiconductor chip C are pushed upwards (step (c); S150). Here, the contact surface 31 of the elastic member 30 is adhered to the tape T.

[0030] Meanwhile, when the semiconductor chip C is lifted up by the elastic member 30, the pick-up head 50 also lifts up the semiconductor chip C in synchronization with movement of the elastic member 30 (step (e); S160).

[0031] While the contact surface 31 of the elastic member 30 is being elastically deformed in a convex shape by the pressing member 40, a portion of the tape T having a lower surface that is not supported by the elastic member 30 is gradually detached from the lower surface of the semiconductor chip C. That is, detaching of the tape T is conducted from an edge of the semiconductor chip C toward a center of the semiconductor chip C. As the detaching of the semiconductor chip C is performed while the tape T is being supported by a pressure acting upon the elastic member 30 as described above, the tape T may be effectively detached from the lower surface of the semiconductor chip C. In addition, as the tape T may be detached from the lower surface of the semiconductor chip C according to continuous elastic deformation of the elastic member 30, the detaching operation may be performed efficiently without breaking the semiconductor chip C by the adhesive force of the tape T. In addition, since the elastic member 30 is elastically deformed in proportion to displacement of the pressing member 40, an elevation height of the tape T and the semiconductor chip C may be precisely controlled.

[0032] While performing the lifting up of the lifting member 20 (step (b); S130) and the lifting up of the elastic member 30 (step (c); S150) as described above, the lifting up of the pick-up head 50 (step (c); S140, S160) is performed simultaneously and continuously.

[0033] Next, when the pick-up head 50 is lifted up at the same time when the elastic member 30 is elastically deformed in a convex shape as illustrated in FIG. 6, the pick-up head 50 is lifted up as illustrated in FIG. 7, and the pressing member 40 is retracted to thereby elastically restore the elastic member 30 (step (f); S170). The contact surface 31 of the elastic member 30 is formed of an adhesive material, and thus, the elastic member 30 adheres to the tape T to lower the tape T. As the contact surface 31 of the elastic member 30 formed of the adhesive material is elastically restored while being adhered to the tape T as described above, detaching between the semiconductor chip C and the tape T may be performed rapidly. Moreover, when elastic restoration of the elastic member 30 is completed by the pressing member 40, the contact surface 31 is spontaneously detached from the tape T due to the concave portion formed in the contact surface 31 of the elastic member 30, and thus, interference between the tape T and the contact surface 31 occurring when moving for next detaching of the semiconductor chip C may be

prevented.

[0034] Meanwhile, according to circumstances, instead of lowering the pick-up head 50 to clamp the semiconductor chip C after clamping the tape T through the vacuum clamping holes 12 as described above, the chip detaching apparatus may also be operated such that the pick-up head 50 is lowered to clamp the semiconductor chip C by vacuum (step (d); S120) after performing up to the lifting of the lifting member 20 (step (b); S130).

[0035] In addition, in some cases, the chip detaching apparatus may also be operated to clamp the semiconductor chip C by vacuum (step (d); S120) by lowering the pick-up head 50 after performing the lifting of the lifting member 20 (step (b); S130) and the lifting of the elastic member 30 (step (c); S150).

[0036] After the semiconductor chip C is removed from the tape T as illustrated in FIG. 7, the pressing member 40 is lowered to be removed so that the elastic member 30 is elastically deformed again as illustrated in FIGS. 3 through 5. According to circumstances, detaching of the semiconductor chip C may also be performed by restoring the elastic member 30 by rapidly lowering the pressing member 40 in a state where the detaching of the semiconductor chip C has progressed to some extent as illustrated in FIG. 6. When the elastic member 30 that is elastically deformed in a convex shape is elastically restored instantaneously, a portion of the tape T that has been adhered to the elastic member 30 may also instantaneously return to its original state such that the tape T is completely detached from the lower surface of the semiconductor chip C.

MODE OF DISCLOSURE

[0037] Although the preferred embodiments of the present disclosure have been described above, the scope of the present disclosure is not limited to the embodiments described above.

[0038] For example, while the contact surface 31 of the elastic member 30 is described as concave, the contact surface of the elastic member may be formed horizontally at a position lower than the upper surface of the lifting body. Alternatively, the contact surface of the elastic member may be formed at the same level as the upper surface of the lifting body. Accordingly, the pressing member may

pull the elastic member downward to detach the tape from the contact surface of the elastic member, so that the contact surface of the elastic member is elastically deformed in a concave shape in a direction to the cavity.

[0039] Also, while the contact surface of the elastic member 30 is described as being formed of an adhesive material, an adhesive material may be covered on the contact surface of the elastic member or the contact surface of the elastic member may further include an adhesive layer. Alternatively, the contact surface of the elastic member may not be formed of an adhesive material.

[0040] In addition, although the pressing member 40 is described as being raised or lowered along the cavity 23 formed in the lifting body, the pressing member may be installed at a lateral side of the cavity and move forward or backward in a horizontal direction to thereby apply pressure to the elastic member.

CLAIMS

1. A chip detaching apparatus for detaching a semiconductor chip adhered to a thin tape, the chip detaching apparatus comprising:

an ejection hood comprising a supporting body supporting a lower surface of the tape on an outer circumference of the semiconductor chip to be detached from the tape, an vacuum clamping hole formed in an upper surface of the supporting body to clamp a portion of the lower surface of the tape that is in contact with the supporting body, and a push hole formed to vertically pass through a center portion of the upper surface of the supporting body;

a lifting member comprising a lifting body that is inserted into the push hole of the ejection hood and liftably mounted so as to upwardly push up, through the push hole, the tape clamped via vacuum transferred through the vacuum clamping hole of the ejection hood, a through hole formed to vertically pass through a center portion of an upper surface of the lifting body, and a cavity formed in the lifting body to communicate with the through hole;

an elastic member that is filled in the cavity of the lifting member such that the elastic member is elastically deformed in a convex shape through the through hole so as to push up the tape with the semiconductor chip;

a pressing member mounted in the lifting body to move forward and backward with respect to the cavity, the pressing member being formed to correspond to an inner circumferential shape of the cavity of the lifting member so as to elastically deform the elastic member by applying pressure to the elastic member; and

a pick-up head placed above the ejection hood to clamp the semiconductor chip by vacuum and lift up the semiconductor chip to be pushed up by the elastic member so as to detach the semiconductor chip.

2. The chip detaching apparatus of claim 1, wherein a plurality of vacuum clamping holes of the ejection hood are formed and arranged along an outer circumference of the push hole, and the plurality of vacuum clamping holes clamp the tape by vacuum on an outer circumference of the semiconductor chip.

3. The chip detaching apparatus of claim 1, wherein the semiconductor chip is detached from the tape such that when the semiconductor chip is pushed up by the lifting member and the elastic member, the pick-up head lifts up the semiconductor chip while clamping the semiconductor chip by vacuum.

4. The chip detaching apparatus of claim 1, wherein the lifting member further comprises an engaging portion that protrudes from an upper portion of the through hole to prevent the elastic member, which is elastically deformed and protrudes toward an upper portion of the through hole, from deviating to the outside.

5. The chip detaching apparatus of claim 1, wherein an outer surface of the elastic member that comes into contact with the tape is formed of an adhesive material.

6. The chip detaching apparatus of claim 1, wherein the contact surface of the elastic member is formed concavely in a state where no external pressure is applied.

7. A chip detaching method of detaching a semiconductor chip adhered to a thin tape, the chip detaching method comprising:

(a) while the tape is disposed on the ejection hood, clamping a lower surface of the tape by vacuum on an outer circumference of the semiconductor chip that is to be detached from the tape, through a plurality of vacuum clamping holes formed in an upper surface of an ejection hood;

(b) pushing up the tape that is in contact with the lifting member by lifting up the lifting member inserted into a push hole formed in a center portion of the ejection hood;

(c) detaching the tape in a portion around the semiconductor chip, from the semiconductor chip by elastically deforming an elastic member in an upwardly convex shape by applying pressure to the elastic member that is filled in the cavity formed to communicate with a through hole formed in a center portion of the lifting member, by using a pressing member formed to correspond to an inner

circumferential shape of the cavity and installed to move forward or backward with respect to the cavity;

(d) clamping an upper surface of the semiconductor chip by vacuum by lowering the pick-up head placed above the ejection hood; and

(e) lifting the pick-up head that has clamped the semiconductor chip in (d) to detach the semiconductor chip from the tape.

8. The chip detaching method of claim 7, wherein (d) is performed after performing (a),

while performing (b) and (c), in (e), the semiconductor chip is lifted up using the pick-up head in synchronization with operation of the ejection hood and the elastic member.

9. The chip detaching method of claim 7, wherein (d) is performed after performing (a) and (b),

and while performing (c), in (e), the semiconductor chip is lifted up using the pick-up head in synchronization with operation of the elastic member.

10. The chip detaching method of claim 7, further comprising (f) elastically restoring the elastic member by retracting the pressing member after completing (d).

11. The chip detaching method of claim 10, wherein a contact surface of the elastic member is formed of an adhesive material, and the elastic member adheres to the tape to lower the tape in (f).