DESCRIPTION

PICK-UP METHOD AND PICK-UP DEVICE

TECHNICAL FIELD

The present invention relates to a pick-up method and a pick-up device.

BACKGROUND ART

In a manufacturing process of a semiconductor device, semiconductor pellets (referred to, hereinafter, as simply pellets) that have been diced are required to be picked up from an adhesive sheet. A conventional pick-up device includes a stage that holds the adhesive sheet, a thrusting platform that advances and retreats in relation to the stage, and needles that are thrust upwards by the thrusting platform. In other words, the pick-up device is configured such that a needle that is thrust upwards by the thrusting platform strikes the adhesive sheet on the stage from a back surface side and peels a pellet from the adhesive sheet.

However, in the pick-up device using the needles, when the needle penetrate the adhesive sheet, pushes the pellets upwards, and detaches the pellets from the adhesive sheet, a tip section of the needle may become worn due to abrasion, damaged, or bent. In such instances, the damaged needle may damage the back surface of the pellet when the needle pushes the pellet upwards. Moreover, because the length of each needle differs as a result of wear and damage, the pellet is pushed upwards at an angle. As a result, adjacent pellets may bump into one another, mutually causing damage.

Furthermore, the pellet is extracted by being suctioned by a collet. However, when the pellet is pushed upwards at an angle, a pellet suction error by the collet occurs. When the pellet suction error occurs in the collet, subsequent operations are disrupted. Moreover, the pellet may become damaged as a result of being pushed upwards by the needle.

Therefore, a pick-up device (Patent Document 1) that does not use needles such as that described above has been proposed in recent years. As shown in Fig. 8 and Fig. 9, the pick-up device includes a stage 3 that holds an adhesive sheet 2 on which pellets 1 are adhered. A receiving section 4 is attached to the stage 3. An upper surface 4a of the receiving section 4 projects further

outward than a stage upper surface 3a. Therefore, a gap 6, such as that shown in Fig. 9, is formed on an outer periphery of the receiving section 4, between the receiving section 4 and the adhesive sheet 2. Furthermore, suction holes 5 that communicate with the gap 6 are provided on the stage 3. As shown in Fig. 8, from a planar view, a portion of the each suction hole 5 and 5 projects further outward that a first edge 8a of the pellet 1.

Next, a pick-up method using the above-described pick-up device will be described. First, in a state in which a collet (suction collet) 7 suctions (holds) the pellet 1 from above, the adhesive sheet 2 is suctioned through the suction holes 5. As a result, air in the gap 6 is suctioned as indicated by arrow A. The adhesive sheet 2 in the periphery of the receiving section 4 is suctioned, and the adhesive sheet 2 is peeled from the outer periphery of the pellet 1.

Then, as shown in Fig. 10, the receiving section 4 is moved in a direction indicated by arrow B. In other words, the receiving section 4 is moved to a second edge 8b side opposing the first edge 8a. As a result, a received area of the pellet 1 received by the receiving section 4 becomes smaller, and a suction area of the adhesive sheet 2 becomes larger. Ultimately, the adhesive sheet 2 is completely peeled away from the pellet 1.

Patent Document 1: Japanese Patent Application No. 3209736

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

When the pick-up device described above is used, in an early stage of a peeling operation, the adhesive sheet 2 surrounding the receiving section 4 is required to be peeled. Therefore, peeling the adhesive sheet 2 from the periphery of a chip (pellet) 1 by suction is sometimes time consuming. Moreover, force required to peel the adhesive sheet 2 from the periphery of the chip 1 by suction is dispersed along three edges 8a, 8c, and 8d of the receiving section 4 (see Fig. 8), and is therefore weak.

As shown in Fig. 11, the adhesive sheet 2 is peeled from the first edge 8a towards the second edge 8b side opposing the first edge 8a. Therefore, the adhesive sheet 2 is peeled by an amount equivalent to a length of the first edge 8a, thereby requiring a relatively large peeling force. However, the chip 1 is merely held by the suction force of the collet 7 during peeling. Therefore, the

chip (pellet) 1 side may not be able to resist the peeling force during sliding, and the collet 7 may lose hold of the chip 1. Alternatively, the adhesive sheet 2 may be pulled by a sliding movement of the receiving section 4, and the chip 1 may become displaced.

In light of the above-described issues, the present invention provides a pick-up method and a pick-up device that can easily and with certainty detach a pellet that is required to be detached and extract the pellet.

MEANS FOR SOLVING THE PROBLEMS

A pick-up method of the present invention successively detaches a plurality of thin, rectangular pellets adhered to an adhesive sheet from the adhesive sheet, and extracts the pellets. In the pick-up method, a receiving section receives a pellet to be detached with the adhesive sheet therebetween. After a gap is formed between the receiving section and the adhesive sheet at an outer peripheral side of the receiving unit, in a state in which the pellet is held from above, air in the gap is suctioned while a portion of the adhesive sheet is supported from below by a projection that projects into the gap, and the adhesive sheet on the outer peripheral side of the receiving section is peeled. Then, the receiving section moves along a horizontal direction while the adhesive sheet is supported by the projection and the pellet is held from above, and the pellet is detached.

In the pick-up method of the present invention, when the pellet to be detached is received by the receiving section with the adhesive sheet therebetween, and the air in the gap formed between the receiving section and the adhesive sheet on the outer peripheral side of the receiving section is suctioned, the adhesive sheet is suctioned on the outer peripheral side of the receiving section, and the adhesive sheet is peeled away from the pellet. Then, as a result of the receiving section being moved in the horizontal direction, a received area of the pellet received by the receiving section becomes smaller. As a result, a suction area of the adhesive sheet becomes larger. Ultimately, the adhesive sheet can be completely peeled away from the pellet to be detached.

Moreover, in the peeling operation described above, the adhesive sheet is supported from below by the projection that projects into the gap formed on the outer peripheral side of the receiving section. Therefore, when the air is suctioned from the gap, stress can be concentrated near the projection, thereby facilitating detachment of the pellet by suction. Furthermore, the projection

penetrates the adhesive sheet as a result of the suction.

A pick-up device of the present invention successively detaches a plurality of thin, rectangular pellets adhered to an adhesive sheet from the adhesive sheet and extracts the pellets. The pick-up device includes: a holding means that holds a pellet to be detached from above; a stage on which the adhesive sheet is placed; a receiving section that receives the pellet with the adhesive sheet therebetween; an air suctioning means that suctions air from a gap formed between the receiving section and the adhesive sheet on an outer peripheral side of the receiving section; a projection that projects into the gap and supports a portion of the adhesive sheet from below; and a driving means that moves the receiving section along a horizontal direction.

In the pick-up device of the present invention, the receiving section can receive the pellet to be detached with the adhesive sheet therebetween. In a state in which the pellet is received by the receiving section and held from above by the holding means, the air in the gap formed between the receiving section and the adhesive sheet on the outer peripheral side of the receiving section is suctioned by the air suctioning means. As a result, the adhesive sheet is suctioned on the outer peripheral side of the receiving section, and the adhesive sheet is peeled away from the pellet. The receiving section can be moved in the horizontal direction by the driving means. As a result, a received area of the pellet received by the receiving means becomes smaller, and a suction area of the adhesive sheet becomes larger. Therefore, when the suction area becomes the same or greater than a pellet area, the adhesive sheet can be completely peeled away from the pellet to be detached.

Moreover, in the peeling operation described above, the adhesive sheet is supported from below by the projection that projects into the gap formed on the outer peripheral side of the receiving section. Therefore, when the air is suctioned from the gap, stress can be concentrated near the projection, thereby facilitating detachment of the pellet by suction. As a result, the above-described pick-up method can be performed with certainty.

The projection can be configured by a pin that can move vertically. As a result, a height position of the pin can be adjusted. The projection can also be provided integrally with the stage on which the receiving section is placed. In this case, the projection can extend in a vertical direction or in a lateral direction (horizontal direction).

The projection is preferably disposed in a position corresponding to a corner section of the

pellet. As a result of the projection being disposed in this position, stress can be concentrated on the corner section of the pellet from which the adhesive sheet can be easily peeled.

ADVANTAGE OF THE INVENTION

In the present invention, when the air is suctioned from the gap, stress can be concentrated in the periphery of the projection, thereby facilitating detachment of the pellet by suction. In other words, the adhesive sheet can be peeled at an early stage of the peeling operation with relatively little force. Time required to start peeling can be shortened.

In the peeling operation, the projection penetrates the adhesive sheet as a result of the suction. Therefore, the projection 25 serves as an anchor for the adhesive sheet. As a result, the peeling operation is stabilized. The adhesive sheet is not pulled even by a sliding movement of the receiving section. A chip (pellet) side is not overridden by the peeling force during sliding. Therefore, the pellet does not detach from a collet (holding means). Moreover, there is no risk of the adhesive sheet being pulled and the pellets becoming displaced.

Because the projection is configured by a pin that can move vertically, the height position of the pin can be adjusted. Therefore, as a result of the height position of the pin being adjusted based on the thickness of the adhesive sheet, the height of the stage on which the receiving section is placed, and the like, optimal peeling performance can be achieved for the pellet to be detached.

When the projection is formed integrally with the stage, configuration of the overall device can be simplified. Regardless of whether the projection extends in the vertical direction or in the lateral direction (horizontal direction), the projection can support the adhesive sheet from below, and provide a function for enhancing detachment with certainty.

As a result of the projection being disposed in a position corresponding to the corner section of the pellet, stress can be concentrated on the corner section of the pellet from which the adhesive sheet can be easily peeled. Therefore, peeling can be started stably and with certainty. Reliability of the peeling operation is enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A to Fig. 1C are simplified diagrams of procedures of a pick-up method according to

an embodiment of the present invention;

Fig. 2A to Fig. 2F are simplified cross-sectional views of a pick-up device according to the embodiment of the present invention and a pick-up operation performing using the pick-up device;

Fig. 3 is a simplified planar view of pellets adhered to an adhesive sheet;

Fig. 4A to Fig. 4C are simplified diagrams of a relationship between a projection and a receiving section in the pick-up device;

Fig. 5 is a cross-sectional view of a pick-up device according to another embodiment of the present invention;

Fig. 6A to Fig. 6B are simplified diagrams of procedures of a pick-up method using another pick-up device according to another embodiment of the present invention;

Fig. 7 is a simplified diagram of a variation example of a projection in the pick-up device;

Fig. 8 is a simplified planar view of a conventional pick-up device;

Fig. 9 is a simplified cross-sectional view of the conventional pick-up device;

Fig. 10 is a simplified cross-sectional view of a peeling procedure using the conventional pick-up device; and

Fig. 11 is a simplified diagram indicating issues regarding a pick-up method using the conventional pick-up device.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiments of the present invention will be described with reference to Fig. 1 to Fig. 7.

Fig. 2 is a diagram of a pick-up device of the present invention. The pick-up device successively detaches a plurality of thin, rectangular pellets (semiconductor chips) 11 adhered to an adhesive sheet 12 from the adhesive sheet 12, and extracts the pellets 11.

A wafer W serves as a material of the pellets 11 (see Fig. 3). A final product is obtained by the material being cut into rectangular shapes. Therefore, a pellet 11 is square, strip-shaped, or the like. In other words, as shown in Fig. 3, the overall wafer W is circular. The wafer W is divided into individual pellets 11 through dicing. The pellets 11 are adhered to the adhesive sheet 12. A frame 13 that is a ring is adhered to the outer periphery of the adhesive sheet 12. In other words, the frame 13 and the adhesive sheet 12 are integrated. In a state in which the frame 13 and the adhesive

sheet 12 are integrated, the pick-up device extracts the pellets 11.

As shown in Fig. 2A to Fig. 2F, the pick-up device includes a holding means 15, a stage 16, a receiving section 17, an air suctioning means 18, and a driving means (not shown). The holding means 15 holds the pellet 11 to be extracted from above. The adhesive sheet 12 is placed on the stage 16. The receiving section 17 receives the pellet 11 with the adhesive sheet 12 therebetween. The air suctioning means 18 suctions air from a gap 19 formed between the receiving section 17 and the adhesive sheet 12 in the outer periphery of the receiving section 17. The driving means moves the receiving section 17.

The holding means 15 is configured by a suctioning component (collet) 21 including a head 20 that suctions the pellet 11. A suction hole is provided on a lower end surface 20a of the head 20. The pellet 11 is vacuum suctioned through the suction hole, and the pellet 11 is attached to the lower end surface 20a of the head 20. Therefore, when the vacuum suction (vacuum drawing) is released, the pellet 11 detaches from the head 20. The suctioning component 21 is connected, for example, to a robot arm, allowing the suctioning component 21 to be moved in a vertical direction (directions of arrow C and arrow D directions in Fig. 2A and Fig. 2E), a horizontal direction (arrow E directions in Fig. 2D), and a combination of these directions.

A recess 22 is provided on an upper surface of the stage 16. The receiving section 17 is positioned in the recess 22. The recess 22 includes a rectangular main body 22a and a tapered section 22b that is positioned on the outer peripheral side of the main body 22a. The receiving section 17 is a rectangular, planar member that engages with the main body 22a of the recess 22. A thickness of the receiving section 17 is set to be roughly the same as a depth of the main body 22a. As shown in Fig. 1, a width W of the receiving section 17 is set to be smaller than a length (width) W1 of one edge of the pellet 11 that is a square. In this case, one long edge 17a of the receiving section 17 corresponds to a first edge 23a of the pellet 11 to be detached Another long edge 17b of the receiving section 17 corresponds to a second edge 23b (edge opposing the first edge 23a) of the pellet 11 to be detached. A short edge 17c on a tip side of the receiving section 17 corresponds to a third edge 23c (edge forming a right angle with the first edge 23a and the second edge 23b) of the pellet 11.

As shown in Fig. 1, suction holes 30a, 30b, and 30c are provided in the recess 22, corresponding to the middle of the first edge 23a, the middle of the second edge 23b, and the middle

of the third edge 23c. From a planar view, a portion of each suction hole 30a, 30b, and 30c projects further outward than the pellet 11.

As shown in Fig. 2A, the adhesive sheet 12 on which the pellets 11 are adhered is placed on the stage 16. As a result, a gap 19 is formed between the receiving section 17 and the adhesive sheet 12 in the outer periphery of the receiving section 17. More specifically, the gap 19 is formed in at least a front side of the short edge 17c at the tip of the receiving section 17.

The suctioning means 18 includes the suction holes 30a, 30b, and 30c. A vacuum pump (not shown) is connected to the suction holes 30a, 30b, and 30c. In other words, as a result of the vacuum pump being driven, the air in the gap 19 is suctioned through the suction holes 30a, 30b, and 30c.

The receiving section 17 moves along a horizontal direction, via the driving means, such that the short edge 17c at the tip of the receiving section 17 is kept parallel with the third edge 23c of the pellet 11. As the driving means, various mechanisms, such as a cylinder arrangement or a reciprocating mechanism, formed by a bolt shank component and a nut component that is threaded and secured onto the bolt shank component can be used. A supporting component 31 is connected to the receiving section 17. The receiving section 17 and the supporting component 31 form a movement block member 32.

Projections 25 that project into the gap 19 are attached to the stage 16. In other words, a pin (a small-diameter, cylindrical member having an arc-shaped tip) (see Fig. 4A to Fig. 4C) serving as a projection 25 is disposed in each corner formed by the first edge 23a and the third edge 23c of the pellet 11 to be detached, and by the second edge 23b and the third edge 23c of the pellet 11.

In this case, a vertical hole section (not shown) is provided in the stage 16. The pin serving as the projection 25 is disposed in the hole section such as to be allowed vertical movement. The projection 25 moves vertically by a vertical movement mechanism, such as a cylinder arrangement or a ball screw mechanism (not shown). Therefore, as shown in Fig. 4A, a state can be achieved in which a height position of a tip 26 of the projection 25 matches a height position of an upper surface 27 of the receiving section 17. Alternatively, as shown Fig. 4B, a state can be achieved in which the height position of the tip 26 of the projection 25 is higher than the height position of the upper surface 27 of the receiving section 17. Alternatively, as shown in Fig. 4C, a state can be achieved in which

the height position of the tip 26 of the projection 25 is lower than the height position of the upper surface 27 of the receiving section 17. Although the projection 25 may differ based on the size and thickness of the pellet 11 to be detached, the thickness of the adhesive sheet 12, and the like, the projection 25 is, for example, about 0.6 millimeters to 0.7 millimeters. A curvature radius of the arc section of the tip is, for example, about 200 micrometers to 300 micrometers.

Next, a pick-up method using the above-described pick-up device will be described. First, as shown in Fig. 3, in a state in which the frame 13 and the adhesive sheet 12 are integrated, as shown in Fig. 1, a pellet 11a having an edge (in this instance, the fourth edge 23d) that does not oppose another pellet 11 is selected. The stage 16 of the pick-up device is positioned below the pellet 11a. As shown in Fig. 2A, the pellet 11a is received by the receiving section 17 of the movement block body 32, with the adhesive sheet 12 therebetween.

Therefore, as shown in Fig. 2A, the gap 19 is formed on the bottom side of the adhesive sheet 12 on at least the front side of the receiving section 17. The projections 25 corresponding to the corner formed by the first edge 23a and the second edge 23b of the pellet 11a and the corner formed by the second edge 23b and the third edge 23c of the pellet 11a projects into the gap 19. At this time, for example, as shown in Fig. 4A, the height positions of the tips 26 of the projections 25 and the height position of the upper surface 27 of the receiving section 17 match. In this state, the collet 21 of the holding means 15 is lowered as indicated by the arrow D. The head 20 is placed in contact with the upper surface of the pellet 11a. The pellet 11a is vacuum-suctioned by the suction hole, and the pellet 11a is attached to the lower end surface 20a of the head 20.

As described above, the gap 19 communicates with the suction holes 30a, 30b, and 30c. Therefore, as a result of the suctioning means 18 being driven, the air in the gap 19 is suctioned through the suction holes 30a, 30b, and 30c. As a result, as shown in Fig. 2B, in a state in which a portion of the adhesive sheet 12 is held by the projection 25, a portion of the adhesive sheet 12 surrounding the projection 25 is suctioned. The adhesive sheet 12 near the projection 25 is peeled away from the pellet 11a.

Then, as shown in Fig. 1B, Fig. 1C, Fig. 2C, and Fig. 2D, the receiving section 17 is moved (slid) as indicated by arrow F. As a result, the received area of the pellet 11a received by the receiving section 17 becomes smaller, and the suction area of the adhesive sheet 12 suctioned in the

downward direction becomes larger. At this time, because the pellet 11a is held (suctioned) by the collet 21, the adhesive sheet 12 is gradually peeled away from the pellet 11a. As a result, when the suction area become the same or greater than the pellet area, as shown in Fig. 2D, the adhesive sheet 12 can be completely peeled away from the pellet 11 to be detached.

Then, after detachment, as shown in Fig. 2E, the collect 21 is raised as indicated by the arrow C and separated from the stage 16. As a result, the pellet 11a can be extracted from the adhesive sheet 12. Subsequently, as shown in Fig. 2F, the receiving section 17 is returned as indicated by arrow G and enters a stand-by state. The receiving section 17 is positioned so as to receive a next pellet 11 to be detached. In this case, the next pellet 11 to be detached corresponds to the pellet 11 as indicated in Fig. 1.

In this way, as a result of the pick-up device successively handling the pellets 11, all pellets 11 on the adhesive sheet 12 can be detached from the adhesive sheet 12 and extracted.

When the pick-up device handles each pellet 11, the pick-up device side can be moved. Alternatively, the adhesive sheet 12 side on which the pellets 11 are adhered can be moved. Moreover, both the pick-up device side and the adhesive sheet 12 side can be moved.

In the present invention, because the adhesive sheet 12 is supported from below by the projections 25 projecting into the gap 19 formed on the outer peripheral side of the receiving section 17, when the air in the gap 19 is suctioned, stress can be concentrated at the periphery of the projection 25. As a result, detachment of the pellets 11 through suction can be facilitated. In other words, peeling of the adhesive sheet 12 can be performed at an early stage of the peeling operation with relatively little force. Time required to start peeling can be shortened.

In the peeling operation described above, the projections 25 penetrate the adhesive sheet 12 as a result of the suction. Therefore, the projections 25 serve as anchors for the adhesive sheet 12. As a result, the peeling operation is stabilized. The adhesive sheet 12 is not pulled even by the sliding movement of the receiving section 17. The chip (pellet) 11 side is not overridden by the peeling force during sliding. Therefore, the pellets 11 do not detach from the collet 21 (holding means). Moreover, there is no risk of the adhesive sheet 12 being pulled and the pellets 11 becoming displaced.

Because the projections 25 are configured by pins that can be moved vertically, the height

positions of the pins can be adjusted. Therefore, as a result of the height positions of the pins being adjusted based on the thickness of the adhesive sheet 12, the height of the stage 16 on which the receiving section 17 is placed, and the like, optimal peeling performance can be achieved for the pellet 11 to be detached.

As a result of the projections 25 being disposed in positions corresponding to the corners of the pellet 11, stress can be concentrated on the corners of the pellet 11 from which the adhesive sheet 12 can be easily peeled. Therefore, peeling can be started stably and with certainty. Reliability of the peeling operation is enhanced.

Next, another embodiment is shown in Fig. 5. In this instance, the receiving section 17 projects further upwards than the upper surface of the stage 16. Therefore, when the receiving section 17 receives the pellet 11 to be peeled, the pellet 11 is received at a position higher than the upper surface of the stage 16.

Therefore, in the pick-up device shown in Fig. 5 as well, the projection 25 that projects into the gap 19 and can be moved vertically is attached. As a result, when the air in the gap 19 is suctioned in a state in which the collet 21 holds the pellet 11 from above, the adhesive sheet 12 can be peeled from the pellet 11 on the front side of the receiving section 17 in a state in which a portion of the adhesive sheet 12 is supported by the projection 25. When the receiving section 17 is moved along a horizontal direction in this state, the adhesive sheet 12 can be easily peeled in a manner similar to the pick-up device shown in Fig. 2.

According to each of the above-described embodiments, the receiving section 17 is moved in relation to the stage 16. However, as another embodiment, the receiving section 17 can be integrated with the stage 16. The receiving section 17 can move in relation to the pellet 11 by the stage 16 being moved.

Next, another embodiment is shown in Fig. 6A to Fig. 6C. In this instance, the receiving section 17 has a narrow tip section 35 that becomes narrower towards the tip. In other words, the narrow tip section 35 is configured to include a first edge 36 that is parallel with the second edge 23b of the pellet 11 and a second edge 37 that is parallel with the third edge 23c of the pellet 11. The first edge 36 and the second edge 37 form a 90 degree angle. A corner 38 of the narrow tip section 35 corresponds to one pellet corner 39 of the pellet 11 to be detached. The one pellet corner 39 is a

connecting section of the second edge 23b and the third edge 23c.

According to the embodiment, the corner 38 of the receiving section 17 is placed on a diagonal line L that connects the pellet corner 39 and another pellet corner 40 opposing the pellet corner 39 (a corner formed by the first edge 23a and the fourth edge 23d).

According to the embodiment, a suction hole 30d is provided in correspondence with a corner formed by the second edge 23b and the fourth edge 23d. A suction hole 30e is provided in correspondence with the middle of the second edge 23b. A suction hole 30g is provided in correspondence with the middle of the third edge 23c. A suction hole 30h is provided in correspondence with a corner formed by the third edge 23c and the first edge 23a. From a planar view, a portion of each suction hole 30d, 30e, 30g, and 30h projects further outward than the pellet 11. In this case, the projection 25 that projects into the gap 19 and can be moved vertically is attached in correspondence with the corner 39 formed by the second edge 23b and the third edge 23c.

Next, a pick-up method using the pick-up device shown in Fig. 6 will be described. First, in a state in which the frame 13 and the adhesive sheet 12 are integrated, a pellet 11a of which two edges (in this case, the first edge 23a and the fourth edge 23d) do not oppose other pellets 11 is selected. The stage 16 of the pick-up device is positioned below the pellet 11a, and the pellet 11a is received by the receiving section 17 of the movement block body 32 with the adhesive sheet 12 therebetween. At this time, the corner 38 of the receiving section 17 is positioned on the diagonal line L of the pellet 11a such that the first edge 36 of the receiving section 17 is parallel with the second edge 23b of the pellet 11a and the second edge 37 of the receiving section 17 is parallel with the third edge 23c of the pellet 11a. The corner 38 is misaligned with the corner 39 of the pellet 11a in a direction of arrow α in Fig. 6, namely along the diagonal line L, towards the side of the corner 40 opposing the corner 39.

Therefore, the gap 19 is formed on the bottom side of the adhesive sheet 12 on the front side of the narrow tip section 35 of the receiving section 17 (front side of the first edge 36 and the second edge 37), and a portion of the adhesive sheet 12 is supported by the projection 25. In this state, in a manner similar to that shown in Fig. 2A, the pellet 11a is attached to the collet 21 of the holding means 15.

The air in the gap 19 is suctioned by the suction holes 30d, 30e, 30g, and 30h. As a result,

a portion of the adhesive sheet 12 corresponding to the gap 19 is suctioned. The adhesive sheet 12 near the projection 25 is peeled from the pellet 11a.

Then, the receiving section 17 is moved (slid) along the diagonal line L, as indicated by the arrow α. As a result, the received area of the pellet 11a received by the receiving section 17 becomes smaller, and the suction area of the adhesive sheet 12 suctioned in the downward direction becomes larger. At this time, because the pellet 11a is held (suctioned) by the collet 21, the adhesive sheet 12 is gradually peeled away from the pellet 11a. Therefore, when the suction area becomes the same or greater than the pellet area, the adhesive sheet 12 can be completely peeled away from the pellet 11 to be detached.

In the pick-up device shown in Fig. 6, the adhesive sheet 12 is peeled along the diagonal line L of the pellet 11a. Therefore, unlike when the adhesive sheet 12 is peeled by an amount equivalent to the length of one edge of the pellet 11, the peeling force is small. The adhesive sheet 12 can be more easily peeled. Moreover, when the adhesive sheet 12 is peeled, the receiving section 17 moves away from edges of adjacent pellets 11 opposing the two edges forming the pellet corner of the pellet 11a from which the adhesive sheet 12 is initially peeled. Therefore, dynamic flexural stress is not applied to the adjacent pellets 11, and the adjacent pellets 11 do not crack (particularly at the edges opposing the pellet 11 to be detached). Because the adhesive sheet 12 is peeled from one pellet corner, the suction stress suctioning the adhesive sheet 12 can be concentrated in one area. Therefore, even a thin and flexible pellet 11 can be detached. An applicable range of pellets 11 that can be detached widens. Moreover, because a peeling site moves diagonally, the adhesive sheet 12 is peeled away by suction force while shearing is applied, thereby enhancing peeling performance.

In particular, at the start of the peeling operation, the corner of the receiving section 17 is matched with the one pellet corner of the pellet 11 to be detached. Therefore, the receiving section 17 is not required to be manufactured for each type of pellet 11 by the width of the receiving section 17 being set slightly smaller than the edge of the pellet 11, and the like. In other words, the receiving section 17 is not required to be adjusted based on the dimensions of the pellet 11. The receiving section 17 can accommodate pellets of various sizes merely through adjustment of the position of a single type of receiving section 17. Therefore, the receiving section 17 is superior in versatility, and contributes to cost reduction. The receiving section 17 moves is a direction that forms a 45 degree

angle with each of the two edges forming the pellet corner 39. Therefore, the adhesive sheet 12 can be peeled through even application of peeling force. Unnecessary load is not placed on the product (pellet), and damage to the product can be prevented. Moreover, because the projection 25 is provided in correspondence with a pellet corner from which the adhesive sheet 12 can be easily peeled, peeling can be started with certainty. Furthermore, because the adhesive sheet 12 can be peeled along the diagonal line L, the adhesive sheet 12 can be more easily peeled.

When the receiving section 17 is slid in the diagonal direction in relation to the pellet 11 as shown in Fig. 6A to Fig. 6C, the movement direction can be changed. When the movement direction of the receiving section 17 is allowed to be changed in this way, the movement direction can be changed in adherence to properties of the pellet 11 to be detached and the like. In other words, there is a direction in which the pellet 11 is more susceptible to cracking, based on crystal orientation. Therefore, the movement direction of the receiving section 17 can be set such that force is applied in a direction in which an adjacent pellet 11 does not easily crack. As a result, damage to (cracking of) adjacent pellets can be prevented with further stability.

As shown in Fig. 7, the projection 25 can be formed integrally with the stage 16. In this case, the projection 25 can project horizontally into the recess 22 from a lateral direction or can extend in the vertical direction. When the projection 25 is formed integrally with the stage 16 in this way, configuration of the overall device can be simplified. Regardless of whether the projection 25 extends in the vertical direction or extends in the lateral direction (horizontal direction), the projection 25 can support the adhesive sheet 12 from below and provide a function for enhancing detachment with certainty.

The embodiments of the present invention are described above. However, the present invention is not limited to these embodiments. Various modifications can be made. For example, , the size, number, shape, and the like of the suction holes 30 provided on the stage 16 can be arbitrarily set within a range allowing suction of the air from the gap 19. Therefore, only a single suction hole 30 may be provided. The pellet 11 to be detached is not limited to a square. The pellet 11 can be a rectangle including short edges and long edges. Alternatively, the pellet 11 can be strip-shaped, having long edges that are significantly longer than the short edges. The thickness of the adhesive sheet 12 differs depending on suction force and the like. However, all that is required is that the

adhesive sheet 12 can be deformed into a curved shape, such that the adhesive sheet 12 can be peeled away from the pellet 11 when the suctioning means 18 suctions the air from the gap 19.

The thickness of the receiving section 17 can be arbitrarily set based on a range allowing the adhesive sheet 12 to be peeled from the pellet 11 when the suctioning means 18 suctions the air from the gap 19. When the receiving section 17 shown in Fig. 6A to Fig. 6C is used, the corner of the receiving section 17 is not limited to an angle of 90 degrees. The angle can be slightly acute or obtuse.

The number of pellets 11 adhered to the adhesive sheet 12 is arbitrary. In the present invention, all pellets 11 on the adhesive sheet 12 can be successively peeled regardless of the number of pellets 11. In the pick-up method shown in Fig. 1A to Fig. 1C, all that is required is that another pellet 11 does not oppose the fourth edge 23d of the pellet 11a to be peeled. In the pick-up method shown in Fig. 6A to Fig. 6C, all that is required is that other pellets 11 do not oppose the second edge 23b and the fourth edge 23d of the pellet 11 to be removed. Therefore, a sequence by which the pellets 11 are detached can be arbitrarily set within a range meeting these conditions.

In Fig. 1A to Fig. 1C, the projections 25 are disposed in the corner formed by the first edge 23a and the third edge 23c of the pellet 11 to be detached and the corner formed by the second edge 23b and the third edge 23c of the pellet 11. In Fig. 6A to Fig. 6C, the projection 25 is disposed on the corner 39 formed by the second edge 23b and the third edge 23c. However, the position at which the projection 25 is disposed, the number of projections 25, and the like can each be arbitrarily changed. In other words, the projection 25 can be formed in the middle of the first edge 23a, the middle of the second edge 23b, the middle of the third edge 23c, and the like. The projection 25 can be placed in correspondence with the suction hole 30. Alternatively, the projection 25 can be placed such as to avoid the suction hole 30. When the projection 25 is configured by a pin as shown in Fig. 2A to Fig. 2F, the pin can be a fixed component that does not move vertically. In this case, the pin component can be embedded into the stage 16 or the like.

INDUSTRIAL APPLICATION

A plurality of pellets can be formed by a cut wafer or a plate material at a stage prior to becoming a final product being adhered to an adhesive sheet and the wafer or plate material being cut

by a dicing saw and the like in the adhered state. The pick-up device can individually detach each pellet from the adhesive sheet and extract each pellet. The extracted pellet can be supplied to a predetermined land on a lead frame.

CLAIMS

1. A pick-up method for successively detaching a plurality of thin, rectangular pellets adhered to an adhesive sheet from the adhesive sheet and extracting the pellets, wherein:

a receiving section receives a pellet to be detached with the adhesive sheet therebetween,

after a gap is formed between the receiving section and the adhesive sheet at an outer peripheral side of the receiving unit, in a state in which the pellet is held from above, air in the gap is suctioned while a portion of the adhesive sheet is supported from below by a projection that projects into the gap, and the adhesive sheet on the outer peripheral side of the receiving section is peeled,

subsequently, the receiving section moves along a horizontal direction while the adhesive sheet is supported by the projection and the pellet is held from above, and the pellet is detached.

2. A pick-up device for successively detaching a plurality of thin, rectangular pellets adhered to an adhesive sheet from the adhesive sheet and extracting the pellets, the pick-up device comprising:

a holding means that holds a pellet to be detached from above;

a stage on which the adhesive sheet is placed;

a receiving section that receives the pellet with the adhesive sheet therebetween;

an air suctioning means that suctions air from a gap formed between the receiving section and the adhesive sheet on an outer peripheral side of the receiving section;

a projection that projects into the gap and supports a portion of the adhesive sheet from below; and

a driving means that moves the receiving section along a horizontal direction.

3. The pick-up device according to claim 2, wherein the projection is configured by a pin that can move vertically.

4. The pick-up device according to claim 2 or 3, wherein the projection is provided integrally with the stage on which the receiving section is placed.

5. The pick-up device according to any one of claims 2 to 4, wherein the projection is disposed in a position corresponding to a corner section of the pellet to be detached.