Description

Title of Invention: CHIP PEELING METHOD, CHIP PEELING APPARATUS AND SEMICONDUCTOR DEVICE MANUFACTURING METHOD

Technical Field

[0001] The present invention relates to a chip-peeling method, a chip-peeling apparatus, and a method of manufacturing a semiconductor.

Background Art

[0002] In a manufacturing step of semiconductor devices, it is necessary to pick up semiconductor chips (hereinafter, simply referred to as chips) that have undergone dicing from an adhesive sheet. Examples of conventional chip-peeling apparatuses include one provided with a stage for holding the adhesive sheet, a thrust-up base which retracts with respect to the stage, and needles which are thrust up by the thrust-up base. That is, the adhesive sheet on the stage is thrust from a rear-surface side by the needles thrust up by the thrust-up base so that the chips are separated from the adhesive sheet.

[0003] However, in the chip-peeling apparatus using the needles, when the chips are peeled from the adhesive sheet by being trust up by the needles, the adhesive sheet is penetrated in some cases. In such a case, there is a risk that rear surfaces of the chips are damaged. Further, lengths of the needles vary from each other

owing to abrasion and breakage. As a result, the chips enter a state of being thrust up aslant, which leads to a risk that adjacent chips collide against and damage each other.

[0004] In addition, the chips are taken out by being adsorbed by a collet. However, when the chips are thrust up aslant, errors occur in chip adsorption by the collet. The errors having occurred in the chip adsorption by the collet cause disturbance in subsequent operation. Further, thrust-up of the needles causes damage on the chips.

[0005] Under the circumstances, in recent years, there has been proposed a chip-peeling apparatus (Patent Literature 1) without use of such needles. The chip-peeling apparatus includes, as illustrated in Figs. 5A and 5B and 6, a stage 3 for holding an adhesive sheet 2 to which a chip 1 is attached. Further, to the stage 3, there is appended a movable-stage portion 4 having an upper surface 4a projecting from a stage upper surface 3a. That is, a recessed part 5 is provided to the stage 3, and the movable-stage portion 4 is fitted to the recessed part 5. In this case, a step S0 is formed between the upper surface 4a of the movable-stage portion 4 and the upper surface 3a of the stage 3. That is, the upper surface 4a of the movable-stage portion 4 is positioned higher in a vertical direction than the upper surface 3a of the stage 3 by an amount corresponding to the step S0. Further, a first side 1a of the chip 1 is protruded relative to an end surface 9 of the movable-stage portion 4. Thus, on an outer peripheral side of the movable-stage

portion 4, a void 6 is formed between the movable-stage portion 4 and the adhesive sheet 2. Still further, as illustrated in Fig. 6, the stage 3 is provided with a suction hole 8 communicating to the void 6.

[0006] Next, description is made of a chip-peeling method in which the above-mentioned chip-peeling apparatus is used. First, under a state in which the chip 1 is adsorbed (held) by a collet (adsorption collet) (not shown) from above, the adhesive sheet 2 is sucked downward through intermediation of the suction hole 8. In this manner, the air in the void 6 is sucked, and hence the adhesive sheet 2 corresponding to the protruding portion of the chip 1 is sucked. As a result, as indicated by imaginary lines in Fig. 6, the adhesive sheet 2 is peeled in the protruding portion of the chip 1.

[0007] When the above-mentioned chip-peeling apparatus is used, at an early stage of peeling, it is necessary to peel the adhesive sheet 2 corresponding to a part of a rim portion of the chip 1 (in a case illustrated in Figs. 5, the protruding portion of the chip 1). The adhesive sheet 2 corresponding to the protruding portion of the chip 1 firmly adheres due to stress at the time of dicing, and hence stress higher than that necessary for peeling of other parts is required for peeling the adhesive sheet 2 corresponding thereto. In consideration of this, the upper surface 4a of the movable-stage portion 4 is protruded from the stage upper surface 3a by the amount corresponding to the step S0. With this, stress

for peeling the adhesive sheet 2 becomes higher, and the adhesive sheet 2 corresponding to the protruding portion of the chip 1 can be peeled.

[0008] After that, as illustrated in Fig. 5B, the movable-stage portion 4 is moved in a direction of an arrow. With this, an area of the chip 1 received by the movable-stage portion 4 sequentially decreases. Accordingly, an adsorbing area (suction area) of the adhesive sheet 2 increases, and finally, the adhesive sheet 2 can be completely peeled from the chip 1.

Citation List

Patent Literature 1: JP 3209736 B

Summary of Invention

Technical Problems

[0009] When the adhesive sheet 2 is peeled, stress high enough to peel the part (protruding portion) of the rim portion, that is, the high step causes the chip to largely warp, and sliding movement is performed with the step being maintained. As just described above, when the part (protruding portion) of the rim portion is peeled at the early stage of the peeling, a large peeling force is necessary. However, when the other parts are peeled by sliding of the movable stage portion 4 after the part of the rim portion is peeled, the large peeling force at the early stage of the peeling is unnecessary. That is, peeling strength is not uniform on the rear surface of

the chip in accordance with stages of the peeling.

[0010] Thus, with emphasis on the peeling at the early stage, when the step between the upper surface 4a of the movable stage portion 4 and the stage upper surface 3a is set to be large, at the time of peeling of the other parts by sliding of the movable stage portion 4, the sliding movement is performed with the step being high. Thus, dynamic twisting stress is imparted to another adjacent chip 1. When such stress is imparted, there is a risk that the another adjacent chip 1 is largely warped and cracks.

[0011] Further, in contrast, with emphasis on the time of the sliding movement, when the step between the upper surface 4a of the movable stage portion 4 and the stage upper surface 3a is set to be small, the large peeling force necessary for the peeling at the early stage cannot be generated.

[0012] In view of the above-mentioned problems, the present invention provides a chip-peeling method, a chip-peeling apparatus, and a method of manufacturing a semiconductor in which a part (protruding portion) of a rim portion of a chip can be peeled by a large peeling force at an early stage of the peeling, and in which cracking of the chip can be reduced even when sliding stress is imparted at the time of sliding, and the chip to be peeled can be easily peeled and taken out.

Solution to Problems

[0013] The present invention provides a chip-peeling method

for peeling a chip from an adhesive sheet having an upper surface to which the chip is attached. The chip-peeling method includes: installing, on a stage including a fixed-stage portion and a movable-stage portion, a chip to be peeled so that the chip is made to correspond to the movable-stage portion and that at least a part of a rim portion of the chip protrudes from the movable-stage portion; forming, in a protruding state, a void below a protruding portion of the chip by thrusting up the protruding portion with a projection-like portion through intermediation of the adhesive sheet; and driving the movable-stage portion after making a negative pressure act in the void in a lower portion of the protruding portion.

[0014] According to the chip-peeling method of the present invention, the protruding portion of the chip can be thrust up by the projection-like portion through intermediation of the adhesive sheet. Then, in this thrust-up state, a negative pressure is brought into action in the void below the protruding portion. With this, a large peeling force can be imparted. Thus, in the protruding portion of the chip, the adhesive sheet is sucked and peeled from the chip. After that, driving of the movable-stage portion causes a decrease of an area of the chip received by the movable-stage portion, and an adsorbing (suction) area of the adhesive sheet increases, which increases a peeling range. Finally, the adhesive sheet can be completely peeled from the chip to be peeled. Specifically, at the early stage of the peeling, a large peeling force can be imparted to the adhesive sheet. Further, at the time

of sliding of the movable-stage portion, dynamic twisting stress is prevented from being imparted to another adjacent chip. As a result, warp imparted to the another adjacent chip can be reduced.

[0015] The void may be provided below the protruding portion while a thrust-up surface of the projection-like portion is positioned higher than an upper surface of the fixed-stage portion.

[0016] In the protruding state of the chip, an upper surface of the movable-stage portion may be swelled from the upper surface of the fixed-stage portion.

[0017] The movable-stage portion may be slid in a horizontal direction opposite to a protruding side.

[0018] After the thrust-up surface of the projection-like portion is thrust up higher than the upper surface of the movable-stage portion, at a time of driving of the movable-stage portion, the thrust-up surface of the projection-like portion may be adjusted to the same height as a height of the upper surface of the movable-stage portion or lowered relative to the upper surface of the movable-stage portion.

[0019] The present invention provides a method of manufacturing a semiconductor device by using the chip-peeling method.

[0020] The present invention provides a chip-peeling apparatus for peeling a chip from an adhesive sheet having an upper surface to which the chip is attached. The chip-peeling apparatus includes: a stage including a fixed-stage portion and a movable-stage portion; a projection-like portion for forming, under a state in which a

chip to be peeled is made to correspond to the movable-stage portion and at least a part of a rim portion of the chip protrudes from the movable-stage portion, a void below a protruding portion of the chip by thrusting up the protruding portion through intermediation of the adhesive sheet; negative-pressure supply means for making a negative pressure act in the void through a negative-pressure path; and slide means for sliding the movable-stage portion in a horizontal direction opposite to a protruding side.

[0021] The projection-like portion may include a pin member or a plate-like member. That is, the chip can be thrust up even with the pin member and the plate-like member. In addition, the movable-stage portion may be slidable, or capable of being raised and lowered and slidable.

Advantageous Effects of Invention

[0022] In the present invention, prior to adsorption (prior to negative-pressure action), the void for the negative-pressure action can be secured, and hence the protruding portion of the chip can be stably peeled. Further, at the time of sliding, warp is prevented from being imparted to another adjacent chip, and hence cracking of the another adjacent chip is further prevented.

[0023] The projection-like portion may include a pin member or a plate-like member, and hence can be simply configured. Thus, cost reduction can be achieved, and the thrust-up function is stably

exerted. Further, when the movable-stage portion can be raised and lowered, a step (step between the upper surface of the fixed-stage portion and the upper surface of the movable-stage portion) can be formed to be low optimally for sliding of the movable-stage portion. With this, warp imparted to another adjacent chip can be reduced, and hence a large force is reliably prevented from being applied to the another adjacent chip. Thus, cracking of the another adjacent chip can be reduced even when stress is imparted at the time of sliding, and the chip to be peeled can be easily peeled and taken out.

[0024] By thrusting up the thrust-up surface of the projection-like portion so as to be higher than the upper surface of the movable-stage portion, a large void can be secured in the lower portion of the protruding portion. Thus, a large peeling force can be exerted at an early stage of peeling, and hence peeling operation can be stably performed. In addition, when the movable-stage portion is driven (slid), the thrust-up surface of the projection-like portion can be adjusted to the same height as a height of the upper surface of the movable-stage portion or lowered relative to the upper surface of the movable-stage portion. With this, without being influenced by the projection-like portion, the movable-stage portion is allowed to undergo driving such as sliding. As a result, smooth peeling operation can be performed.

Brief Description of Drawings

[0025] [Fig. 1A] A schematic sectional view of a chip-peeling method in which a chip-peeling apparatus of the present invention is used, illustrating a projection-like portion prior to thrust-up.

[Fig. 1B] A schematic sectional view of the chip-peeling method in which the chip-peeling apparatus of the present invention is used, illustrating the projection-like portion in a thrust-up state.

[Fig. 1C] A schematic sectional view of the chip-peeling method in which the chip-peeling apparatus of the present invention is used, illustrating a movable-stage portion in a slide state.

[Fig. 2] A schematic plan view of the chip-peeling apparatus.

[Fig. 3] A schematic plan view of a chip attached to an adhesive sheet.

[Fig. 4A] A schematic plan view of a first modification of the projection-like portion.

[Fig. 4B] A schematic plan view of a second modification of the projection-like portion.

[Fig. 5A] A schematic sectional view of a chip-peeling method in which a conventional chip-peeling apparatus is used, illustrating a movable-stage portion prior to sliding.

[Fig. 5B] A schematic sectional view of the chip-peeling method in which the conventional chip-peeling apparatus is used, illustrating the movable-stage portion in a slide state.

[Fig. 6] A schematic plan view of the conventional chip-peeling apparatus.

Reference Signs List

[0026] 11 chip

12 adhesive sheet

16 stage

16a movable-stage portion

16b fixed-stage portion

19 void

30 negative-pressure path

31 protruding portion

50 projection-like portion

51, 53 plate-like member

52 thrust-up surface

55 pin member

Description of Embodiment

[0027] In the following, description is made of embodiment of the present invention with reference to Figs. 1 to 4.

[0028] Figs. 1 and 2 illustrate a chip-peeling apparatus of the present invention. The chip-peeling apparatus is an apparatus for taking out a plurality of rectangular thin chips (semiconductor chips) 11 attached onto an adhesive sheet 12 by sequentially peeling the same from the adhesive sheet 12. That is, the chip-peeling apparatus is used for a semiconductor-device-manufacturing apparatus for manufacturing the semiconductor chips 11 as semiconductor devices.

[0029] The chip 11 is made of a wafer 10 (refer to Fig. 3) as a raw material, and is produced as a finished product by cutting-out of the raw material into a rectangular shape. Thus, the chip 11 has a square shape, a reed shape, or the like. Specifically, as illustrated in Fig. 3, the wafer 10 has a circular shape as a whole, and divided into separate chips 11 by dicing. The chips 11 are attached to the adhesive sheet 12. Further, a frame 13 constituted by a ring body is attached to an outer peripheral side of the adhesive sheet 12. That is, the frame 13 and the adhesive sheet 12 are integrated with each other. Then, under a state in which the frame 13 and the adhesive sheet 12 are integrated with each other, the chips 11 are taken out by the chip-peeling apparatus.

[0030] As illustrated in Figs. 1, the chip-peeling apparatus includes holding means 15 for holding from above the chips 11 to be peeled and a stage 16 on which the adhesive sheet 12 is placed. The stage 16 includes a fixed-stage portion 16b and a slidable movable-stage portion 16a. Specifically, a recessed part 22 is provided in an upper surface 37 of the fixed-stage portion 16b, and the movable-stage portion 16a, which is a rectangular flat-plate body, is arranged in the recessed part 22. An upper surface 34 of the movable-stage portion 16a is positioned higher than the upper surface 37 of the fixed-stage portion 16b. That is, a step S is formed between the upper surface 34 of the movable-stage portion 16a and the upper surface 37 of the fixed-stage portion 16b.

[0031] As illustrated in Fig. 2, a width dimension W of the

movable-stage portion 16a is set to be smaller than a length (width dimension) W1 of a side of the square chip 11. In this case, a distal end surface 17a on one side of the movable-stage portion 16a corresponds to a first side 23a of the chip 11 to be peeled, the first side 23a of the chip 11 protrudes relative to the distal end surface 17a of the movable-stage portion 16a.

[0032] The stage 16 is provided with a negative-pressure path 30 for introducing a negative pressure onto a boundary surface between the stage 16 and the adhesive sheet 12. The negative-pressure path 30 is provided with suction ports 30a and 30b pening on a first-side-23a side of the chip 11. In this case, as seen in plan view, the suction ports 30a and 30b correspond to a protruding portion 31 of the chip 11.

[0033] A vacuum pump (not shown) is connected to the negative-pressure path 30. Specifically, driving of the vacuum pump enables the suction ports 30a and 30b of the negative-pressure path 30 to suck the air. In this manner, negative-pressure supply means (air-suction means) can be constituted by the negative-pressure path 30, the vacuum pump, and the like.

[0034] The holding means 15 is constituted by an adsorption member (collet) 21 including a head 20 for adsorbing the chip 11. The head 20 is provided with an adsorption hole in a lower end surface 20a thereof. The chip 11 is vacuum-sucked through intermediation of the adsorption hole, with the result that the chip 11 is adsorbed onto the lower end surface 20a of the head 20. Thus, when the vacuum

suction (vacuum attraction) is discontinued, the chip 11 comes out of contact with the head 20.

[0035] Through intermediation of a drive mechanism (not shown), the movable-stage portion 16a moves in a horizontal direction, with the distal end surface 17a of the movable-stage portion 16a being parallel with the first side 23a of the chip 11. The drive machine may include various mechanisms such as a reciprocating mechanism constituted by a bolt shaft member and a nut member threadedly engaged therewith, and a cylinder mechanism.

[0036] Further, in the recessed part 22 of the fixed-stage portion 16b, there is provided a projection-like portion 50 constituted by a plate-like member 51 correspondingly to the protruding portion 31 of the chip 11. Specifically, as illustrated in Fig. 2, an upper end surface (thrust-up surface) of the projection-like portion 50 has a long side 51a set to have a length dimension substantially equal to that of the distal end surface 17a of the movable-stage portion 16a, and has a short side 51b set to have a width dimension smaller than that of the protruding portion 31. In addition, the projection-like portion 50 is arranged so as to be brought into contact with or come close to the distal end surface 17a of the movable-stage portion 16a.

[0037] An up-and-down movement mechanism (not shown) is provided continuously with the projection-like portion 50, the projection-like portion 50 vertically moving independently of the movable-stage portion 16a. Note that, the up-and-down movement

mechanism may include various mechanisms such as a reciprocating mechanism constituted by a bolt shaft member and a nut member threadedly engaged therewith, and a cylinder mechanism.

[0038] In the present invention, a void 19 is formed in a lower portion of the protruding portion 31 of the chip 11. By raising of the projection-like portion 50, the protruding portion 31 of the chip 11 can be thrust up through intermediation of the adhesive sheet 12 as illustrated in Fig. 1B. This thrust-up increases a step between the protruding portion 31 of the chip 11 and an upper surface of the fixed-stage portion 16b.

[0039] Next, description is made of a chip-peeling method in which the chip-peeling apparatus illustrated in Figs. 1 is used. Under a state in which the chip 11 is supported by the movable-stage portion 16a, at least a part of a rim portion (in other words, the first-side-23a side) of the chip 11 is protruded from the movable-stage portion 16a. In this manner, the void 19 is provided below the protruding portion 31 as illustrated in Fig. 1A. The void 19 communicates to the suction ports 30a and 30b. At this time, the collet 21 of the head 20 of the holding means 15 is brought into contact with an upper surface of the chip 11. Then, the chip 11 is vacuum-sucked through intermediation of the adsorption hole so that the chip 11 is adsorbed to the lower end surface 20a of the head 20.

[0040] In this state, a height position of a thrust-up surface (distal end surface) 52 of the projection-like portion 50 is adjusted

to a height position of the upper surface 34 of the movable-stage portion 16a. Next, as illustrated in Fig. 1B, by raising of the projection-like portion 50, the protruding portion 31 of the chip 11 can be thrust up through intermediation of the adhesive sheet 12. That is, the step increases between the protruding portion 31 of the chip 11 and the upper surface of the fixed-stage portion 16b.

[0041] As described above, the void 19 communicates to the suction ports 30a and 30b. In this context, by driving of the suction means (negative-pressure supply means), the air in the void 19 is sucked through the suction ports 30a and 30b so that a negative pressure is brought into action. With this, the protruding portion 31 of the chip 11 is sucked, and as indicated by imaginary lines in Fig. 1B, the adhesive sheet 12 is peeled from the protruding portion 31 of the chip 11.

[0042] After that, as illustrated in Fig. 1C, the projection-like portion 50 is lowered. In this case, the height position of the thrust-up surface 52 of the projection-like portion 50 is lower than the height position of the upper surface 34 of the movable-stage portion 16a. Next, the movable-stage portion 16a is slid in a direction of an arrow B through intermediation of the drive mechanism, the direction being opposite to a protruding side. This sliding causes a sequential decrease of an area of the chip 1 received by the movable-stage portion 16a, with the result that a downward adsorbing (suction) area of the adhesive sheet 12 increases.

At this time, the chip 11 is held (adsorbed) by the collet 21, and hence the adhesive sheet 12 is sequentially peeled from the chip 11. Thus, when the distal end surface 17a of the movable-stage portion 16a comes out of contact with the first side 23a of the chip 11, the adhesive sheet 12 is completely peeled from the chip 1 to be peeled.

[0043] Then, after the peeling, the collet 21 is raised and separated from the stage 16. With this, the chip 11 can be taken out from the adhesive sheet 12. After that, the negative pressure state is canceled, and then the movable-stage portion 16a is slid in a direction opposite to the direction of the arrow B. In this manner, the state illustrated in Fig. 1A is restored.

[0044] After that, when the chip-peeling apparatus is made to sequentially correspond to the chips 11, all of the chips 11 on the adhesive sheet 12 can be taken out by being peeled from the adhesive sheet 12. As has been described above, the chip-peeling apparatus can be used for manufacture of semiconductor devices. Here, the semiconductor devices refer to general devices capable of functioning by using semiconductor characteristics, and include all of electrical-optical devices, semiconductor circuits, and electronic equipment. Further, the semiconductor devices may include ones in a wafer state in which circuits are formed, separate semiconductor chips obtained by cutting-out of a wafer, ones obtained by division of a wafer into a plurality of semiconductor devices, ones packaged in a wafer state, ones obtained by division of

semiconductor devices packaged in a wafer state into a plurality of semiconductor devices, and separate semiconductor elements obtained by cutting-out of packaged semiconductor devices in a wafer state.

[0045] In the present invention, the protruding portion 31 of the chip 11 can be thrust up through intermediation of the adhesive sheet 12. Then, in this thrust-up state, a negative pressure is brought into action in the void 19 below the protruding portion 31. With this, a large peeling force can be imparted. After that, by driving of the movable-stage portion, finally, the adhesive sheet 12 can be completely peeled from the chip 11 to be peeled. Specifically, at an early stage of the peeling, a large peeling force can be brought into action with respect to the adhesive sheet 12. Further, at the time of sliding of the movable-stage portion 16a, dynamic twisting stress is prevented from being imparted to another adjacent chip 11. As a result, warp imparted to the another adjacent chip 11 can be reduced, and hence cracking of the another adjacent chip 11 is further prevented.

[0046] In addition, when the movable-stage portion 16a is driven (slid), the thrust-up surface 52 of the projection-like portion 50 can be lowered relative to the upper surface 34 of the movable-stage portion 16a. Thus, without being influenced by the projection-like portion 50, the movable-stage portion 16a is allowed to undergo driving such as sliding. As a result, smooth peeling operation can be performed.

[0047] Figs. 4 each illustrate a modification of the projection-like portion 50. In Fig. 4A, the projection-like portion 50 is constituted by a plate-like member 53 having a substantially C-shape in plan view. Specifically, the plate-like member 53 is constituted by a flat-plate-like main body portion 53a arranged in parallel with the distal end surface 17a of the movable-stage portion 16a and by end-piece portions 53b and 53b bent at right angle from end portions of the flat-plate-like main body portion 53a. The end-piece portions 54b and 54b are arranged along side surfaces of the distal end surface 17a of the movable-stage portion 16a. The thrust-up surface 52 used at the time of thrust-up of the chip 11 with the projection-like portion 50 has a C-shape in plan view. Thus, with use of the projection-like portion 50 of Fig. 4A, the chip 11 can be stably thrust up, and hence a large peeling force can be exerted at the early stage of the peeling. As a result, the peeling operation can be stably performed.

[0048] In Fig. 4B, projection-like portions 50 are constituted by pin members 55. In this case, three pin members 55 are arranged at predetermined pitch along the distal end surface 17a of the movable-stage portion 16a. Each of the pin members 55 is vertically movable. Thus, as a result of raising of the pin members 55, the protruding portion 31 of the chip 11 can be thrust up through intermediation of the adhesive sheet 12. Thus, also with use of the projection-like portions 50 constituted by the pin members 55, a large peeling force can be exerted at the early stage of the peeling.

In this state, the peeling operation can be performed.

[0049] By the way, although the movable-stage portion 16a only slides in the chip-peeling apparatus illustrated in Figs. 1, the movable-stage portion 16a may be vertically moved (raised and lowered) in addition to sliding.

[0050] That is, the drive means in this case includes a raising-and-lowering mechanism portion (raising-and-lowering means) for raising and lowering the movable-stage portion 16a and a slide-mechanism portion (slide means) for sliding the movable-stage portion 16a. The raising-and-lowering mechanism portion includes, for example, a push-up pin, the push-up pin being vertically moved through intermediation of a reciprocating mechanism. Further, the slide-mechanism portion (slide means) includes a reciprocating mechanism for sliding the raising-and-lowering mechanism portion in a substantially horizontal direction. Note that, the reciprocating mechanism of each of the raising-and-lowering mechanism portion and the slide-mechanism portion may include various well-known and widely-used mechanisms such as a reciprocating mechanism constituted by a bolt shaft member and a nut member threadedly engaged therewith, a cylinder mechanism, and a linear actuator.

[0051] When the movable-stage portion 16a is freely raised and lowered, an amount of the step between the upper surface 34 of the movable-stage portion 16a and the upper surface 37 of the fixed-stage portion 16b can be variously changed. Specifically, for example,

the movable-stage portion can be lowered to an original position after being raised once, and the movable-stage portion 16a can be lowered to an intermediate-height position higher than the original position after being raised once.

[0052] Such changes enable the step between the movable-stage portion 16a and the fixed-stage portion 16b to be high and low. Thus, at the early stage of the peeling, when the step between the movable-stage portion 16a and the fixed-stage portion 16b is set to be large, a large peeling force can be brought into action with respect to the adhesive sheet 12 even with a small raising amount of the projection-like portion 50. Thus, a folding force to the chip 11 is prevented from being generated by thrust-up of the projection-like portion 50. Further, when the step between the movable-stage portion 16a and the fixed-stage portion 16b is set to be small, at the time of sliding of the movable-stage portion 16a, dynamic twisting stress is effectively prevented from being imparted to another adjacent chip 11. As a result, warp imparted to the another adjacent chip 11 can be reduced.

[0053] Hereinabove, although description is made of the embodiment of the present invention, the present invention is not limited to the embodiment described above, and various modifications may be made thereto. For example, a size, the number, a shape, and the like of the suction ports 30a provided to the stage 16 may be arbitrarily set as long as the air in the void 19 can be sucked. Thus, the number of the suction ports 30a may be one. Further, a

shape of the chip 11 to be peeled is not limited to a square, and may be a rectangular having short sides and long sides, alternatively, a reed shape having long sides extremely longer than short sides. Although varying in accordance with a sucking force and the like, the thickness of the adhesive sheet 12 only has to be set to such an extent that the adhesive sheet 12 is capable of undergoing curvature deformation so as to be peelable from the chip 11 when the air in the void 19 is sucked by the suction means (negative-pressure supply means).

[0054] The thickness of the movable-stage portion 16a also may be arbitrarily set as long as the adhesive sheet 12 is peelable from the chip 11 when the air in the void 19 is sucked by the suction means (negative-pressure supply means). Further, angles of angular portions of the movable-stage portion 16a are not limited to 90 degrees, and may be somewhat acute or obtuse.

[0055] The number of the chips 11 attached onto the adhesive sheet 12 is also arbitrary. In the present invention, all the chips 11 on the adhesive sheet 12 can be sequentially peeled irrespective of the number. The area of the protruding portion 31 of the chip 11 can be variously set as long as a peeling force acts on the adhesive sheet 12 when a negative pressure is brought into action.

[0056] When the plate-like member 51 is used as the projection-like portion 50, in the above-mentioned embodiment, as illustrated in Fig. 2, the long side 51a thereof is set to have a length substantially equal to that of the movable-stage portion

16a. In this context, the long side 51a may be longer or shorter than the movable-stage portion 16a. Further, a thickness dimension of the plate-like member 51 only has to be set to such an extent that the plate-like member 51 can be arranged below the protruding portion 31. A plurality of plate-like members 51 may be provided.

[0057] When the pin members 55 are used as the projection-like portions 50, in the above-mentioned embodiment, as illustrated in Fig. 4B, the number of the pin members 55 is three. In this context, the number of the pin members 55 may be arbitrarily increased or decreased. Further, the pin member 55 may include a columnar body having a circular shape in cross-section, a pillar body having an elliptical shape or an oblong shape in cross-section, and a prismatic body having a triangular shape, a quadrangular shape, a pentagonal shape, or a polygonal shape having more sides and corners in cross-section. Alternatively, the pin member 55 may include a cylindrical body. The area of the thrust-up surface 52 of each of the pin members 55 can also be variously changed as long as the protruding portion 31 can be pushed up.

[0058] In the state illustrated in Fig. 1C, the height position of the thrust-up surface 52 of the projection-like portion 50 may be adjusted to the height position of the upper surface 34 of the movable-stage portion 16a. Also in this case, such adjustment does not have an adverse effect on sliding of the movable-stage portion 16a.

[0059] A protruding amount of the protruding portion 31 of the

chip 11 can be arbitrarily set in accordance with the size, the thickness, the material, and the like of the chip 11 as long as negative-pressure action enables the adhesive sheet 12 to be peeled at the early stage of the peeling.

Industrial Applicability

[0060] The chip-peeling apparatus of the present invention is applicable to a pick-up apparatus for picking up, by sequential peeling from an adhesive sheet, a plurality of rectangular thin chips (semiconductor chips) attached onto the adhesive sheet. The chip is made of a wafer as a raw material, and is produced as a finished product by cutting-out of the raw material into a rectangular shape. Thus, the chip has a square shape, a reed shape, or the like.

Claims

[Claim 1] A chip-peeling method for peeling a chip from an adhesive sheet having an upper surface to which the chip is attached, the chip-peeling method comprising:

installing, on a stage comprising a fixed-stage portion and a movable-stage portion, a chip to be peeled so that the chip is made to correspond to the movable-stage portion and that at least a part of a rim portion of the chip protrudes from the movable-stage portion;

forming, in a protruding state, a void below a protruding portion of the chip by thrusting up the protruding portion with a projection-like portion through intermediation of the adhesive sheet; and

driving the movable-stage portion after making a negative pressure act in the void in a lower portion of the protruding portion.

[Claim 2] A chip-peeling method according to claim 1, wherein the void is provided below the protruding portion while a thrust-up surface of the projection-like portion is positioned higher than an upper surface of the fixed-stage portion.

[Claim 3] A chip-peeling method according to claim 1 or 2, wherein, in the protruding state of the chip, an upper surface of the movable-stage portion is swelled from the upper surface of the fixed-stage portion.

[Claim 4] A chip-peeling method according to any one of claims 1 to 3, wherein the movable-stage portion is slid in a horizontal direction opposite to a protruding side.

[Claim 5] A chip-peeling method according to any one of claims 1 to 4, wherein, after the thrust-up surface of the projection-like portion is thrust up higher than the upper surface of the movable-stage portion, at a time of driving of the movable-stage portion, the thrust-up surface of the projection-like portion is adjusted to the same height as a height of the upper surface of the movable-stage portion or lowered relative to the upper surface of the movable-stage portion.

[Claim 6] A method of manufacturing a semiconductor device by using the chip-peeling method according to any one of claims 1 to 5.

[Claim 7] A chip-peeling apparatus for peeling a chip from an adhesive sheet having an upper surface to which the chip is attached, the chip-peeling apparatus comprising:

a stage comprising a fixed-stage portion and a movable-stage portion;

a projection-like portion for forming, under a state in which a chip to be peeled is made to correspond to the movable-stage portion and at least a part of a rim portion of the chip protrudes from

the movable-stage portion, a void below a protruding portion of the chip by thrusting up the protruding portion through intermediation of the adhesive sheet;

negative-pressure supply means for making a negative pressure act in the void through a negative-pressure path; and

slide means for sliding the movable-stage portion in a horizontal direction opposite to a protruding side.

[Claim 8] A chip-peeling apparatus according to claim 7, wherein the projection-like portion comprises a pin member or a plate-like member.

[Claim 9] A chip-peeling apparatus according to claim 7 or 8, wherein the movable-stage portion is slidable.

[Claim 10] A chip-peeling apparatus according to claim 7 or 8, wherein the movable-stage portion is capable of being raised and lowered and slidable.