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SEMICONDUCTOR WAFER ASSEMBLY AND MACHINING APPARATUS HAVING CHUCK TABLES FOR HOLDING THE SAME

Filed of the Invention

The present invention relates to a semiconductor wafer assembly to be held on a chuck table when a semiconductor wafer is to be machined, and to a machining apparatus having chuck tables for holding the same.

Description of the Prior Art

As known to people of ordinary skill in the art, in a semiconductor device production process, a substantially disk-like semiconductor wafer is divided into individual pellets to form semiconductor chips. To improve the heat radiation properties of the semiconductor chip, the semiconductor chip is desirably made as thin as possible. Also to enable the downsizing of a portable telephone, smart card and personal computer in which a large number of semiconductor chips are used, the semiconductor chip is desirably made as thin as possible. To this end, prior to the semiconductor wafer is divided into pellets, the back surface of the semiconductor wafer is ground to machine it to have a predetermined thickness. In a grinding machine for grinding the back surface of the semiconductor wafer, the semiconductor wafer as a workpiece is suction-held on a chuck table, and the back surface of the semiconductor wafer whose top surface is suction-held on the chuck table is ground by a grinding means.

When the semiconductor wafer is thus ground up to a thickness of 100 μm or less, for example, the rigidity of the semiconductor wafer lowers and consequently, flexure occurs in the entire semiconductor wafer, thereby making it difficult to transport and store in a cassette the semiconductor wafer. Further, in a so-called "pre-dicing" production method that dicing grooves having a predetermined

depth from the surface are in advance formed by a dicing machine and then, the back surface of the semiconductor wafer is finished to have a thickness of about 50 μm by grinding it to divide the semiconductor wafer into chips, the ground semiconductor wafer does not fall apart into chips owing to the function of a protective tape stuck to the surface side of the semiconductor wafer but it does not have rigidity at all as a semiconductor wafer, thereby making it extremely difficult to transport the semiconductor wafer after grinding.

To make it easy to transport and store in a cassette the semiconductor wafer after grinding, it is conceivable that a semiconductor wafer assembly is constructed by mounting a semiconductor wafer on a frame by a tape like a case where dicing is carried out, for example, and the semiconductor wafer assembly in this state is ground and transported. However, the semiconductor wafer assembly which is used for dicing machining is constituted such that a tape is stuck to the back surface of an annular frame and a semiconductor wafer is stuck to the top surface of the tape so that the semiconductor wafer and the frame are arranged on the same plane. Therefore, there is a problem that as the frame is existent on the side of the semiconductor wafer, a grinding wheel interferes with the frame at the time when the semiconductor wafer is ground.

Summary of the Invention

It is an object of the present invention to provide a semiconductor wafer assembly which makes it easy to transport a semiconductor wafer after machining and prevents a member other than the semiconductor wafer from interfering with a machining tool during machining, and a machining apparatus having chuck tables for holding the semiconductor wafer assembly.

To attain the above object, according to the present

invention, there is provided a semiconductor wafer assembly consisting of an annular frame, a tape mounted to the frame and a semiconductor wafer stuck to the tape, wherein

the back surface of the tape is stuck to the surface of the frame, and the semiconductor wafer is stuck to the surface of the tape.

An adhesion layer is formed in at least an area where the semiconductor wafer is arranged, of the surface of the tape and an adhesion layer is also formed in an area which sticks to the surface of the frame, of the back surface of the tape. A cutout corresponding to a cutout showing the crystal orientation of the semiconductor wafer is formed in an outer circumferential portion of the frame and the both cutouts are aligned with each other.

According to the present invention, there is provided a semiconductor wafer assembly consisting of an annular frame, a tape mounted to the frame, a semiconductor wafer stuck to the surface of the tape and a fixing ring for fixing the periphery portion of the tape to the frame, wherein

the annular frame consists of an annular frame portion and an annular mounting portion that projects upward from the inner peripheral portion of the frame portion, and

the tape is placed to the surface of the mounting portion, the fixing ring is fitted onto the outer circumferential portion of the mounting portion to sandwich the periphery portion of the tape between the outer peripheral surface of the mounting portion and the inner peripheral surface of the fixing ring.

A cutout corresponding to a cutout showing the crystal orientation of the semiconductor wafer is formed in an outer circumferential portion of the frame portion of the frame and the both cutouts are aligned with each other.

According to the present invention, there is provided a machining apparatus comprising chuck tables having a

placing surface for suction-holding a semiconductor wafer assembly and a machining means for machining the semiconductor wafer of the semiconductor wafer assembly suction-held on the chuck tables, wherein

the semiconductor wafer assembly consists of an annular frame, a tape mounted to the frame and a semiconductor wafer stuck to the surface of the tape, and

each of the chuck tables has a semiconductor wafer placing surface for supporting the back surface of the tape to which the semiconductor wafer is stuck and an annular frame placing surface for supporting the back surface of the frame, formed, on the outer peripheral side of the semiconductor wafer placing surface, at a position below the semiconductor wafer placing surface with a level difference therebetween.

The level difference between the semiconductor wafer placing surface and the frame placing surface is desirably equivalent to the thickness of the frame. The suction ports of communication paths connected to a suction source are desirably formed in the frame placing surface. The above machining means is a grinding means for grinding the semiconductor wafer of the semiconductor wafer assembly.

Brief Description of the Drawings

Fig. 1 is a perspective view of a semiconductor wafer assembly constructed according to an embodiment of the present invention;

Fig. 2 is a sectional view cut on A-A of Fig. 1;

Fig. 3 is a perspective view, in a disassembled way, of the constituent members of the semiconductor wafer assembly shown in Fig. 1;

Fig. 4 is a perspective view of a semiconductor wafer assembly constructed according to another embodiment of the present invention;

Fig. 5 is a sectional view cut on B-B of Fig. 4;

Fig. 6 is a perspective view, in a disassembled way, of the constituent members of the semiconductor wafer assembly shown in Fig. 4;

Fig. 7 is a perspective view of a surface grinding machine as a machining apparatus constructed by the present invention;

Fig. 8 is a perspective view of an embodiment of a chuck table mounted in the surface grinding machine shown in Fig. 7;

Fig. 9 is a sectional view showing a state where the semiconductor wafer assembly shown in Figs. 1 to 3 is held on the chuck table shown in Fig. 8; and

Fig. 10 is a sectional view of another embodiment of a chuck table mounted in the surface grinding machine shown in Fig. 7 and shows a state where it holds the semiconductor wafer assembly shown in Figs. 4 to 6.

Detailed Description of the Preferred Embodiments

A semiconductor wafer assembly and a grinding machine constructed according to preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings hereinafter.

Fig. 1 is a perspective view of a semiconductor wafer assembly constructed according to a preferred embodiment of the present invention, Fig. 2 is a sectional view cut on A-A of Fig. 1, and Fig. 3 is a perspective view, in a disassembled way, of the constituent members of the semiconductor wafer assembly shown in Fig. 1. The semiconductor wafer assembly 2 of the illustrated embodiment consists of an annular frame 21, a tape 22 mounted to the frame 21 and a semiconductor wafer 23 stuck to the tape 22. The annular frame 21 is formed from a thin plate as thick as about 1 mm, that is made from stainless steel or the like, for example. The tape 22 is formed in a circular form from an appropriate resin film, an adhesion layer 221 is formed

on the surface side (upper side in Fig. 2) of the tape 22 and an adhesion layer 222 is formed on the back side (lower side in Fig. 2) of the periphery portion of the tape 22. The adhesion layer 222 on the back side (lower side in Fig. 2) of the periphery portion of the thus constructed tape 22 is stuck to the surface (upper side in Fig. 2) of the above frame 21. The semiconductor wafer assembly 2 is constructed by sticking the semiconductor wafer 23 to the adhesion layer 221 on the surface of the tape 22 of which the back surface of the peripheral portion is stuck to the surface of the annular frame 21. At this point, the adhesion layer to be formed on the surface of the tape 22 may be formed in at least an area where the semiconductor wafer 23 is arranged. The adhesion layer 222 formed on the back surface of the periphery portion of the tape 22 is not always necessary. In this case, an adhesion layer is formed on the surface of the frame 21 to stick the back surface of the periphery portion of the tape 22 thereto. A cutout 21a corresponding to a cutout 23a showing a crystal orientation of the semiconductor wafer 23 is formed at a predetermined position of an outer circumferential portion of the frame 21. Therefore, when the semiconductor wafer 23 is to be mounted on the surface of the tape 22 stuck to the frame 21, it is mounted at a position where the cutout 23a formed in the semiconductor wafer 23 is aligned with the cutout 21a formed in the frame 21, thereby making it possible to confirm the crystal orientation of the semiconductor wafer 23 in the transportation.

A semiconductor wafer assembly according to another embodiment will be described with reference to Figs. 4 to 6.

The semiconductor wafer assembly 3 of this embodiment consists of an annular frame 31, a tape 32 mounted to the frame 31, a semiconductor wafer 33 stuck to the tape 32 and an annular fixing ring 34 for fixing the tape 32 to the frame 31. The annular frame 31 consists of an annular frame

portion 311 and an annular mounting portion 312 projecting upward from the inner peripheral portion of the frame portion 311 and is made from a metal material such as stainless steel. The tape 32 is formed in a circular form from an appropriate resin film, and an adhesion layer 321 is formed on the surface (upper side in Fig. 5) of the tape 32. The outer diameter of the tape 32 is made larger than the outer diameter of the annular mounting portion 312 constituting the above annular frame 31 by a size corresponding to the height of the mounting portion 312. The semiconductor wafer 33 is stuck to the adhesion layer 321 on the surface of the tape 32. The above annular fixing ring 34 has an inner diameter slightly larger than the outer diameter of the annular mounting portion 312 constituting the above annular frame 31, and is made from a metal material such as stainless steel, for example. The tape 32 is placed on the surface side (upper side) of the mounting potion 312 constituting the above annular frame 31, and the fixing ring 34 is fitted onto the outer circumferential portion of the mounting portion 312 to sandwich the periphery portion of the tape 32 between the outer peripheral surface of the mounting portion 312 and the inner peripheral surface of the fixing ring 34, thereby making it possible to fix the tape 32 to the frame 31. Since the tape 32 is sandwiched between the mounting portion 312 of the frame 31 and the fixing ring 34, an adhesion layer does not need to be formed on the back surface of the tape 32. A cutout 311a corresponding to a cutout 33a showing the crystal orientation of the semiconductor wafer 33 is formed at a predetermined position of an outer circumferential portion of the frame portion 311 constituting the annular frame 31. Therefore, the semiconductor wafer 33 is mounted at a position where the cutout 33a formed in the semiconductor wafer 33 is aligned with the cutout 311a, thereby making it possible to confirm the crystal

orientation of the semiconductor wafer 33 in the transportation.

A description is subsequently given of a grinding machine for grinding the semiconductor wafer 23 by holding the semiconductor wafer assembly 2 as shown in Fig. 1 with reference to Fig. 7 and Fig. 8.

The grinding machine of the illustrated embodiment comprises a substantially rectangular parallelepiped housing 4. A static support plate 6 is provided upright at a right upper end of the housing 4 in Fig. 7. Two pairs of guide rails 7,7 and 8,8 extending in a vertical direction are provided on the inside surface of the static support plate 6. A rough-grinding unit 10 as a rough-grinding means is mounted to one pair of guide rails 7,7 in such a manner that it can move in an up and down direction, and a finish-grinding unit 12 as a finish-grinding means is mounted to the other pair of guide rails 8,8 in such a manner that it can move in an up and down direction.

The rough-grinding unit 10 comprises a unit housing 101, a grinding wheel 102 rotatably attached to the lower end of the unit housing 101, a rotary drive unit 103, mounted to the upper end of the unit housing 101, for rotating the grinding wheel 102 in a direction indicated by an arrow, and a movable base 104 mounting the unit housing 101. To-be-guide rails 105,105 are provided on the movable base 104 and movably fitted to guide rails 7,7 provided on the above static support plate 6 so that the rough-grinding unit 10 is supported movably in an up and down direction. The rough-grinding unit 10 of the illustrated embodiment comprises a feeding unit 11 for moving the above movable base 104 along the guide rails 7,7 to adjust the cutting depth of the grinding wheel 102. The feeding unit 11 comprises a male screw rod 111 which is rotatably provided in an up and down direction in parallel to the guide rails 7,7 and supported to the above static support plate 6, a

pulse motor 112 for rotary-driving the male screw rod 111 and an female screw block (not shown) that is mounted on the movable base 104 and meshed with the male screw rod 111. The male screw rod 111 is driven in a forward direction or reverse direction by the pulse motor 112 to move the rough-grinding unit 10 in an up and down direction.

The above finish-grinding unit 12 has the same constitution as that of the rough-grinding unit 10. That is, it comprises a unit housing 121, a grinding wheel 122 rotatably attached to the lower end of the unit housing 121, a rotary drive unit 123, attached to the upper end of the unit housing 121, for rotating the grinding wheel 122 in a direction indicated by an arrow, and a movable base 124 mounting the unit housing 121. To-be-guide rails 125,125 are provided on the movable base 124, and movably fitted to guide rails 8,8 provided on the above static support plate 6 so that the finish-grinding unit 12 is supported movably in an up and down direction. The finish-grinding unit 12 of the illustrated embodiment comprises a feeding unit 13 for moving the above movable base 124 along the guide rails 8,8 to adjust the cutting depth of the grinding wheel 122. The feeding unit 13 has substantially the same constitution as the above feeding means 11. That is, the feeding unit 13 comprises a male screw rod 131 which is rotatably provided in an up and down direction in parallel to the guide rails 8, 8 and supported to the above static support plate 6, a pulse motor 132 for rotary-driving the male screw rod 131 and a female screw block (not shown) mounted on the movable base 124 and fitted to the male screw rod 131. The male screw rod 131 is driven in a forward direction or reverse direction by the pulse motor 132 to move the finish-grinding unit 12 in an up and down direction.

The grinding machine of the illustrated embodiment has a turn table 15 which is disposed substantially flush with the top surface of the housing 4 on the front side of the

above static support plate 6. This turn table 15 is formed like a disk having a relatively large diameter and suitably rotated in a direction indicated by an arrow 15a by a rotary drive unit that is not shown. In the illustrated embodiment, three chuck tables 5 are arranged each other at a phase angle of 120° rotatably on the horizontal plane on the turn table 15. The chuck tables 5 are suitable for holding the semiconductor wafer assembly 2 shown in Figs. 1 to 3 and will be descried in detail with reference to Fig. 8 and Fig. 9. The chuck table 5 shown in Fig. 8 and Fig. 9 consists of a disk-like base 51 and a disk-like suction-holding chuck 52. The base 51 is made from a metal material such as stainless steel, and a rotary shaft portion 511 projects from the center portion of the under surface thereof and is rotatably supported onto the turn table 15 by a bearing that is not shown. Since the rotary shaft portion 511 is connected to a rotary drive unit that is not shown, the chuck table 5 is caused to rotate in a direction indicated by an arrow in Fig. 7 when the rotary drive unit is activated.

A circular depressed portion 512 whose top portion is open is formed in the top surface of the base 51 and is connected to a communication path 513 provided in the rotary shaft portion 511. The communication path 513 is connected to a suction source that is not shown. The above suction-holding chuck 52 is formed of a porous ceramic disk and is fitted in the depressed portion 512 formed in the above base 51. Thus, the top surface of the suction-holding chuck 52 fitted in the depressed portion 512 of the base 51 serves as a semiconductor wafer placing surface 521 for supporting the back surface of the tape 22 to which the semiconductor wafer 23 of the above semiconductor wafer assembly 2 has been stuck, as will be described hereinafter. On the outer peripheral side of depressed portion 512 in the top surface of the base 51, an annular frame placing surface 514 for supporting the back surface of the frame 21 of the

semiconductor wafer assembly 2 is formed at a position below the semiconductor wafer placing surface (top surface) of the suction-holding chuck 52 with a level difference 515 therebetween. The level difference 515 of this annular frame placing surface 514 is equivalent to the thickness of the frame 21. The suction ports 517 of a plurality of communication paths 516 connected to the depressed portion 512 are formed in the annular frame placing surface 514.

On the chuck table 5 constituted as described above is placed the semiconductor wafer assembly 2 as shown in Fig. 9. That is, the back surface of the tape 22 to which the semiconductor wafer 23 is stuck is placed on the semiconductor wafer placing surface 521 which is the top surface of the suction-holding chuck 52, and the back surface of the frame 21 is placed on the annular frame placing surface 514. By connecting the communication path 513 to the suction source (not shown), the semiconductor wafer assembly 2 can be suction-held on the suction-holding chuck 5. Therefore, the frame 21 is located at a position lower than the semiconductor wafer 23 by the above level difference 515. Consequently, while the semiconductor wafer 23 is ground, the grinding wheels 102 and 122 do not interfere with the frame 21. The three chuck tables 5 arranged on the turn table 15 constituted as described above are moved to a workpiece carrying-in/carrying-out area A, rough-grinding area B, finish-grinding area C and workpiece carrying-in/carrying-out A in this order by properly turning the turn table 15.

The illustrated grinding machine comprises a first cassette 41, arranged on one side relative to the workpiece carrying-in/carrying-out area A, for storing the semiconductor wafer assembly 2 which is a workpiece before grinding, a second cassette 42, arranged on the other side relative to the workpiece carrying-in/carrying-out area A, for storing the semiconductor wafer assembly 2 after

grinding, a workpiece placing unit 43 provided between the first cassette 41 and the workpiece carrying-in/carrying-out area A, a cleaning means 44 provided between the workpiece carrying-in/carrying-out area A and the second cassette 42, a workpiece delivering means 45 for delivering the semiconductor wafer assembly 2 stored in the first cassette 41 to the workpiece placing unit 43 and delivering the semiconductor wafer assembly 2 cleaned by the cleaning means 44 to the second cassette 42, a workpiece carrying-in means 46 for carrying the semiconductor wafer assembly 2 placed on the workpiece placing unit 43 to the top of the chuck table 4 positioned in the workpiece carrying-in/carrying-out area A, and a workpiece carrying-out means 47 for carrying the semiconductor wafer assembly 2 after grinding placed on the chuck table 5 positioned in the workpiece carrying-in/carrying-out area A to the cleaning means 44.

The semiconductor wafer assembly and the grinding machine in the illustrated embodiment are constituted as described above, and their functions will be described hereinafter.

The semiconductor wafer assembly 2 before grinding stored in the first cassette 41 is carried by the up and down movement and forward and reverse movement of the workpiece delivering means 45, mounted on the workpiece placing unit 43 and centered by the radial movement toward the center of six pins 431. The semiconductor wafer assembly 2 which has been mounted on the workpiece placing unit 43 and has centered is placed on the chuck table 5 positioned in the workpiece carrying-in/carrying-out area A by the turning movement of the workpiece carrying-in means 46. When the communication path 513 formed in the base 51 of the chuck table 5 is connected to the suction source (not shown), the back surface of the tape 22 to which the semiconductor wafer 23 is stuck, of the semiconductor wafer assembly 2 mounted on the chuck table 5, is sucked to the

semiconductor wafer placing surface 521 of the suction-holding chuck 52 and the back surface of the frame 21 is suction-held on the annular frame placing surface 514. When the semiconductor wafer assembly 2 is suction-held on the chuck table 5, the turn table 15 is turned at 120° in a direction indicated by the arrow 15a by the rotary drive unit (not shown) to position the chuck table 5 on which the semiconductor wafer assembly 2 has been placed in the rough-grinding area B.

When the chuck table 5 on which the semiconductor wafer has been placed is positioned in the rough-grinding area B, it is turned in a direction indicated by an arrow by the rotary drive unit (not shown), and the grinding wheel 102 of the rough-grinding unit 10 is, while being rotated in a direction indicated by an arrow, lowered a predetermined amount by the feeding unit 11 so that the semiconductor wafer 23 of the semiconductor wafer assembly 2 on the chuck table 5 is roughly ground. At this point, since the frame 21 of the semiconductor wafer assembly 2 held on the chuck table 5 is located at a position lower than the semiconductor wafer 23 by the above level difference 515 as described above, the frame 21 does not interfere with the grinding wheel 102 at the time when the semiconductor wafer 23 is ground by the grinding wheel 102. Further, since the semiconductor wafer placing surface 521 and the annular frame placing surface 514 of the chuck table 5 are covered with the frame 21 and the tape 22, contaminants generated by grinding do not contaminate the placing surfaces, thereby making it possible to maintain the function of the chuck table with high accuracy. While this grinding work is thus carried out, the semiconductor wafer assembly 2 before grinding is mounted on the next chuck table 5 positioned in the workpiece carrying-in/carrying-out area A, as described above. The chuck table 5 on which the roughly ground semiconductor wafer assembly 2 has been placed is then

positioned in the finish-grinding area C by turning the turn table 15 at 120° in a direction indicated by the arrow 15a. At this point, the next chuck table 5 on which the semiconductor wafer assembly 2 has been placed in the workpiece carrying-in/carrying-out area A is positioned in the rough-grinding area B, and the chuck table 5 after the next is positioned in the workpiece carrying-in/carrying-out area A.

The semiconductor wafer 23 of the semiconductor wafer assembly 2 before rough-grinding placed on the chuck table 5 positioned in the rough-grinding area B is thus roughly ground by the rough-grinding unit 10 and the semiconductor wafer 23 of the semiconductor wafer assembly 2 placed on the chuck table 5 positioned in the finish-grinding area C and roughly ground is finish-ground by the finish-grinding unit 12. During this finish-grinding, too, the frame 21 of the semiconductor wafer assembly 2 held on the chuck table 2 is located at a position lower than the semiconductor wafer 23 by the level difference 515. Therefore, while the semiconductor wafer 23 is ground by the grinding wheel 122, the frame 21 does not interfere with the grinding wheel 122. The chuck table 5 on which the finish-ground semiconductor wafer assembly 2 has been placed is then positioned in the workpiece carrying-in/carrying-out area A by turning the turn table 15 at 120° in a direction indicated by the arrow 15a. The chuck table 5 on which the semiconductor wafer assembly 2 roughly ground in the rough-grinding area B is placed is moved to the finish-grinding area C and the chuck table 5 on which the semiconductor wafer assembly 2 before grinding in the workpiece carrying-in/carrying-out area A is placed is moved to the rough-grinding area B, respectively.

The chuck table 5 that has returned to the workpiece carrying-in/carrying-out area A via the rough-grinding area B and the finish-grinding area C releases here the suction-holding of the finish ground semiconductor wafer assembly 2.

That is, communication between the communication path 513 formed in the base 51 of the chuck table 5 and the suction source (not shown) is cut off. The finish-ground semiconductor wafer assembly 2 on the chuck table 5 positioned in the workpiece carrying-in/carrying-out area A is carried to the cleaning means 44 by the workpiece carrying-out means 47. The semiconductor wafer assembly 2 carried to the cleaning means 44 is cleaned and then stored at a predetermined position of the second cassette 42 by the workpiece delivering means 45.

A chuck table 5a suitable for holding the semiconductor wafer assembly 3 shown in Figs. 4 to 6 will be described with reference to Fig. 10.

The chuck table 5a shown in Fig. 10 consists of a disk-like base 51a and a disk-like suction-holding chuck 52a, like the chuck table 5 shown in Figs. 8 and 9. The base 51a is made from a metal material such as stainless steel, and a rotary shaft portion 511a projects from the center portion of the under surface thereof and is rotatably supported to the above turn table 15 of the grinding machine shown in Fig. 7 by a bearing that is not shown.

A circular depressed portion 512a whose top portion is open is formed in the top surface of the base 51a and is connected to a communication path 513a provided in the rotary shaft portion 511a and connected to the suction source that is not shown. The suction-holding chuck 52a is formed of a porous ceramic disk and is fitted in the depressed portion 512a formed in the above base 51a. Thus, the top surface of the suction-holding chuck 52a fitted in the depressed portion 512a of the base 51a serves as a semiconductor wafer placing surface 521a for supporting the back surface of the tape 32 to which the semiconductor wafer 33 of the above semiconductor wafer assembly 3 is stuck, as will be described hereinafter. In the outer peripheral side of the depressed portion 512a in the top surface of the

base 51a, an annular frame placing surface 514a for supporting the back surface of the frame portion 311 constituting the frame 31 of the semiconductor wafer assembly 3 is formed at a position below the semiconductor wafer placing surface (top surface) of the suction-holding chuck 52a with a level difference 515a therebetween. The level difference 515a of this annular frame placing surface 514a is equivalent to the total of the thickness of the frame portion 311 and the thickness of the mounting portion 312 constituting the frame 31. The suction ports 517a of a plurality of communication paths 516a connected to the above communication path 513a are formed in the annular frame placing surface 514a.

On the chuck table 5a constituted as described above is placed the semiconductor wafer assembly 3 as shown in Fig. 10. That is, the back surface of the tape 32 to which the semiconductor wafer 33 is stuck is placed on the semiconductor wafer placing surface 521a which is the top surface of the suction-holding chuck 52a, and the back surface of the frame portion 311 constituting the above frame 31 is placed on the annular frame placing surface 514a. By connecting the communication path 513a to the suction source (not shown), the semiconductor wafer assembly 3 can be suction-held on the suction-holding chuck 5a. Therefore, the frame 31 is located at a position lower than the semiconductor wafer 33 by the level difference 515a. Consequently, while the semiconductor wafer 23 is ground, the grinding wheels 102 and 122 of the grinding machine shown in Fig. 7 do not interfere with the frame 31. Since the semiconductor wafer placing surface 521a and the annular frame placing surface 514a of the chuck table 5a are covered with the frame 31 and the tape 32, contaminants generated by grinding do not contaminate the mounting surfaces, thereby making it possible to maintain the function of the chuck table with high accuracy.

Since the semiconductor wafer assembly and the machining apparatus according to the present invention are constituted as described above, the following function and effect are obtained.

That is, according to the present invention, since the back surface of the tape of the semiconductor wafer assembly is stuck to the surface of the frame and the semiconductor wafer is stuck to the surface of the above tape, the semiconductor wafer and the frame are located on opposite sides of the tape, whereby while the semiconductor wafer is ground, the machining tools do not interfere with the frame, thereby making it possible to machine the semiconductor wafer smoothly. Further, as the machined semiconductor wafer is united with the frame via the tape, it is not bent by the rigidity of the frame and can be delivered smoothly and stored in the cassette, even if it has been made thin or divided.

According to the present invention, the semiconductor wafer assembly consists of an annular frame, a tape mounted to the frame, a semiconductor wafer stuck to the surface of the tape and a fixing ring for fixing the periphery portion of the tape to the frame, the tape is placed to the surface of the mounting portion constituting the annular frame, the fixing ring is fitted onto the outer circumferential portion of the mounting portion to sandwich the outer peripheral portion of the tape between the outer peripheral surface of the mounting portion and the inner peripheral surface of the fixing ring. Therefore, the tape can be mounted to the frame without forming an adhesion layer on the back surface of the tape.

The machining apparatus according to the present invention is constituted such that the chuck table for holding the semiconductor wafer assembly has a semiconductor wafer placing surface for supporting the back surface of the tape to which the semiconductor wafer is stuck and an

annular frame placing surface for supporting the back surface of the frame, which is formed, in the outer peripheral side of the semiconductor wafer placing surface, at a position below the semiconductor wafer placing surface with a level difference therebetween. Therefore, the frame is located at a position where the machining tool does not interfere with the frame during the machining of the semiconductor wafer, thereby making it possible to machine the semiconductor wafer smoothly. Further, as the semiconductor wafer placing surface and the annular frame placing surface of the chuck table are covered with the frame and the tape, contaminants generated by grinding do not contaminate the placing surfaces, thereby making it possible to maintain the function of the chuck table with high accuracy.

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What is claimed is:

1. A semiconductor wafer assembly consisting of an annular frame, a tape mounted to a front surface of the frame and a semiconductor wafer to be processed, which is stuck to a front surface of the tape, wherein

a cutout showing a crystal orientation is provided in an outer circumferential portion of the semiconductor wafer, a cutout corresponding to the cutout showing the crystal orientation provided in the outer circumferential portion of the semiconductor wafer is formed in an outer circumferential portion of the annular frame, a back surface of the tape is stuck to a front surface of the frame and the semiconductor wafer is stuck to a front surface of the tape, the both cutouts being aligned with each other.

2. A semiconductor wafer assembly consisting of an annular frame, a tape mounted to a front surface of the frame, a semiconductor wafer to be processed, which is stuck to a front surface of the tape and a fixing ring for fixing a periphery portion of the tape to the frame, wherein

the annular frame consists of an annular frame portion and an annular mounting portion that projects upward from an inner peripheral portion of the frame portion, and

the tape is placed on a front surface of the mounting portion and the fixing ring is fitted onto an outer circumferential portion of the mounting portion to sandwich a periphery portion of the tape between the outer peripheral surface of the mounting portion and an inner peripheral surface of the fixing ring.

3. The semiconductor wafer assembly of claim 2, wherein a cutout showing a crystal orientation is provided in an outer circumferential portion of the semiconductor

wafer, a cutout corresponding to the cutout showing the crystal orientation provided in the outer circumferential portion of the semiconductor wafer is formed in an outer circumferential portion of the annular frame, and the both cutouts are aligned with each other.

4. A machining apparatus comprising chuck tables having a placing surface for suction-holding a semiconductor wafer assembly and a machining means for machining the semiconductor wafer of the semiconductor wafer assembly suction-held on each of the chuck tables, wherein

the semiconductor wafer assembly consists of an annular frame, a tape mounted to a front surface of the frame and a semiconductor wafer stuck to a front surface of the tape, and

each of the chuck tables has a semiconductor wafer placing surface for supporting a back surface of the tape, the semiconductor wafer being stuck to a front surface of the tape, and an annular frame placing surface for supporting a back surface of the frame, formed, on an outer peripheral side of the semiconductor wafer placing surface, at a position below the semiconductor wafer placing surface with a level difference therebetween.

5. The machining apparatus of claim 4, wherein the level difference between the semiconductor wafer placing surface and the frame placing surface is equivalent to the thickness of the frame.

6. The machining apparatus of claim 4, wherein suction ports of communication paths connected to a suction source are formed in the frame placing surface.

7. The machining apparatus of claim 4, wherein the machining means is a grinding means for grinding the semiconductor wafer of the semiconductor wafer assembly.