STATIC PRESSURE PAD, GRINDING DEVICE AND SILICON WAFER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims a priority to the Chinese patent application No. 202310340170.3 filed in China on March 31, 2023, a disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present application relates to the field of semiconductor manufacturing technology, and in particular, to a static pressure pad, a grinding device and a silicon wafer.

BACKGROUND

[0003] A manufacturing process of semiconductor silicon wafers typically includes processes such as crystal pulling, wire sawing, grinding, and polishing. Double-sided grinding, as a grinding process, is used to simultaneously grind both main surfaces of a silicon wafer to achieve highly flatness of the surfaces. During double-sided grinding, a dedicated apparatus is required to hold the silicon wafer, allowing grinding wheels to process both main surfaces simultaneously. Typically, this holding apparatus includes a pair of opposing hydrostatic pressure supports, with the silicon wafer positioned vertically between them. The hydrostatic pressure supports form a fluid barrier between the supports and the main surfaces of the silicon wafer, allowing the silicon wafer to be held upright without contact with the supports. Meanwhile, opposing grinding wheels can grind both main surfaces of the silicon wafer simultaneously. Compared to physical clamping, a fluid-based clamping method of the hydrostatic pressure supports reduces damage to the silicon wafer, and allows the silicon wafer to move or rotate tangentially with lower friction relative to the surfaces of the hydrostatic supports.

[0004] In a double-sided grinding device, it is necessary to adjust the angles of a pair of opposing grinding wheels to adjust the flatness of the silicon wafer. During the adjustment process of the grinding wheels, if deflection angles of the left and right grinding wheels become excessive, the silicon wafer in direct contact with these grinding wheels may experience tilting. Alternatively, when the above-mentioned dedicated apparatus is configured to hold the silicon wafer, the silicon wafer will tilt due to the mechanical instability. In this case, since the gap between a pair of static pressure supports is fixed and the distance between a single static pressure support and the silicon wafer is fixed, the silicon wafer will come into contact with the static pressure support. This results

in friction between the silicon wafer and the static pressure support, thereby degrading the flatness of the silicon wafer and even causing wafer breakage.

[0005] After grinding is completed, the silicon wafer is moved into contact with the static pressure support by an unloading apparatus for unloading. The dedicated apparatus for holding the silicon wafer drives the silicon wafer to move into contact with the static pressure support. The side of the silicon wafer in contact with the static pressure support is held by the suction generated from the static pressure support. Since the machining residues will splash onto the static pressure support during the processing or the cleanliness of the surface of the silicon wafer may be poor, the surfaces of the silicon wafer may be contaminated when the silicon wafer comes into contact with the static pressure support, resulting in a significant number of pit-like defects on the surfaces of the silicon wafer.

SUMMARY

[0006] To solve the above technical problems, embodiments of the present application provide a static pressure pad, a grinding device and a silicon wafer. During the double-sided grinding process, the configuration of the static pressure pad is adjusted in real time to alter the gap between the static pressure pad and the silicon wafer. This ensures the stability of the grinding process and improves product quality, and reduces the area of the static pressure pad in contact with the silicon wafer, thereby reducing damage to the surface of the silicon wafer.

[0007] The technical solutions of the present application are as follows.

[0008] In a first aspect, the present application provides a static pressure pad, wherein the static pressure pad is used for clamping, in pairs, both sides of each of silicon wafers in a double-sided grinding device for the silicon wafer, the static pressure pad includes: a base having a fixed plane facing the silicon wafer; a plurality of static pressure blocks that is uniformly distributed along a vertical direction on the fixing plane and protrudes outward from the fixing plane, the plurality of static pressure blocks is configured to provide hydrostatic pressure to the silicon wafer through a fluid, to support one side of the silicon wafer in a non-contact manner; a driving module, configured to drive, when a first plane formed by an end of each of the static pressure blocks is not parallel to a target plane where the silicon wafer is positioned, each of static pressure blocks to move in a direction perpendicular to the fixed plane, to allow the first plane to be parallel to the target plane.

[0009] Optionally, the static pressure pad further includes a support block arranged on the fixed plane, the support block is configured to be movable in the direction perpendicular to the fixed

plane to protrude from the fixed plane, and the support block is configured to allow a protrusion height of the support block relative to the fixed plane to be greater than a protrusion height of any one of the plurality of static pressure blocks.

[0010] Optionally, an end of the support block is provided with a plurality of suction holes, and the suction holes are configured to apply vacuum suction to the silicon wafer.

[0011] Optionally, the static pressure pad further includes a sensor and a controller, the sensor is configured to detect a spatial position of the target plane, the controller is configured to transmit a control signal to the driving module based on the spatial position of the target plane, and the driving module is configured to drive the plurality of static pressure blocks to move according to the control signal, to allow the first plane to be parallel to the target plane.

[0012] Optionally, the sensor is a pressure sensor, and the pressure sensor is configured to detect a change of the hydrostatic pressure applied to the silicon wafer, to obtain a spatial orientation of the silicon wafer.

[0013] Optionally, the sensor is a distance sensor, and the distance sensor is configured to measure a distance between the silicon wafer and the first plane, to obtain spatial orientation of the silicon wafer.

[0014] Optionally, the end of each of the static pressure block is provided with a plurality of via holes, and the via holes are configured to allow the fluid to flow out to support the silicon wafer in a non-contact manner.

[0015] Optionally, the driving module includes a hydraulic driving unit or a pneumatic driving unit configured to drive the static pressure block to move.

[0016] In a second aspect, the present application provides a grinding device for double-sided grinding of a silicon wafer, the grinding device including: a carrier for supporting the silicon wafer in a vertical direction; two grinding wheels symmetrically arranged with respect to the carrier; and two of the above-mentioned static pressure pads symmetrically arranged with respect to the carrier.

[0017] In a third aspect, the present application provides a silicon wafer obtained by using the above-mentioned grinding device.

[0018] The embodiments of the present application provide a static pressure pad, a grinding device and a silicon wafer, wherein the static pressure pad includes a base, a plurality of static pressure blocks that can be extended and retracted to protrude from the surface of the base, and a driving module for driving the static pressure blocks to move. The first plane formed by the ends of the plurality of static pressure blocks is used to provide hydrostatic pressure to the silicon wafer to hold the silicon wafer. The static pressure pad can adjust the extension length of the plurality of static pressure blocks according to the target plane where the silicon wafer is positioned, thereby

altering the spatial position of the first plane, so that the first plane and the target plane are parallel. This ensures that when the silicon wafer is tilted significantly, the static pressure pad will not come into contact with the silicon wafer, avoiding the occurrence of wafer breakage and/or damage to the static pressure pad. In addition, the contact area of the static pressure pad on the silicon wafer is reduced by the support block, thereby reducing damage to the backside of the silicon wafer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is a schematic structural diagram of a vertical grinding device in the related art;

[0020] FIG. 2 is a schematic structural diagram of a static pressure pad according to an embodiment of the present application;

[0021] FIG. 3 is a schematic view of a tilted silicon wafer being clamped by a static pressure pad according to an embodiment of the present application;

[0022] FIG. 4 is a schematic diagram of the shape of the static pressure pad according to an embodiment of the present application.

DETAILED DESCRIPTION

[0023] The technical solutions in the embodiments of the present application will be described clearly and thoroughly below in conjunction with the drawings in the embodiments of the present application.

[0024] As the diameter of silicon wafers increases while a feature size of the integrated circuit become smaller, higher requirements are placed on the flatness and cleanliness of surface of the silicon wafer, as well as the degree of surface damage. Double-sided grinding refers to simultaneously grinding both sides of a silicon wafer to produce a wafer with a highly flat surface. During double-sided grinding using a vertical grinding device, a wafer clamping apparatus is required to maintain the silicon wafer upright. The clamping apparatus typically includes a pair of static pressure pads. The pair of static pressure pads is configured to simultaneously apply fluid pressure to both sides of the silicon wafer placed between them, thereby supporting the silicon wafer in a non-contact manner. In the vertical grinding device, the grinding apparatus used to grind the silicon wafer includes a pair of opposing grinding wheels. The pair of opposing grinding wheels simultaneously grinds both sides of the silicon wafer along a predetermined grinding path while the silicon wafer is supported by the pair of the static pressure pads.

[0025] When the vertical grinding device is used to grind both sides of the silicon wafer, the silicon wafer may tilt expectedly or unexpectedly. For example, when the flatness of the surface of a silicon wafer needs to be adjusted, it can be achieved by modifying the deflection angle of the

pair of grinding wheels. Specifically, referring to FIG. 1, which illustrates a schematic diagram of a vertical grinding device in the related art, wherein the vertical grinding device 30 includes a pair of grinding wheels 31 and a pair of static pressure pads 32. The pair of static pressure pads 32 provides non-contact support for the silicon wafer W through fluid L. The pair of grinding wheels 31 needs to be deflected in the same direction to adjust the flatness of the surface of a silicon wafer. In this case, the pair of grinding wheels 31 will drive the silicon wafer W to deflect at the same deflection angle. At this time, the silicon wafer W comes into contact with the surface of the pair of static pressure pads 32, which compromises the quality of wafer W or leads to breakage.

[0026] After processing is completed, the pair of grinding wheels 31 retreats along its own central axis in a direction away from the silicon wafer W and returns to the initial position. The silicon wafer W is held by vacuum pressure on either side of the pair of static pressure pads 32, waiting for the robotic arm used for unloading to pick up the silicon wafer W from the opposite side. Then， the hydrostatic pads stop holding, and the wafer removal process is completed. However, a large amount of residues may splash onto the pair of static pressure pads 32 during the processing，and the pair of static pressure pads 32 does not have a self-cleaning function. Therefore, when the silicon wafer W comes into contact with the static pressure pads, a large number of pit-like defects will be formed on the surface of the silicon wafer W. In addition, contaminants present on the surface of the silicon wafer W will also cause the same problem.

[0027] To solve the technical problems above, referring to FIGs. 2 to 4, the present application provides a static pressure pad 10. The static pressure pad 10 can determine a position of a target plane C in which the silicon wafer W is located according to spatial orientation of the silicon wafer W. Based on the target plane C, the static pressure pad 10 adjusts its orientation to become parallel to the target plane C, thereby preventing potential degradation of the quality of the silicon wafer W or breakage that may occur when the silicon wafer W tilts and comes into contact with the static pressure pad 10. Furthermore, during the unloading process of the silicon wafer W, the static pressure pad 10 reduces the contact area that supports the silicon wafer W, thereby reducing damage to the backside of the silicon wafer W.

[0028] Specifically, referring to FIGs. 2 and 3, the static pressure pad 10 includes a base 11, a plurality of static pressure blocks 12, and a driving module (not shown). The base 11 has a fixed plane A facing the silicon wafer W. The plurality of static pressure blocks 12 are uniformly distributed across the fixed plane A in the vertical direction. The plurality of static pressure blocks 12 can be actuated in a direction perpendicular to the fixed plane A by the driving module, so that the first plane B formed by the end of each of the plurality of static pressure blocks 12 is parallel

to the target plane C in which the silicon wafer W is located, wherein the number of the plurality of static pressure blocks 12 is at least two. The static pressure pad 10 alters the spatial orientation of the first plane B by adjusting the height at which the plurality of static pressure blocks 12 protruding from the fixed plane A. When the silicon wafer W tilts, the spatial orientation of the first plane B is dynamically adjusted by the above structure so that the first plane B remains parallel to the target plane C.

[0029] Optionally, the static pressure pad 10 further includes a support block (not shown) for supporting the silicon wafer W. The support block can protrude from the fixed plane A of the base 11 under the actuation of the driving module. When the silicon wafer W is unloaded by a robotic arm, is moves to abut against the static pressure pad 10, and the support block protrudes from the fixed plane A. The protrusion height of the support block relative to the fixed plane A is greater than the protrusion height of the plurality of static pressure blocks 12 relative to the fixed plane A, so that the support block can contact the silicon wafer W before each of the plurality of static pressure blocks 12 and provide a supporting force to the silicon wafer W. This reduces the area of the static pressure pad 10 used to support the silicon wafer W, thereby preventing damage to the backside of the silicon wafer W.

[0030] When associated components used to grind the silicon wafer W undergo displacement, it causes the silicon wafer W to tilt during the grinding process. In order to prevent the silicon wafer W from contacting the static pressure pad 10 and adversely affecting the quality of the silicon wafer W or prevent from the occurrence of wafer breakage, unlike conventional static pressure pads, the static pressure pad 10 provided in the embodiments of the present application can adjust the configuration of the associated components of the static pressure pad 10 facing the silicon wafer W. This ensures that the surface of the static pressure pad 10 facing the silicon wafer W remains continuously parallel to the silicon wafer W throughout the process. In addition, in order to prevent scratching the surface of the silicon wafer W during the process of removing the silicon wafer W and causing damage to the surface of the silicon wafer W, the static pressure pad 10 also reduces the area of the associated components used to support the silicon wafer W.

[0031] Specifically, in order to stably support the various components of the static pressure pad 10 to allow the static pressure pad 10 to firmly hold the silicon wafer W, the base 11 is typically made of metal. Referring to FIGs. 2 and 3, the base 11 has a fixed plane A and a central axis (not shown), the fixed plane A is the surface of the base 11 facing the silicon wafer W, the fixed plane A is in a vertical plane, and the central axis is perpendicular to the fixed plane A. The plurality of static pressure blocks 12 are uniformly distributed along the vertical direction on the fixed plane A and protrude from the fixed plane A. Referring to FIGs. 2 to 4, the plurality of static pressure

blocks 12 are configured to be of equal length in the vertical direction, and as shown in FIG. 4, the plurality of static pressure blocks 12 are arranged on the fixed plane A to form a contour that conforms to the shape of the base 11.

[0032] Before the silicon wafer W tilts, the plurality of static pressure blocks 12 protrude from the fixed plane A at the same height to provide hydrostatic pressure to support the silicon wafer W. The first plane B is parallel to the target plane C, as shown in FIG. 2, the first plane B is in a vertical plane. The plurality of static pressure blocks 12 support a side of the silicon wafer W in a non-contact manner through fluid. When the silicon wafer W tilts, the spatial orientation of the silicon wafer W alters, resulting in a corresponding change in the target plane C where the silicon wafer W is located. Illustratively, as shown in FIG. 3, the silicon wafer W tilts in a clockwise direction. When a conventional static pressure pad is used, tilting of the silicon wafer W may cause it to come into contact with the static pressure pad, resulting in poor grinding quality of the silicon wafer W or the occurrence of wafer breakage. However, in an embodiment of the present application, when the silicon wafer W tilts in a clockwise direction, that is, the first plane B is no longer parallel to the target plane C. The plurality of static pressure blocks 12 extends along the central axis of the base 11 under the drive of the driving module, so that the first plane B is parallel to the target plane C, thereby avoiding contact between the silicon wafer W and the static pressure blocks, and preventing the grinding quality of the silicon wafer W from being adversely affected or the occurrence of wafer breakage.

[0033] Specifically, when the first plane B and the target plane C are no longer parallel, the plurality of static pressure blocks 12, driven by the driving module, protrude from the fixed plane A by varying distances along the central axis, causing the end of each of the plurality of static pressure blocks 12 to move to different positions along the central axis, thereby altering the spatial position of the first plane B formed by the end of each static pressure block. Illustratively, as shown in FIGs. 2 and 3, the plurality of static pressure blocks 12 include five static pressure blocks arranged vertically from top to bottom. Before the silicon wafer W tilts, the five static pressure blocks are arranged on the fixed plane A, protruding from the fixed plane A by the same height. The first plane B, formed by the ends of the five static pressure blocks, is in a vertical plane and ejecting fluid toward the side of the silicon wafer W, supporting the side of the silicon wafer W with hydrostatic pressure. When the silicon wafer W tilts as shown in FIG. 3, the five static pressure blocks extend from top to bottom along the central axis toward the silicon wafer W, extending at uniformly increasing distances, causing the first plane B formed by the ends of the five static pressure blocks to also tilt clockwise. It should be noted that, under the drive of the driving module, the five static pressure blocks are not limited to extending toward the silicon wafer

W along the central axis. Any of the five static pressure blocks may also retract in a direction away from the silicon wafer W along the central axis, thereby achieving the effect of altering the spatial position of the first plane B.

[0034] It should be noted that, in the double-sided grinding apparatus, static pressure pads 10 are provided on both sides of the silicon wafer W to provide hydrostatic pressure to support the silicon wafer W. It is readily understood by those skilled in the art that when the static pressure pads 10 on both sides of the silicon wafer W need to be tilted, the tilt directions and tilt angles of the respective first planes B of the two static pressure pads 10 are identical. However, the expansion and contraction states of the static pressure blocks used to achieve the aforementioned tilting are different. Illustratively, as shown in FIG. 3, the first plane B formed by the plurality of static pressure blocks 12 on the right side of the silicon wafer W is tilted in a clockwise direction, and the first plane B formed by the plurality of static pressure blocks 12 disposed on the left side of the silicon wafer W is also tilted in a clockwise direction. However, the expansion and contraction states of the plurality of static pressure blocks 12 used to achieve the tilting of the two first planes B are different, respectively.

[0035] The driving module includes a driving unit configured to drive movement of each static pressure block. The driving unit can be a hydraulic driving apparatus, a pneumatic driving apparatus or other driving apparatus that can facilitate the movement of the static pressure block. Illustratively, the driving unit uses a leadscrew mechanism actuated by a motor. The leadscrew mechanism is mounted within the base 11. One end of the screw in the leadscrew mechanism is connected to the end of the static pressure block 12 distal to the silicon wafer W. Under the drive of the motor, the leadscrew mechanism can be extended and retracted along the direction of the central axis, thereby driving the static pressure block to move along the direction of the central axis.

[0036] In order to accurately obtain the specific spatial position of the target plane C as a reference for the expansion and contraction of the static pressure block, the static pressure pad 10 further includes a sensor (not shown) and a controller (not shown). The sensor is configured to sense the spatial orientation of the silicon wafer W to obtain specific positional information of the target plane C. The controller is configured to send a control signal to the driving module based on the positional information of the target plane C, so that each driving unit in the driving module drives each corresponding static pressure block to expand and contract, thereby achieving the tilt of the first plane B and making the first plane B parallel to the target plane C.

[0037] Specifically, the sensor is a pressure sensor, and configured to sense the hydrostatic pressure applied to the silicon wafer W. The hydrostatic pressure is stably provided by the plurality

of static pressure blocks 12, i.e., the fluid flowing out of the plurality of static pressure blocks 12 applies hydrostatic to the side of the silicon wafer W as a supporting force for the silicon wafer W. When the first plane B is parallel to the target plane C, the hydrostatic pressure applied to each point on the silicon wafer W is equal in magnitude and direction. When the silicon wafer W tilts, the pressure sensor detects a variation in the hydrostatic pressure applied to the silicon wafer W. The pressure sensor determines that the silicon wafer W has tilted by detecting the distribution of hydrostatic pressure of varying magnitudes, and determines the positional change of the silicon wafer W relative to its previous position based on the distribution of hydrostatic pressure of varying magnitudes applied to the silicon wafer W, thereby obtaining the new spatial position of the target plane C after the silicon wafer W has tilted. The controller sends a control signal to the driving module based on the new target plane C. The driving module controls, according to the control signal, each driving unit to extend and retract, causing each corresponding static pressure block to extend and retract along the central axis, thereby tilting the first plane B until it is parallel to the target plane C.

[0038] In another embodiment of the present application, the sensor is a distance sensor, which is used to directly measure the distance between each point on the silicon wafer W and the fixed plane A of the base 11. The distance refers to a straight-line distance between each point on the silicon wafer W and the fixed plane A, and the straight line is oriented horizontally. When the distance between each point on the silicon wafer W and the fixed plane A is inconsistent, it is determined that the silicon wafer W has tilted. The distance sensor obtains the angle between the target plane C and the fixed plane A based on the distance between each point on the silicon wafer W and the fixed plane A. The controller sends a control signal to the driving module based on the angle. The driving module controls each driving unit to extend and retract according to the control signal, so that each corresponding static pressure block extends and retracts along the central axis, thereby tilting the first plane B until it is parallel to the target plane C.

[0039] Optionally, referring to FIG. 4, each static pressure block is uniformly provided with a plurality of via holes T. The via holes T are configured to allow fluid to pass through an end face of the static pressure block under pressure and be ejected toward the side of the silicon wafer W facing the static pressure block, allowing the silicon wafer W to be supported by hydrostatic pressure. It should be noted that in the double-sided grinding apparatus, the hydrostatic pressure is provided on both sides of the silicon wafer W. As shown in FIG. 3, according to an embodiment of the present application, a static pressure pad 10 and another static pressure pad 20 are respectively arranged on opposite sides of the silicon wafer W, jointly providing hydrostatic pressure for the silicon wafer W.

[0040] Optionally, the static pressure blocks include a fluid pressure driving unit, which is configured such that: when the static pressure blocks exert hydrostatic pressure to the surface of the silicon wafer W in the target plane C, the fluid pressure driving unit individually controls the pressure of the fluid in each static pressure block, so that each static pressure block consistently exerts an equal and constant hydrostatic pressure to the surface of the silicon wafer W in the target plane C. Specifically, the fluid pressure driving unit includes a pressure cylinder for containing fluid, a pressurizing unit, and a sensor. The pressurizing unit is configured to constantly eject the fluid out of a via hole T at a set pressure. The sensor is configured to detect the reaction force of the silicon wafer W on the fluid, and the pressurizing unit is configured to control the pressure of the fluid when being ejected out of the via hole T based on the detection result of the sensor, so that each static pressure block consistently applies a constant hydrostatic pressure to the surface of the silicon wafer W in the target plane C.

[0041] After the silicon wafer W completes the grinding process by using the static pressure pad 10, the silicon wafer W is unloaded by being clamped with a robotic arm. The robotic arm drives the silicon wafer W to approach to the static pressure pad 10 and abuts against the static pressure pad 10 to hold the silicon wafer W by vacuum suction. In order to avoid scratches or other physical defects caused by friction with foreign objects on the surface of the silicon wafer W that is in contact with the static pressure pad 10, the static pressure pad 10 further includes a support block. When the silicon wafer W abuts against the static pressure pad 10, the support block is used to protrude from the fixed plane A to contact the silicon wafer W. The support block is arranged on the side of the base 11 proximate to the silicon wafer W, that is, on the fixed plane A. The support block can be extended and retracted along the central axial direction under the drive of the driving module. When the plurality of static pressure blocks 12 hold the silicon wafer W, the support block retracts into the base 11 to prevent from adversely affecting the stability of the fluid used by the plurality of static pressure blocks 12, and fix the position of the silicon wafer W. At the same time, this also helps to reduce the adhesion of residue and/or debris to the end face of the support block. When the silicon wafer W needs to be unloaded, the support block extends out from the fixed plane A of the base 11 to contact the silicon wafer W. To ensure that the support block can contact the silicon wafer W before the plurality of static pressure blocks 12, the support block is configured such that, with the fixed plane A as a reference, the height by which the support block protruding from the fixed plane A is greater than the height of any of the plurality of static pressure blocks 12 protruding from the fixed plane A.

[0042] Optionally, to further enhance the contact stability between the support block and the silicon wafer W, a vacuum apparatus is connected to the end of the support block distal to the

silicon wafer W, and the end of the support block proximate to the silicon wafer W is provided with a plurality of suction holes. The support block holds the silicon wafer W by vacuum suction through the suction holes.

[0043] Optionally, the end of the support block that is adjacent to the silicon wafer W is made of rubber or other flexible materials, or is coated with the above materials to further avoid scratching the surface of the silicon wafer W.

[0044] An embodiment of the present application discloses a static pressure pad 10, which includes a base 11, a plurality of static pressure blocks 12, and a driving module. The end of each static pressure block 12 that is proximate to the wafer W is provided with a via hole T, and the via hole T is used to allow fluid to flow out to support the silicon wafer W in a non-contact manner. The driving module includes a driving unit for driving each static pressure block to move, and each static pressure block can move towards or away from the silicon wafer W under the drive of the driving unit. The static pressure pad 10 further includes a sensor and a controller. When the silicon wafer W tilts due to expected or unexpected reasons, it is characterized by an alter in the target plane C in which the silicon wafer W is located in space. The sensor is configured to sense the alter in the silicon wafer W to obtain the new spatial position of the target plane C. The controller sends a control signal to the driving module based on the new spatial position of the target plane C. The driving module drives the plurality of static pressure blocks 12 to move horizontally according to the control signal until the first plane B, formed by the end of each static pressure block, is parallel to the target plane C where the tilted silicon wafer W is located.

[0045] The static pressure pad 10 can dynamically adjust the gap between the static pressure pad 10 and the silicon wafer W in real time, ensuring that the static pressure pad 10 remains parallel to the silicon wafer W at all times. This ensures the stability of the grinding process and improves product quality. It should be noted that when is static pressure pad 10 in use, the static pressure pad 10 is positioned on both sides of the silicon wafer W to provide hydrostatic pressure to support the silicon wafer W. The static pressure pads 10 on both sides of the silicon wafer W follow the same adjustment principle, and the ultimate technical effect achieved is that the static pressure pad 10 remains parallel to the silicon wafer W.

[0046] Based on the above-mentioned static pressure pad 10, an embodiment of the present application further provides a grinding device for double-sided grinding of a silicon wafer W. The grinding device includes a carrier, a pair of grinding wheels, and a pair of the above-mentioned static pressure pads 10. The carrier is used to hold the silicon wafer W in a vertical direction; the pair of grinding wheels are symmetrically arranged on both sides of the silicon wafer W with respect to the carrier; and the pair of the above-mentioned static pressure pads 10 are

symmetrically arranged on both sides of the silicon wafer W with respect to the carrier. Specifically, referring to FIG. 4, the static pressure pad 10 is configured in a crescent shape, so as to allow the grinding wheels to be arranged in a circular cutout in the double-sided grinding device for the silicon wafer W. The pair of grinding wheels rotate about a common rotation axis to grind the two main surfaces of the silicon wafer W, which is held by the carrier and supported by the pair of static pressure pads 10. The grinding wheels can retract into the circular cutout of the static pressure pad when not in use.

[0047] Based on the above-mentioned grinding device, an embodiment of the present application further provides a silicon wafer W, which is obtained by using the above-mentioned grinding device.

[0048] It should be noted that the technical solutions described in the embodiments of the present application can be combined in any manner, as long as there is no conflict between them.

[0049] The above description is merely about specific embodiments of the present application, but the protection scope of the present application is not limited thereto. Any modifications or substitutions that can be readily conceived by those skilled in the art within the scope of the disclosed techniques of the present application shall fall within the protection scope of the present application. Therefore, the protection scope of the present application shall be subject to the protection scope defined by the claims.

What is claimed is:

1. A static pressure pad, wherein the static pressure pad is used for clamping, in pairs, both sides of each of silicon wafers in a double-sided grinding device for the silicon wafer, the static pressure pad comprises:

a base having a fixed plane facing the silicon wafer;

a plurality of static pressure blocks that is uniformly distributed along a vertical direction on the fixing plane and protrudes outward from the fixing plane, the plurality of static pressure blocks is configured to provide hydrostatic pressure to the silicon wafer through a fluid, to support one side of the silicon wafer in a non-contact manner;

a driving module, configured to drive, when a first plane formed by an end of each of the static pressure blocks is not parallel to a target plane where the silicon wafer is positioned, each of static pressure blocks to move in a direction perpendicular to the fixed plane, to allow the first plane to be parallel to the target plane.

2. The static pressure pad according to claim 1, wherein the static pressure pad further comprises a support block arranged on the fixed plane, the support block is configured to be movable in the direction perpendicular to the fixed plane to protrude from the fixed plane, and the support block is configured to allow a protrusion height of the support block relative to the fixed plane to be greater than a protrusion height of any one of the plurality of static pressure blocks.

3. The static pressure pad according to claim 2, wherein an end of the support block is provided with a plurality of suction holes, and the suction holes are configured to apply vacuum suction to the silicon wafer.

4. The static pressure pad according to claim 1 or 2, wherein the static pressure pad further comprises a sensor and a controller, the sensor is configured to detect a spatial position of the target plane, the controller is configured to transmit a control signal to the driving module based on the spatial position of the target plane, and the driving module is configured to drive the plurality of static pressure blocks to move according to the control signal, to allow the first plane to be parallel to the target plane.

5. The static pressure pad according to claim 4, wherein the sensor is a pressure sensor, and the pressure sensor is configured to detect a change of the hydrostatic pressure applied to the

silicon wafer, to obtain a spatial orientation of the silicon wafer.

6. The static pressure pad according to claim 4, wherein the sensor is a distance sensor, and the distance sensor is configured to measure a distance between the silicon wafer and the first plane, to obtain spatial orientation of the silicon wafer.

7. The static pressure pad according to claim 1 or 2, wherein the end of each of the static pressure block is provided with a plurality of via holes, and the via holes are configured to allow the fluid to flow out to support the silicon wafer in a non-contact manner.

8. The static pressure pad according to claim 1 or 2, wherein the driving module comprises a hydraulic driving unit or a pneumatic driving unit configured to drive the static pressure block to move.

9. A grinding device configured for double-sided grinding of a silicon wafer, the grinding device comprising:

a carrier for supporting the silicon wafer in a vertical direction;

two grinding wheels symmetrically arranged with respect to the carrier; and

two static pressure pads that are according to any one of claims 1 to 8 and symmetrically arranged with respect to the carrier.

10. A silicon wafer obtained by using the grinding device according to claim 9.