

SUBSTRATE CONTROL DEVICE AND SEMICONDUCTOR

REACTION CHAMBER

TECHNICAL FIELD

The present application relates to the field of semiconductors, in particular to a substrate control device and a semiconductor reaction chamber.

BACKGROUND

Amid the rapid development of the global science and technology industry, the importance of chip manufacturing technology keeps increasing. As the carrier for chip manufacturing, semiconductor apparatuses serve as the fundamental support for manufacturing advanced chips. Various apparatuses including semiconductor electroplating apparatuses involve lifting and rotational movement of substrates. However, existing substrate lifting and rotating devices are bulky and require relatively large footprints, and are therefore not suitable for deployment in space-constrained settings. Apparatuses such as electroplating apparatuses have constrained available space. Accordingly, it is critical to achieve high-precision lifting, lowering, and rotational movement in space-constrained settings.

SUMMARY

The technical problem to be solved by the present application is the relatively large volume of existing substrate lifting and rotating devices.

To solve the technical problem described above, the present application provides a substrate control device, comprising: a substrate supporting portion, a first driving portion, a second driving portion, and a bottom tray. Wherein, the substrate supporting portion is used to support a substrate; the first driving portion is disposed below the substrate supporting portion and used to drive the substrate supporting portion to rotate within the horizontal plane, and a hollow region is formed inside the first driving portion; the second driving portion includes a tubular portion and a rod portion, the tubular portion is disposed inside the hollow region, one end of the rod portion is disposed inside the tubular portion, the other end of the rod portion is fixedly mounted on the bottom tray, and the second driving portion is configured to drive the tubular

portion to lift and lower along the rod portion, so as to drive the substrate supporting portion and the first driving portion to lift and lower in the vertical direction.

The present application further proposes a semiconductor reaction chamber to solve the technical problem described above. The semiconductor reaction chamber comprises at least two process stations and the substrate control device described above, and the substrate control device is used to transfer a substrate to any one of the at least two process stations.

In the substrate control device of the present application, the substrate supporting portion, the first driving portion, and the second driving portion are sequentially stacked in the vertical direction, and the second driving portion and the first driving portion are sleeved with each other, thereby achieving a compact structure of the substrate control device and a smaller volume compared with existing designs. The relatively small footprint makes the device applicable to semiconductor apparatuses with constrained space. By arranging a lifting guide member on the bottom tray, the substrate control device of the present application achieves convenient installation without operations such as centering and simplifies installation. Besides, a plurality of sealing members are arranged in the substrate control device of the present application to form a sealed connection between components of the substrate control device as well as between the substrate control device and the semiconductor reaction chamber, preventing mutual interference between the substrate control device and the semiconductor reaction chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and performance of the present application will be further described with reference to the following embodiments and the accompanying drawings of the embodiments. The accompanying drawings are incorporated into the present application to provide further understanding of the present application, and the accompanying drawings show the embodiments of the present application, and together with the specification, serve to explain the principle of the present application. In the accompanying drawings:

FIG. 1 is a schematic perspective view of a substrate control device according to

an embodiment of the present application;

FIG. 2 is a side cross-sectional view of the substrate control device in the embodiment shown in FIG. 1;

FIG. 3 is a top schematic view of a semiconductor reaction chamber according to an embodiment of the present application;

FIG. 4 is another top schematic view of a semiconductor reaction chamber according to an embodiment of the present application.

PREFERRED EMBODIMENTS OF THE PRESENT APPLICATION

To further clarify the technical solutions of the embodiments of the present application, a brief introduction to the accompanying drawings required in the description of the embodiments is provided hereinafter. Obviously, the accompanying drawings described below are only some examples or embodiments of the present application, and those of ordinary skill in the art can also apply the present application to other similar scenarios based on these accompanying drawings without making creative efforts. Unless apparent from the context or otherwise specified, identical reference numerals in the drawings denote identical structures or operations.

As shown in the present application, words such as "a/an," "one," and/or "the" are not limited to singular meanings and may also cover plural connotations unless the context dictates otherwise. Generally speaking, the terms "comprise" and "include" are used merely to indicate the inclusion of the steps and elements that have been explicitly identified, these steps and elements do not constitute an exclusive list, and a method or an apparatus may also comprise other steps or elements.

Unless specifically stated otherwise, the relative arrangement of components and steps, numerical expressions, and numerical values set forth in these embodiments do not limit the scope of the present application. Meanwhile, it should be understood that, for ease of description, the dimensions of various parts shown in the accompanying drawings are not drawn to actual scale. Techniques, methods, and apparatuses known to those of ordinary skill in the relevant art may not be discussed in detail, but where appropriate, such techniques, methods, and apparatuses shall be regarded as part of the

authorized specification. In all examples shown and discussed herein, any specific value should be interpreted as merely illustrative, rather than limiting. Accordingly, other examples of the exemplary embodiments may have different values. It should be noted that similar reference numerals and letters denote similar items in the following accompanying drawings, and therefore, once an item is defined in one accompanying drawing, further discussion of the item is not required in subsequent accompanying drawings.

In the description of the present application, it should be understood that directional terms such as "front, rear, upper, lower, left, right," "lateral, vertical, perpendicular, horizontal," and "top, bottom" generally refer to the orientations or positional relationships shown in the accompanying drawings, and are merely for ease of describing the present application and simplifying the description. Unless stated to the contrary, these directional terms do not indicate or imply that the referred device or element must have a specific orientation or be constructed and operated in a specific orientation, and thus should not be construed as limiting the scope of protection of the present application. The directional terms "inner" and "outer" refer to the interior and exterior relative to the contour of each component itself.

For ease of description, spatial relative terms such as "above," "over," "on the upper surface," "upper," and the like may be used herein to describe the spatial positional relationship of one device or feature shown in the drawings relative to other devices or features. It should be understood that the spatial relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the drawings. For example, if a device in the accompanying drawings is inverted, the device described as being "above" or "over" another device or structure will then be positioned "below" or "under" another device or structure. Thus, the exemplary term "above" may encompass both "above" and "below" orientations. The device may also be otherwise oriented (rotated 90 degrees or in other orientations), and the spatial relative description used herein should be interpreted accordingly.

Furthermore, it should be noted that the use of terms such as "first," "second," and the like to define components is merely for the purpose of distinguishing the corresponding components from one another. Unless otherwise stated, these terms

carry no special meaning and thus should not be construed as limiting the scope of protection of the present application. Moreover, although the terms used in the present application are selected from commonly known and publicly used terms, some terms mentioned in the specification of the present application may have been selected by the applicant at his or her own discretion, with the detailed meanings of the terms being explained in relevant parts of the description herein. Furthermore, the present application should be understood not only by the actual terms used, but also by the meaning embodied in each term.

The substrate control device of the present application is mainly used to support substrates and drive substrates to lift, lower, and rotate, and the device is applicable to all scenarios requiring the control of substrate lifting, lowering, and rotation, including but not limited to annealing devices in semiconductor electroplating apparatuses.

FIG. 1 is a schematic perspective view of a substrate control device according to an embodiment of the present application. FIG. 2 is a side cross-sectional view of the substrate control device in the embodiment shown in FIG. 1. As shown in FIG. 1 and FIG. 2, the substrate control device 100 according to the embodiment comprises a substrate supporting portion 110, a first driving portion 120, a second driving portion 130, and a bottom tray 140. Wherein, the substrate supporting portion 110 is used to support substrates W. As shown in FIG. 1, a substrate W is supported by the substrate supporting portion 110. In this example, the substrate supporting portion 110 is a flat robot including a small end 111 and a large end 112; the shape and size of the large end 112 match the substrate W, and a plurality of support rods are included for the placement of the substrate W. The small end 111 is connected to the lifting and rotating mechanism of the substrate control device 100, and when the small end 111 lifts, lowers, or rotates, the large end 112 and the substrate W can be driven to lift, lower, and rotate.

The first driving portion 120 is disposed below the substrate supporting portion 110 to drive the substrate supporting portion 110 to rotate within the horizontal plane, and a hollow region is formed inside the first driving portion 110. The second driving portion 130 includes a tubular portion 131 and a rod portion 132, the tubular portion 131 is disposed inside the hollow region, one end of the rod portion 132 is disposed inside the tubular portion 131, and the other end of the rod portion 132 is fixedly mounted on the bottom tray 140. The second driving portion 130 is configured to drive

the tubular portion 131 to lift and lower along the rod portion 132, so as to drive the substrate supporting portion 110 and the first driving portion 120 to lift and lower in the vertical direction D.

As shown in FIG. 2, the figure shows the assembled state of the substrate control device 100. Therefore, the space where the tubular portion 131 of the second driving portion 130 is located is the hollow region inside the first driving portion 110, and a gap can be reserved between the tubular portion 131 and the first driving portion 120.

In some embodiments, the substrate supporting portion 110 can be directly fixed on the first driving portion 120 via the small end 111 of the substrate supporting portion 110, so that when the first driving portion 120 rotates, the substrate supporting portion 110 can be driven to rotate. The tubular portion 131 of the second driving portion 130 is fixedly connected to the first driving portion 120, and when the second driving portion 130 drives the tubular portion 131 to lift and lower along the rod portion 132, the tubular portion 131 drives the first driving portion 120 to lift and lower together, thereby driving the substrate supporting portion 110 and the substrate W to lift and lower together.

In the substrate control device 100 of the present application, the substrate supporting portion 110, the first driving portion 120, and the second driving portion 130 are sequentially stacked in the vertical direction D, and the second driving portion 130 and the first driving portion 120 are sleeved with each other, thereby achieving a compact structure of the substrate control device 100 and a smaller volume compared with existing designs. The relatively small footprint makes the device applicable to semiconductor apparatuses with constrained space.

Specifically, in some embodiments, the substrate control device 100 further comprises an inner sleeve 150 and an outer sleeve 160, the outer sleeve 160 is sleeved around the outer periphery of the inner sleeve 150, and a lower end 161 of the outer sleeve 160 is fixedly mounted on the bottom tray 140. A sealed connection is formed between the inner sleeve 150 and the outer sleeve 160. The inner sleeve 150 includes a bottom wall 151 and a cylindrical wall 152, the upper surface of the bottom wall 151 is connected to the substrate supporting portion 110, and the lower surface of the bottom wall 151 is connected to the first driving portion 120; the cylindrical wall 152

is located between the outer periphery of the first driving portion 120 and the outer sleeve 160.

As shown in FIG.1 and FIG.2, both the inner sleeve 150 and the outer sleeve 160 can be embodied as cylinders, and can be other shapes in other embodiments. The bottom wall 151 and the cylindrical wall 152 of the inner sleeve 150 can either be separately manufactured and then connected or integrally formed. The lower end 161 of the outer sleeve 160 can be mounted onto the bottom tray 140 via adhesive bonding, welding, or screw connection, so that the outer sleeve 160 and the bottom tray 140 together define a cylindrical shape. As shown in FIG. 2, the inner sleeve 150 and the outer sleeve 160 are sleeved with each other, and the relative position of the inner sleeve 150 and the outer sleeve 160 can be changed in the vertical direction D. In addition, when the second driving portion 130 lifts and lowers, a sealed connection is retained between the inner sleeve 150 and the outer sleeve 160, and the inner sleeve 150 and the outer sleeve 160 will not be separated.

Since the lower surface of the bottom wall 151 is connected to the first driving portion 120, when the first driving portion 120 rotates, the inner sleeve 150 is driven to rotate simultaneously. Specifically, a plurality of screws 113 shown in FIG. 1 can be used to fixedly connect the substrate supporting portion 110, the bottom wall 151, and the rotating component of the first driving portion 120.

According to these embodiments, a sealed connection is formed between the inner sleeve 150 and the outer sleeve 160, and the first driving portion 120 and the second driving portion 130 are disposed inside a sealed space to prevent communication between the sealed space and the external environment. When the substrate control device 100 is disposed inside a semiconductor reaction chamber, such a sealed connection prevents gas or liquid inside the reaction chamber from entering the interior of the substrate control device 100, which can otherwise cause corrosion or device aging.

No restriction is imposed on the sealed connection between the inner sleeve 150 and the outer sleeve 160 in the present application. As shown in FIG. 2, in some embodiments, a first sealing member 171 is disposed between the cylindrical wall 152 and the inner wall of the outer sleeve 160 to achieve a sealed connection between the

inner sleeve 150 and the outer sleeve 160. Specifically, the first sealing member 171 can be a sealing ring. More specifically, an accommodating groove for the first sealing member 171 can be provided on the cylindrical wall 152 for accommodating the first sealing member 171. In other embodiments, the first sealing member 171 can be a multi-layer sealing ring, spring-energized sealing ring, magnetic fluid sealing ring, or a plurality of separately disposed sealing members.

In some embodiments, the second driving portion 130 is a pneumatic cylinder; one end of the rod portion 132 is a piston portion 134 disposed inside the tubular portion 131 to divide the interior of the tubular portion 131 into an upper space 135 and a lower space 136. The rod portion 132 includes a first gas passage 137 and a second gas passage 138, wherein the first gas passage 137 is in communication with the upper space 135 and the second gas passage 138 is in communication with the lower space 136. Specifically, the second driving portion 130 further includes a first gas inlet 211 and a second gas inlet 212 for supplying gas into the first gas passage 137 and second gas passage 138, respectively. When a lifting movement is required, gas is supplied to the first gas inlet 211 from a gas source, and the gas flows into the upper space 135 through the first gas passage 137 to expand the upper space 135 and contract the lower space 136, pushing the tubular portion 131 to lift and thereby driving the first driving portion 120 and substrate supporting portion 110 to lift. When a lowering movement is required, gas is supplied to the second gas inlet 212 from the gas source, and the gas flows into the lower space 136 through the second gas passage 138 to expand the lower space 136 and contract the upper space 135, pushing the tubular portion 131 to lower and thereby driving the first driving portion 120 and the substrate supporting portion 110 to lower.

When the second driving portion 130 is a pneumatic cylinder, since the connection to an external gas source is involved, and the pneumatic cylinder involves processes such as gas inflation and deflation during control, gas leakage may occur inside the enclosed space by the inner sleeve 150 and the outer sleeve 160. Therefore, the sealed connection between the inner sleeve 150 and the outer sleeve 160 can prevent the leaked gas from entering the semiconductor reaction chamber, which can otherwise affect the processes of the substrate.

In some embodiments, the first driving portion 120 includes a stator 121 and a

rotor 122, the rotor 122 is disposed around the outer periphery of the tubular portion 131, the stator 121 is disposed around the outer periphery of the rotor 122, and the upper surface of the rotor 122 is fixedly connected to the lower surface of the bottom wall 151 to drive the inner sleeve 150 and the substrate supporting portion 110 to rotate. According to these embodiments, a hollow region is reserved at the middle portion of the rotor 122 for disposing the tubular portion 131.

In some embodiments, the first driving portion 120 is specifically a direct drive-motor (DD-motor). The encoder of the DD-motor can control the rotation angle, and the speed of the motor is uniform, achieving high-precision control.

In some embodiments, the substrate control device 100 further comprises an intermediate connecting plate 180 fixedly connected to both the tubular portion 131 and the stator 121 to allow the tubular portion 131 to drive the first driving portion 120 to lift and lower in the vertical direction. Specifically, the intermediate connecting plate 180 can be a flat plate, with a screw 181 disposed in the circumferential direction of the intermediate connecting plate 180. The lower surface of the stator 121 is provided with a threaded hole corresponding to the screw 181. The stator 121 and the intermediate connecting plate 180 can be fixedly connected via the screw. A through-hole is further provided at the middle portion of the intermediate connecting plate 180 to enable the insertion of the tubular portion 131 and the penetration of the rod portion 132. With a stepped structure provided inside the through-hole, in combination with the upper surface of the intermediate connecting plate 180, the intermediate connecting plate 180 can support the tubular portion 131 and maintain a relatively fixed positional relationship with the tubular portion 131, and the diameter of the portion of the through-hole near the lower surface in the intermediate connecting plate 180 matches the rod portion 132 to enable the vertical lifting and lowering of the intermediate connecting plate 180 relative to the rod portion 132. By providing the intermediate connecting plate 180, the stator 121 can lift and lower in a horizontal and stable manner.

In some embodiments, the substrate control device 100 further comprises at least one lifting guide member 220. In the embodiment shown in FIG. 2, two lifting guide members 220 are disposed between the intermediate connecting plate 180 and the bottom tray 140 in the vertical direction D. When the tubular portion 131 lifts and lowers in the vertical direction D, the lifting guide members 220 lift and lower

synchronously with the tubular portion 131. In a preferred embodiment, three lifting guide members 220 are uniformly disposed around the rod portion 132 to assist the stable vertical lifting and lowering of the first driving portion 120, the second driving portion 130, and the substrate supporting portion 110 in the vertical direction when the tubular portion 131 lifts and lowers.

In the embodiment shown in FIG. 2, each lifting guide member 220 includes a linear bearing 221 and a guide shaft 222, wherein one end of the linear bearing 221 is fixedly mounted on the bottom tray 140, and the guide shaft 222 is vertically movably disposed inside the linear bearing 221. One end of the guide shaft 222 (upper end in FIG. 2) is fixedly disposed on the intermediate connecting plate 180. Wherein, the upper end of the guide shaft 222 may be provided with a threaded hole, embedded into the intermediate connecting plate 180, and fastened by a screw.

In the present application, by providing the lifting guide member 220 on the bottom tray 140, unified levelness of the plurality of lifting guide members 220 can be ensured merely by adjusting the levelness of the bottom tray 140, featuring convenient installation and simplified leveling, while lowering fit and tolerance requirements for components and reducing the processing cost.

In some embodiments, the substrate control device 100 further comprises a guide member 172 disposed between the cylindrical wall 152 and the outer sleeve 160, the guide member 172 lifts and lowers synchronously with the inner sleeve 150 when the inner sleeve 150 lifts and lowers, and the guide member 172 maintains frictional contact with the inner wall of the outer sleeve 160 during lifting and lowering. The guide member 172 can be specifically embodied as a guide ring sleeved on the periphery of the cylindrical wall 152 of the inner sleeve 150 to prevent lateral movement of the inner sleeve 150 when the inner sleeve 150 lifts, lowers, and rotates, maintain horizontality of the inner sleeve 150, and further guarantee horizontal stability of the substrate W when the substrate W lifts, lowers, and rotates. Accordingly, an accommodating groove can be provided on the cylindrical wall 152 for accommodating the guide member 172.

As shown in FIG. 2, in some embodiments, the outer sleeve 160 further includes a radially extending flange 162, and the substrate control device 100 further comprises

a second sealing member 173 disposed on the lower surface of the flange 162 and/or the outer wall of the outer sleeve 160. When the outer sleeve 160 is disposed inside a semiconductor reaction chamber, the flange 162 is used to mate with the semiconductor reaction chamber, and the second sealing member 173 is used to form a seal between the outer sleeve 160 and the semiconductor reaction chamber. Wherein, the second sealing member 173 is disposed at the lower surface of the flange 162 and the outer wall of the outer sleeve 160, that is, the second sealing member 173 is disposed at the angular intersection between the lower surface of the flange 162 and the outer wall of the outer sleeve 160, and the second sealing member 173 can contact both the lower surface of the flange 162 and the outer wall of the outer sleeve 160 simultaneously. Correspondingly, an accommodating groove adapted to the second sealing member 173 can be provided on the lower surface of the flange 162 and/or the outer wall of the outer sleeve 160.

In the embodiment shown in FIG. 2, the second sealing member 173 is also a sealing ring and can alternatively include a plurality of separated sealing members in other embodiments.

In some embodiments, both the first sealing member 171 and the second sealing member 173 are made of flexible materials.

FIG. 3 is a top schematic view of a semiconductor reaction chamber according to an embodiment of the present application. The semiconductor reaction chamber 300 comprises at least two process stations. As shown in FIG. 3, two process stations are denoted as P1 and P2. It can be understood that an accommodating chamber is disposed inside the semiconductor reaction chamber 300, and the substrate control device 100 can be disposed in the accommodating chamber, mate with the accommodating chamber via the flange 162, and be sealed with the accommodating chamber via the second sealing member 173, thereby forming a seal between the substrate control device 100 and the semiconductor reaction chamber 300.

In some embodiments, the semiconductor reaction chamber 300 is an annealing chamber comprising a cold plate 301 arranged at the process station P1 and a hot plate 302 arranged at the process station P2. FIG.3 shows a state where the substrate supporting portion 110 is located at the cold plate 301, and FIG.4 shows a state where

the substrate supporting portion 110 is located at the hot plate 302.

The movement sequence of the substrate control device 100 inside the semiconductor reaction chamber is explained below with reference to FIG.3 and FIG.4. Assuming that FIG.3 is the initial state: The DD-motor rotates and drives the robot of the substrate supporting portion 110 to rotate rightward to the cold plate 301 at P1, and the pneumatic cylinder lowers and drives the robot to lower. An external robot delivers the substrate W into the chamber through an entrance 310 and places the substrate W onto the cold plate 301, the pneumatic cylinder lifts and drives the robot to lift, the DD-motor rotates and drives the robot to rotate leftward to the hot plate 302, and the robot is then driven to lower and places the substrate W onto the hot plate 302, as shown in FIG.4. After completion of an annealing process, the pneumatic cylinder lifts and drives the robot to lift and pick up the substrate W, the DD-motor rotates and drives the robot to rotate rightward to the initial position at the cold plate 301, as shown in FIG.3, and the pneumatic cylinder then lowers and drives the robot to lower to place the substrate W onto the cold plate 301, waiting for an external robot to pick up the substrate.

The basic principles have been described above. It will be apparent to those skilled in the art that the present disclosure is merely exemplary and does not constitute a limitation on the present application. Although not explicitly illustrated herein, those skilled in the art may make various modifications, improvements, and corrections to the present application. Such modifications, improvements, and corrections are proposed by the present application, and therefore shall still fall within the spirit and scope of the exemplary embodiments of the present application.

Also, specific terms are used in the present application to describe the embodiments of the present application. For example, "one embodiment," "an embodiment," and/or "some embodiments" refer to a feature, structure, or characteristic related to at least one embodiment of the present application. Therefore, it should be emphasized and noted that "an embodiment," "one embodiment," or "an alternative embodiment" mentioned twice or more at different locations in the present specification do not necessarily refer to the same embodiment. Furthermore, certain features, structures, or characteristics in one or more embodiments of the present application may be appropriately combined.

Similarly, it should be noted that, in order to simplify the description of the disclosure of the present application and thereby facilitate understanding of one or more embodiments of the present invention, the foregoing description of the embodiments of the present application sometimes merges a plurality of features into a single embodiment, accompanying drawing, or description thereof. However, this disclosure method does not mean that the subject matter of the present application requires more features than the features mentioned in the claims. In fact, the features of the embodiments are fewer than all the features of a single embodiment disclosed above.

In some embodiments, numbers describing quantities of components and properties are used. It should be understood that such numbers used in the description of the embodiments are modified by modifiers such as "about," "approximately," or "substantially" in some examples. Unless otherwise stated, "about," "approximately," or "substantially" indicates that the stated numbers allow for a variation of $\pm 20\%$. Accordingly, in some embodiments, the numerical parameters used in the present application are all approximate values, and the approximate values may vary depending on the characteristics required by individual embodiments. In some embodiments, numerical parameters should take into account specified significant figures and employ a standard rounding method. Although the numerical ranges and parameters used in some embodiments of the present application to define the scope of the present application are approximate values, in specific embodiments, the setting of such numerical values is as precise as possible within the feasible range.

What is claimed is:

1. A substrate control device, comprising:

a substrate supporting portion, a first driving portion, a second driving portion, and a bottom tray,

wherein, the substrate supporting portion is used to support a substrate; the first driving portion is disposed below the substrate supporting portion and used to drive the substrate supporting portion to rotate within the horizontal plane, and a hollow region is formed inside the first driving portion; the second driving portion includes a tubular portion and a rod portion, the tubular portion is disposed inside the hollow region, one end of the rod portion is disposed inside the tubular portion, the other end of the rod portion is fixedly mounted on the bottom tray, and the second driving portion is configured to drive the tubular portion to lift and lower along the rod portion, so as to drive the substrate supporting portion and the first driving portion to lift and lower in the vertical direction.

2. The substrate control device according to claim 1, wherein the substrate control device further comprises an inner sleeve and an outer sleeve, the outer sleeve is sleeved around the outer periphery of the inner sleeve, a lower end of the outer sleeve is fixedly mounted on the bottom tray, a sealed connection is formed between the inner sleeve and the outer sleeve, the inner sleeve includes a bottom wall and a cylindrical wall, the upper surface of the bottom wall is connected to the substrate supporting portion, and the lower surface of the bottom wall is connected to the first driving portion; the cylindrical wall is located between the outer periphery of the first driving portion and the outer sleeve.

3. The substrate control device according to claim 2, wherein the substrate control device further comprises a first sealing member disposed between the cylindrical wall and the outer sleeve.

4. The substrate control device according to claim 3, wherein the outer sleeve further includes a radially extending flange, and the substrate control device further comprises a second sealing member disposed on the lower surface of the flange and/or

the outer wall of the outer sleeve, when the outer sleeve is disposed inside a semiconductor reaction chamber, the flange is used to mate with the semiconductor reaction chamber, and the second sealing member is used to form a seal between the outer sleeve and the semiconductor reaction chamber.

5. The substrate control device according to claim 3, wherein the first sealing member includes a combination of one or more of a multi-layer sealing ring, spring-energized sealing ring, and magnetic fluid sealing member.

6. The substrate control device according to claim 2, wherein the substrate control device further comprises a guide member disposed between the cylindrical wall and the outer sleeve, the guide member lifts and lowers synchronously with the inner sleeve when the inner sleeve lifts and lowers, and the guide member maintains frictional contact with the inner wall of the outer sleeve during lifting and lowering.

7. The substrate control device according to claim 2, wherein the first driving portion includes a stator and a rotor, the rotor is disposed around the outer periphery of the tubular portion, the stator is disposed around the outer periphery of the rotor, and the upper surface of the rotor is fixedly connected to the lower surface of the bottom wall.

8. The substrate control device according to claim 7, wherein the substrate control device further comprises an intermediate connecting plate fixedly connected to both the tubular portion and the stator to allow the tubular portion to drive the first driving portion to lift and lower in the vertical direction.

9. The substrate control device according to claim 8, wherein the substrate control device further comprises at least one lifting guide member disposed between the intermediate connecting plate and the bottom tray in the vertical direction, and when the tubular portion lifts and lowers in the vertical direction, the lifting guide member lifts and lowers synchronously with the tubular portion.

10. The substrate control device according to claim 9, wherein the lifting guide member includes a linear bearing and a guide shaft, one end of the linear bearing is fixedly mounted on the bottom tray, the guide shaft is vertically movably disposed

inside the linear bearing, and one end of the guide shaft is fixedly disposed on the intermediate connecting plate.

11. The substrate control device according to claim 1, wherein the second driving portion is a pneumatic cylinder, one end of the rod portion is a piston portion disposed inside the tubular portion to divide the interior of the tubular portion into an upper space and a lower space, the rod portion includes a first gas passage and a second gas passage, and the first gas passage is in communication with the upper space and the second gas passage is in communication with the lower space.

12. A semiconductor reaction chamber, comprising at least two process stations, wherein the semiconductor reaction chamber comprises the substrate control device according to any one of claims 1 to 11, and the substrate control device is used to transfer a substrate to any one of the at least two process stations.