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D E S C R I P T I O N

PORT STRUCTURE IN SEMICONDUCTOR PROCESSING APPARATUS

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Technical Field

The present invention relates to a port structure for transferring a target substrate therethrough into and from a semiconductor processing apparatus. The term "semiconductor process" used herein includes various kinds of processes which are performed to manufacture a semiconductor device or a structure having wiring layers, electrodes, and the like to be connected to a semiconductor device, on a target substrate, such as a semiconductor wafer or an LCD substrate, by forming semiconductor layers, insulating layers, and conductive layers in predetermined patterns on the target substrate.

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Background Art

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A vertical heat-processing apparatus is one of semiconductor processing apparatuses, for subjecting a number of semiconductor wafers, as a batch, to a heat process. The vertical heat-processing apparatus includes a partition wall with a port for transferring target wafers therethrough, disposed to separate an exterior area and an interior area of the apparatus from each other. Typically, the exterior area is an I/O area on the atmospheric pressure side, to and



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from which a carrier container that stores a plurality of wafers is transferred by an automatic transfer robot or operator. On the other hand, the interior area is a loading area where wafers are transferred between
5 the carrier container and a wafer boat or substrate holder, which is loaded and unloaded to and from the heat-processing furnace.

In this vertical heat-processing apparatus, it is necessary to set the loading area to have a cleaner
10 atmosphere than the I/O area, and to prevent a natural oxide film from being generated on the wafers. It is also necessary to suppress particle contamination of the wafers. Accordingly, it is preferable to separate the I/O area and loading area from each other by
15 a partition wall, and to fill the loading area with a clean gas, such as nitrogen (N_2) gas, thereby forming a clean gas atmosphere. It is also preferable to use an airtight type carrier container (also called a closed type carrier container) for transferring wafers, which
20 includes a lid airtightly closing the front mouth (wafer transfer port).

FIG. 10 is a view showing a state where an airtight type carrier container is mounted on a port of a partition wall, as that described above, in
25 a conventional vertical heat-processing apparatus. The partition wall 4 separates an I/O area S1 and a loading area S2 from each other. The port 11 is formed in the

partition wall 4, and is opened and closed by a door 12. A mount table 13 for placing a carrier container 2 thereon is disposed in the I/O area S1. The door 12 is provided with an attaching/detaching device 14 for attaching and detaching the lid 21 of the carrier container 2 to and from the carrier container 2.

The carrier container 2 is mounted on the mount table 13, and the mount table 13 is then moved forward until the front edge of the carrier container 2 comes into contact with the lip of the port 11 (i.e., the edge of the partition wall 4 defining the port 11). Then, while the door 12 is kept closed, the lid 21 is detached from the carrier container 2 by the attaching/detaching device 14. Then, the atmosphere inside the carrier container 2 is replaced with nitrogen gas by replacing means (not shown). Then, the door 12 is withdrawn along with the lid 21 from the port 11. Consequently, a state is established where wafers W stored in the carrier container 2 can be transferred into the loading area S2. According to this handling method, the oxygen concentration within the loading area S2 is advantageously prevented from raising. Jpn. Pat. Appln. KOKAI Publication No. 11-274267 discloses a technique of this kind.

On the other hand, as wafers increase the size, carrier containers need to have a larger internal volume. Accordingly, when the atmosphere inside the

carrier container 2 is replaced with nitrogen gas, the flow rate of supplied nitrogen gas is preferably set higher so as not to reduce the throughput. However, if nitrogen gas is supplied into the carrier container 2 at a high flow rate, the internal pressure of the carrier container 2 increases, and the carrier container 2 may be vibrated by this impact. In this case, portions on the bottom of the carrier container 2 in contact with the mount table may separate from the mount table (rattling), and the airtightness between the carrier container 2 and partition wall 4 is deteriorated. As a consequence, the atmosphere inside the carrier container 2 is not sufficiently replaced, and then flows into the loading area S2, thereby affecting the atmosphere inside the loading area S2. For example, oxygen, moisture, organic components or the like may flow into the loading area S2. Furthermore, wafers W may be positionally shifted within the carrier container 2, thereby causing transfer errors thereafter.

Disclosure of Invention

An object of the present invention is to ensure a stable mounted state of a carrier container, in a port structure for transferring target substrates therethrough to and from a semiconductor processing apparatus.

According to an aspect of the present invention,

there is provided a port structure for transferring a target substrate therethrough into and from a semiconductor processing apparatus, the port structure comprising:

5 a partition wall that separates an exterior area and an interior area of the apparatus from each other, and has a port for transferring the target substrate therethrough;

a door disposed on the partition wall and
10 configured to open and close the port;

a mount portion disposed in the exterior area in front of the port, the mount portion being configured to mount thereon a carrier container with its mouth facing the port, the carrier container being configured
15 to store a plurality of target substrates stacked at intervals;

a pressing member disposed above the mount portion, and configured to press down the carrier container against the mount portion; and

20 a driving portion configured to move the pressing member between a lower position to engage with the carrier container and an upper position not to interfere with transfer of the carrier container.

The port structure may further comprise a gas
25 supply section and a gas exhaust section respectively configured to supply and exhaust a clean gas to and from the carrier container, when the mouth of the

carrier container is in contact with the port.

The port structure may further comprise a control section configured to control the door, the gas supply section, and the gas exhaust section, wherein the control section causes the gas supply section and the gas exhaust section to replace an atmosphere inside the carrier container with the clean gas, when the door is closed.

Brief Description of Drawings

FIG. 1 is a perspective view schematically showing a vertical heat-processing apparatus according to an embodiment of the present invention;

FIG. 2 is a sectional side view schematically showing the interior of the vertical heat-processing apparatus shown in FIG. 1;

FIG. 3 is a sectional plan view schematically showing the interior of the vertical heat-processing apparatus shown in FIG. 1;

FIG. 4 is a perspective view showing an example of an airtight type carrier container;

FIG. 5 is a sectional view showing a port of a partition wall and portions around it, in the vertical heat-processing apparatus shown in FIG. 1;

FIG. 6 is a sectional view showing a state where an engaging member provided at a mount table engages with the bottom of the carrier container, in the vertical heat-processing apparatus shown in FIG. 1;

FIG. 7 is a perspective view showing a pressing mechanism employed in the vertical heat-processing apparatus shown in FIG. 1;

5 FIGS. 8A and 8B are a sectional side view and a sectional plan view, respectively, showing a state where the carrier container is mounted on a port of a partition wall, in the vertical heat-processing apparatus shown in FIG. 1;

10 FIGS. 9A and 9B are views for explaining other examples of a pressing mechanism; and

FIG. 10 is a sectional side view showing a state where a carrier container is mounted on a port of a partition wall, in a conventional vertical heat-processing apparatus.

15 Best Mode for Carrying Out the Invention

Embodiments of the present invention will be described hereinafter with reference to the accompanying drawings. In the following description, the constituent elements having substantially the same function and arrangement are denoted by the same reference numerals, and a repetitive description will be made only when necessary.

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FIG. 1 is a perspective view schematically showing a vertical heat-processing apparatus according to an embodiment of the present invention. FIGS. 2 and 3 are a sectional side view and a sectional plan view, each schematically showing the interior of the vertical

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heat-processing apparatus shown in FIG. 1.

As shown in FIGS. 1 to 3, this vertical heat-processing apparatus includes a casing 3, which defines the outer hull of the apparatus. The casing 3 contains
5 an I/O area (exterior area) S1 and a loading area (interior area) S2. The I/O area S1 is used as an area to and from which a carrier container 2 that stores a plurality of wafers (target substrates) is transferred by an automatic transfer robot or operator.
10 The loading area S2 is used as an area where wafers are transferred between the carrier container 2 and a wafer boat or substrate holder 92, which is loaded and unloaded to and from the heat-processing furnace.

A partition wall 4 is disposed to separate the I/O
15 area S1 and loading area S2 from each other. A port 41 is formed in the partition wall 4, and is opened and closed by a door 43. The I/O area S1 is set to have an atmospheric pressure atmosphere (the atmosphere inside a clean room). The loading area S2 is set to
20 have an inactive gas atmosphere, such as a nitrogen (N_2) gas atmosphere, or a clean and dry gas atmosphere (air containing few particles and organic components, and having a dew point of $-60^{\circ}C$ or less).

FIG. 4 is a perspective view showing an example
25 of an airtight type carrier container. The carrier container 2 is an airtight container made of, e.g., a resin with a front mouth (wafer transfer port) 20

opened and closed by a lid 21. The carrier container 2 can store a plurality of, e.g., 25, wafers W with a diameter of, e.g., 300 mm, in a state where they are stacked at intervals. The carrier container 2 is
5 provided with a rectangular flange 22 fixed on the top with a gap therebetween. A circular recess 23 is formed at the center of the flange 22.

The lid 21 of the carrier container 2 is provided with a latch mechanism (not shown) to hold
10 the lid 21 on the mouth 20 of the carrier container 2. An attaching/detaching device described later is used to unfasten this latch mechanism, when the lid 21 needs to be removed from the mouth 20. The lid 21 has a keyhole 21a, in which the key of the attaching/
15 detaching device is inserted and rotated by about 90° to unfasten the latch mechanism.

The I/O area S1 comprises a first area 5 near the front side of the apparatus and a second area 6 on the deep side. The first area 5 has first mount tables 51
20 and 52 respectively disposed on the right and left sides, each configured to mount one carrier container 2 thereon. Each of the first mount tables 51 and 52 has a mount face, where pins (positioning members) 53 are disposed at, e.g., three positions, to fit in recesses
25 formed on the bottom of the carrier container 2, so as to position the carrier container 2 (see FIG. 1).

A U-shaped panel portion 54 is disposed to

surround the space above the first area 5, i.e., above the first mount tables 51 and 52. The space surrounded by the panel portion 54 is arranged such that the automatic transfer robot, which moves along the ceiling (not shown) of the clean room, can pass therethrough while supporting the carrier container 2 to transfer it to and from the first mount tables 51 and 52.

The second area 6 has second mount tables (mount portion) 61 and 62. Each of the second mount tables 61 and 62 has a mount face, where pins (positioning members) 63 are disposed at, e.g., three positions, to fit in recesses formed on the bottom of the carrier container 2 (see FIG. 1). When the carrier container 2 is positioned on the second mount table 61 (62) by the pins 63, the mouth 20 of the carrier container 2 faces and aligns with the port 41 of the partition wall 4.

FIG. 5 is a sectional view showing the port 41 of the partition wall 4 and portions around it, in the vertical heat-processing apparatus shown in FIG. 1.

FIG. 6 is a sectional view showing a state where an engaging member provided at the mount table 61 (62) engages with the bottom of the carrier container 2, in the vertical heat-processing apparatus shown in FIG. 1.

As shown in FIG. 5, each of the mount tables 61 and 62 is movable back and forth by a driving portion 63a, such as an air cylinder, between a position where the carrier container 2 is placed thereon by

a container transfer device described later, and a position where the carrier container 2 comes into contact with the portion around the port 41 of the partition wall 4. As shown in FIG. 6, each of the mount tables 61 and 62 is provided with a hook-shaped engaging member 60 configured to engage with an engagement recess 24 formed on the bottom of the carrier container 2. The engaging member 60 can swing about a horizontal axis by a driving portion 60a, between a position where it engages with the engagement recess 24, and a position where this engagement is undone.

On the other hand, a storage section 64 for storing carrier containers 2 is disposed above the second area. The storage section 64 has shelves of two levels and two rows, in this example. A container transfer device 65 is disposed in the second area 6 to transfer the carrier container 2 among the first mount tables 51 and 52, the second mount tables 61 and 62, and the storage section 64. The container transfer device 65 includes a guide 66 horizontally extending and movable up and down, and a mobile member 67 movable while being guided by the guide 66. An articulated arm 68 is connected to the mobile member 67, and is used to hold the flange 22 on the top of the carrier container 2, and transfer it in a horizontal direction.

FIGS. 8A and 8B are a sectional side view and

a sectional plan view, respectively, showing a state where the carrier container 2 is mounted on the port 41 of the partition wall 4, in the vertical heat-processing apparatus shown in FIG. 1.

5 When the second mount table 61 (62) is moved forward, the carrier container 2 mounted thereon comes into contact with the partition wall 4 while the mouth 20 aligns with the port 41. In this state, the lid 21 is detached from the carrier container 2, so the
10 interior of the carrier container 2 communicates with the loading area S2 through the port 41 of the partition wall 4. The edge of the port 41 on the I/O area S1 side is provided with a sealing member 42, which the carrier container 2 comes into contact
15 with (i.e., the edge of the mouth 20 of the carrier container 2 comes into contact with). The sealing member 42 works as a part of the partition wall 4 defining the opening of the port 41.

 A door 43 is disposed on the partition wall 4 on
20 the loading area S2 side, to open and close the port 41. The door 43 is recessed toward the loading area S2, so that a buffer space BS is formed between the door 43 and the mouth 20 of the carrier container 2, when the carrier container 2 is mounted on the port 41.
25 In the buffer space BS, the door 43 is provided with an attaching/detaching device 44 for attaching and detaching the lid 21 to and from carrier container 2.

The door 43 is driven by a door-driving portion (not shown). When the door 43 is opened, it retreats upward or downward along the partition wall 4, while supporting the lid 21 detached from the carrier container 2, to a position where it does not interfere with transfer of wafers W.

The buffer space BS is connected to a gas supply section GS and a gas exhaust section ES for supplying and exhausting a clean gas to and from the carrier container 2. Specifically, as shown in FIGS. 5, 8A and 8B, two porous filters 45 are disposed on a side edge of the port 41 of the partition wall 4 and connected to the gas supply section GS. An inactive gas, such as nitrogen gas, adopted as a clean gas is supplied into the buffer space BS through the filters 45. On the other hand, an exhaust passage 46 is disposed at the bottom of the port 41 and connected to the gas exhaust section ES. The exhaust passage 46 is laterally long in the front view, so that the gas is uniformly exhausted. As described later, the gas supply section GS and gas exhaust section ES are operated under the control of a control section, to replace the atmosphere inside the buffer space BS and carrier container 2 with the clean gas, in a state where the door 43 is closed and the lid 21 is removed from the carrier container 2.

Two pressing mechanisms 7 are disposed right and left on the I/O area S1 side of the partition wall 4,

each to press down the top of the carrier container 2 mounted on the second mount table 61 or 62. FIG. 7 is a perspective view showing one pressing mechanism 7 employed in the vertical heat-processing apparatus shown in FIG. 1.

The pressing mechanism 7 includes a rotary shaft 71 pivotally supported and horizontally extending along the partition wall 4, and a pressing member 72 fixed to the rotary shaft 71 at the proximal end. The pressing member 72 is formed of a reversed Y-shaped plate 73, whose two legs 73a and 73b are fixed to the rotary shaft 71. The head 74 of the plate 73 is provided with a circular projection 75 on a side that faces downward when the pressing member 72 is in a horizontal state. When the pressing member 72 is moved down to an almost horizontal state, the projection 75 engages with the circular recess 23 of the flange 22 disposed on the top of the carrier container 2.

Air cylinders 81a and 81b are disposed as driving sources of the pressing mechanism 7. The air cylinders 81a and 81b are attached on the partition wall 4 above the pressing member 72 on both sides thereof, such that their piston rods 80a and 80b vertically reciprocate. The bottom ends of the piston rods 80a and 80b are respectively provided with pivot support members 82a and 82b. The pivot support members 82a and 82b respectively pivotally support ends of actuation arms

83a and 83b. The other ends of the actuation arms 83a and 83b are pivotally connected to the opposite sides of the pressing member 72.

As a consequence, when the piston rods 80a and 80b are withdrawn by the air cylinders 81a and 81b, the pressing member 72 takes on a standing position along the partition wall 4 (upper position), as shown with chain lines. When the piston rods 80a and 80b are extended downward, the pressing member 72 takes on a lying-down position in an almost horizontal state (lower position), as shown with solid lines. At this lower position, the projection 75 is inserted into the recess 23 of the carrier container 2, and presses the carrier container 2 against the mount table 61 (62).

A program stored in the control section 8 (see FIG. 5) is used to control the door 43, attaching/detaching device 44, second mount table 61 (62), pressing member 72, gas supply section GS, gas exhaust section ES, and so forth. In summary, the control section 8 executes the following operation. Specifically, the carrier container 2 mounted on the second mount table 61 (62) is detected, and then the second mount table 61 (62) is moved to a position where the carrier container 2 comes into contact with the portion around the port 41 of the partition wall 4. Then, the air cylinders 81a and 81b of the pressing mechanism 7 are activated, so that the pressing member

72 presses the carrier container 2 against the second mount table 61 (62). Then, the attaching/detaching device 44 is activated, so that the lid 21 is detached from the carrier container 2. Then, while the door 43 is kept closed, the gas supply section GS and gas exhaust section ES are activated, so that the atmosphere inside the buffer space BS and carrier container 2 is replaced with a clean gas. Then, door 43 and lid 21 are withdrawn from the port 41. Consequently, wafers W stored in the carrier container 2 can be transferred to the loading area S2.

Returning back to FIGS. 2 and 3, an explanation will be given of the interior of the loading area S2. The loading area S2 includes therein a vertical heat-processing furnace 91 having a furnace port at the bottom, which is opened and closed by a lid 94. Below the vertical heat-processing furnace 91, the lid 94 supports a holder or wafer boat 92 mounted thereon, which is used for stacking and holding a number of wafers W at intervals. Furthermore, a thermal insulator portion 93 is disposed on the lid 94 between the wafer boat 92 and lid 94. The lid 94 is supported by an elevator mechanism 95, which is used for loading and unloading the wafer boat 92 to and from the heat-processing furnace 91.

A wafer transfer device 96 is disposed between the wafer boat 92 and the port 41 of the partition wall 4.

The wafer transfer device 96 is used to transfer wafers W between the wafer boat 92 and carrier container 2 mounted on the second mount table 61 or 62. The wafer transfer device 96 includes a mobile body 98, which is
5 movable along a guide mechanism 97 extending right and left, and rotatable about a vertical axis. The mobile body 98 has a plurality of, e.g., five, arms 99 movable back and forth.

Next, an explanation will be given of an operation
10 of the embodiment described above. The following operation is executed in accordance with a program stored in the control section 8 (see FIG. 5).

At first, a carrier container 2 is transferred downward through the inside of the panel portion 54
15 and is mounted on the first mount table 51 (52) by the automatic transfer robot (not shown), which can move along the ceiling of the clean room. Then, the carrier container 2 is transferred onto the second mount table 61 (62) by the container transfer device 65. There may
20 be a case where the carrier container 2 is transferred to the storage section 64 by the container transfer device 65 and temporarily stored therein, and then transferred to the second mount table 61 (62). After the carrier container 2 is mounted on the second mount
25 table 61 (62), the engaging member 60 first swings to engage with the engagement recess 24 formed at the bottom of the carrier container 2, as shown in FIG. 6.

Then, the second mount table 61 (62) is moved toward the partition wall 4, so that the edge of the mouth 20 of the carrier container 2 comes into close contact with the sealing member 42 disposed around the port 41 of the partition wall 4.

Then, the piston rods 80a and 80b are extended downward by the air cylinders 81a and 81b of the pressing mechanism 7, and the actuation arms 83a and 83b are moved down while being restricted by the pressing member 72. By doing so, the pressing member 72 swings about the rotary shaft 71 and assumes a horizontal state. As a consequence, as shown in FIG. 8A, the projection 75 of the pressing member 72 is inserted into the recess 23 of the flange 22 of the carrier container 2, and presses the carrier container 2 against the second mount table 61 (62). Then, the key (not shown) of the attaching/detaching device 44 is inserted into the keyhole 21a (see FIG. 4) of the lid 21 of the carrier container 2, and rotated by about 90°. Then, the lid 21 is detached from the carrier container 2 (the state shown in FIGS. 8A and 8B).

Then, a clean gas, such as nitrogen gas, is horizontally blown from the porous filter 45 toward the interior of the carrier container 2 at a flow rate of, e.g., 50 to 200 l/min. This nitrogen gas flows between wafers W and along the inner wall of the carrier container 2, and then returns toward the mouth 20 and

exhausted through the exhaust passage 46 on the bottom side. As a consequence, the atmosphere in the carrier container 2 and the buffer space BS between the carrier container 2 and door 43 is replaced with the nitrogen gas. At this time, since the nitrogen gas is supplied into the carrier container 2 at a high flow rate, the pressure in the carrier container 2 increases, and the carrier container 2 receives an impact when the gas starts being supplied. However, the pressing member 72 presses the carrier container 2 from above, and prevents it from positionally shifting. As a consequence, the mouth 20 of the carrier container 2 is kept in airtight contact with the sealing member 42.

Then, for example, the door 43 is withdrawn upward from the port 41, along with the attaching/detaching device 44 and lid 21, so that the interior of the carrier container 2 communicates with the loading area S2. Then, the wafers W are sequentially transferred out of the carrier container 2 and onto the wafer boat 92 by the wafer transfer device 96. After all the wafers W are transferred out of the carrier container 2, the lid 21 of the carrier container 2 is closed by an operation reverse to that given above.

The timing at which the pressing mechanism 7 releases pressing, i.e., the timing at which the pressing member 72 returns to the standing position in this embodiment, is set at, e.g., a point after the

mouth 20 of the carrier container 2 is closed by the lid 21. Then, the second mount table 61 (62) is move backward, so that the carrier container 2 is separated from the partition wall 4. Then, the carrier container 2 is transferred to the storage section 64 by the container transfer device 65, and temporarily stored therein.

On the other hand, after a predetermined number of wafers W are transferred onto the wafer boat 92, the wafer boat 92 is loaded into the heat-processing furnace 91. Then, the wafers W on the wafer boat 92 are subjected to a heat process, such as CVD, annealing, or oxidation, in the heat-processing furnace 91. After the heat process is completed, the wafers W are returned into the carrier container 2 by an operation reverse to that described above.

In the embodiment described above, the pressing member 72 is used to press down the carrier container 2 mounted on the second mount table 61 (62) and in contact with the partition wall 4. This prevents the carrier container from vibrating and stabilizes it when the atmosphere inside the carrier container 2 is replaced with a clean gas, even if the clean gas is supplied at a high flow rate and causes a heavy impact on the carrier container 2 due to a gas blow. Furthermore, even if the carrier container 2 receives a large impact when the lid 21 is opened and closed,

since the carrier container 2 is pressed down, the position of the carrier container 2 remains stable.

As a consequence, the airtightness between the carrier container 2 and partition wall 4 is not broken, and air is prevented from flowing into the loading area S2 from the I/O area S1 or atmospheric pressure side. Furthermore, since wafers W are not positionally shifted or projected, the wafers W can be taken out afterward by the wafer transfer device 96 without a hitch. Furthermore, the clean gas can be supplied into the carrier container 2 at a higher flow rate, which allows replacement with the clean gas to be performed in a shorter time, thereby improving the throughput.

The pressing member 72 of the pressing mechanism 7 swings between a standing position along the partition wall 4 (upper position), and a lying-down position (lower position). Thus, the pressing member 72 does not interfere with transfer of the carrier container 2 after the pressing force on the carrier container 2 is released. Furthermore, the pressing mechanism 7 can have a simple structure as a whole.

The embodiment described above only shows one example of the pressing mechanism for securing a carrier container 2. The pressing mechanism may be alternatively formed of means for applying a lateral pressure on a carrier container 2. FIGS. 9A and 9B are

views for explaining other examples of a pressing mechanism.

The pressing mechanism shown in FIG. 9A includes a pressing member 92 that presses a carrier container 2 on the second mount table 61 (62) against the partition wall 4 from behind to fix it. For example, the pressing member 92 is movable back and forth, and can be withdrawn below the mount face of the second mount table 61 (62).

The pressing mechanism shown in FIG. 9B includes a pair of members 95 and 96 that sandwich a carrier container 2 on the second mount table 61 (62) from opposite sides to fix it. In this case, the timing at which the pressing mechanism fixes the carrier container 2 to the second mount table 61 (62) may be set at a point before the carrier container 2 comes into contact with the partition wall.

The present invention is not limited to the embodiments described above, but may be modified in various ways within the spirit of the present invention. For example, the atmosphere inside the loading area S2 is not limited to an inactive gas, but may be clean dry air. In this case, the clean dry air may be supplied into the carrier container 2 to replace the atmosphere inside the carrier container 2, after the carrier container 2 comes into contact with the partition wall 4. Furthermore, the present invention

may be applied to an apparatus that has an I-area and an O-area separate from each other for transferring carrier containers 2 therethrough. Furthermore, the present invention is not limited to a vertical
5 heat-processing apparatus, but may be applied to a semiconductor processing apparatus of another type, such as an apparatus for heat-processing substrates one by one, an apparatus for coating and developing resist, or an apparatus for implanting ions.

1. A port structure for transferring a
5 target substrate therethrough into and from a semiconductor processing apparatus, using a carrier container that is configured to store a plurality of target substrates stacked at intervals, and has a mouth on a front side for the target substrate to pass there-
10 through and an engagement portion on a bottom side, the port structure comprising:

a partition wall that separates an exterior area and an interior area of the apparatus from each other, and has a port for transferring the target substrate
15 therethrough;

a door disposed on the partition wall and configured to open and close the port;

a mount table disposed in the exterior area in front of the port and configured to mount thereon
20 the carrier container with the mouth facing the port, the mount table being movable back and forth between a first position where the mouth comes into contact with the port and a second position where the mouth separates from the port;

25 a positioning member disposed on the mount table to engage with the carrier container and position the carrier container;

a hook-shaped engaging member, other than the positioning member, provided at the mount table, and configured to swing to selectively engage with the engagement portion of the carrier container;

5 a pressing member disposed above the mount table, and configured to swing to selectively engage with a top of the carrier container, the pressing member being capable of swinging between a lower position to press down the carrier container against the mount
10 table and an upper position not to interfere with transfer of the carrier container;

a gas supply section and a gas exhaust section respectively configured to supply and exhaust a clean gas to and from the carrier container; and

15 a control section configured to control an operation of the port structure, and execute steps of placing the mount table at the second position, and swinging the engaging member relative to the carrier container positioned by the positioning member,
20 thereby engaging the engaging member with the engagement portion of the carrier container,

then, moving the mount table from the second position to the first position, thereby bringing the mouth of the carrier container into contact with the
25 port,

then, swinging the pressing member from the upper position to the lower position, thereby engaging the

pressing member with the top of the carrier container,
and

then, keeping the door closed, and replacing an
atmosphere inside the carrier container with the clean
5 gas by the gas supply section and the gas exhaust
section.

2. The port structure according to
claim 1 , wherein the pressing member is configured to
swing about a horizontal axis to move between the lower
10 position and the upper position.

3. The port structure according to
claim 1 , wherein the pressing member stands along the
partition wall in the upper position.

4. The port structure according to
15 claim 1 , wherein the carrier container is provided
with a recess formed on the top, and the pressing
member is provided with a projection to engage with
the recess.

5. The port structure according to
20 claim 1 , wherein the partition wall and the door are
arranged such that a buffer space is formed between the
door and the mouth of the carrier container when the
mouth is in contact with the port, and the gas supply
section and the gas exhaust section are connected to
25 the buffer space.

6. The port structure according to
claim 5 , further comprising a porous filter through

which the gas is supplied from the gas supply section into the buffer space.

7. The port structure according to claim 5 , wherein the carrier container further comprises a lid configured to open and close the mouth, and the door comprises an attaching/detaching device configured to attach and detach the lid to and from the carrier container, when the door airtightly separates the exterior area and the interior area from each other.

8. The port structure according to claim 7 , wherein the control section is configured to execute a step of detaching the lid from the carrier container by the attaching/detaching device, after engaging the pressing member with the top of the carrier container, and before replacing the atmosphere inside the carrier container with the clean gas.

9. The port structure according to claim 8 , wherein the lid detached by the attaching/detaching device is placed in the buffer space when replacing the atmosphere inside the carrier container with the clean gas.

10. The port structure according to claim 9 , wherein the control section is configured to execute a step of withdrawing the door from the port to open the port, while supporting the lid on the door by the attaching/detaching device, after replacing the

atmosphere inside the carrier container with the clean gas.