SUPERCRITICAL FLUID DRYING DEVICE

TECHNICAL FIELD

The present invention relates to the technical field of semiconductor manufacturing, and in particular, to a supercritical fluid drying device.

BACKGROUND

In the process of integrated circuit manufacturing, wet processes for substrates such as wafers can be used for cleaning, etching, and other steps in integrated circuit manufacturing. After the wet etching or cleaning process is completed, a substrate needs to be dried.

It is known that a supercritical fluid having zero surface tension can be used to dry the substrate. For example, a substrate covered with isopropyl alcohol (IPA) is transferred from a cleaning chamber to a drying chamber, the drying chamber is closed to form a sealed chamber, and then the supercritical fluid is supplied into the sealed chamber, so that the IPA on the substrate surface dissolves into the supercritical fluid to remove the IPA from the substrate, thereby drying the substrate. Then, the supercritical fluid in the sealed chamber is vaporized and discharged from the sealed chamber. After the pressure in the sealed chamber returns to atmospheric pressure, the sealed chamber is opened, and finally the dried substrate is taken out.

Particle count is an important factor affecting the process result of the device. During the substrate drying process described above, in one aspect, actions such as opening, closing, locking of the drying chamber, and loading and unloading of the substrate are involved. During the movement of related components, particles are easily generated due to factors such as friction between moving components. If these particles enter the interior of the drying chamber, the substrate will be contaminated and the process result of the device will be affected. In another aspect, since the drying chamber needs to be opened to load or unload the substrate, various contaminants from the environment may also enter the drying chamber during this process, which can contaminate the substrate and affect the process result of the device.

Therefore, it is necessary to improve the supercritical fluid drying device to reduce or even eliminate particle contamination of the substrate.

SUMMARY

In view of the above-mentioned disadvantages of the prior art, the objective of the present invention is to provide a supercritical fluid drying device to solve the problem in the prior art that a chamber of a supercritical fluid drying device is contaminated by contaminants such as particles.

To achieve the objective described above and other related objectives, according to an embodiment of the present invention, a supercritical fluid drying device is provided, comprising: a chamber, including an upper chamber body and a lower chamber body, the lower chamber body being disposed below the upper chamber body and configured to be movable relative to the upper chamber body in the vertical direction, allowing the upper chamber body and the lower chamber body to be closed to form a sealed chamber; a connection assembly and a locking mechanism, the connection assembly being used for connecting the upper chamber body and the lower chamber body, and the locking mechanism being used for locking or unlocking the connection assembly; an isolation assembly, configured to prevent contaminants generated by the connection assembly and the locking mechanism from entering the sealed chamber when the upper chamber body and the lower chamber body are closed, and/or to prevent the contaminants from entering an open space between the upper chamber body and the lower chamber body corresponding to the sealed chamber when the upper chamber body and the lower chamber body are not closed.

Optionally, the connection assembly includes a connecting member, the upper chamber body is provided with an upper connecting hole, the lower chamber body is provided with a lower connecting hole corresponding to the upper connecting hole, and the connecting member is inserted into the upper connecting hole and the lower connecting hole for connecting the upper chamber body and the lower chamber body; the locking mechanism is disposed on the upper chamber body, the locking mechanism includes a driving mechanism and locking blocks located on both sides of the connecting member, and the locking blocks are configured to move towards or away from each other in the horizontal direction on the upper chamber body under the drive of the driving mechanism, to lock or unlock the connecting member; the isolation assembly includes a first retractable isolation member located between the upper chamber body and the lower chamber body, and the first retractable isolation member is sleeved on the connecting member.

Optionally, the isolation assembly further includes an upper cover body, disposed above the upper chamber body, for covering the locking mechanism and the upper portion of the connecting member located above the upper chamber body.

Optionally, the connection assembly further includes a fixing member, located below the lower chamber body, connected to the lower portion of the connecting member located below the lower chamber body, for fixedly securing the connecting member to the lower chamber body; the isolation assembly further includes a lower cover body, disposed below the lower chamber body, for covering the lower portion of the connecting member and the fixing member.

Optionally, the device further comprises an outer cover body, disposed on the periphery of the chamber, forming an isolation space with the chamber, for preventing contaminants outside the isolation space from entering the isolation space.

According to another embodiment of the present invention, a supercritical fluid drying device is provided, comprising: a chamber, including an upper chamber body and a lower chamber body, the lower chamber body being disposed below the upper chamber body and configured to be movable relative to the upper chamber body in the vertical direction, allowing the upper chamber body and the lower chamber body to be closed to form a sealed chamber; an outer cover body, forming an isolation space with the chamber, for preventing contaminants outside the isolation space from entering the isolation space.

Optionally, the outer cover body includes an outer cover body bottom plate and outer cover body side plates, wherein the outer cover body bottom plate is disposed below the lower chamber body, and the outer cover body side plates extend upward from the periphery of the outer cover body bottom plate to the lower surface of the top of the upper chamber body.

Optionally, the outer cover body is further provided with a gas inlet and an outer cover body exhaust port; the gas inlet is used for blowing gas into the outer cover body, and the outer cover body exhaust port is disposed on a transfer mechanism isolation cover, for exhausting gas from the outer cover body.

As described above, the supercritical fluid drying device provided by the present invention has at least the following beneficial effects:

1. By providing a first retractable isolation member between the connection assembly and the open space of the chamber, for preventing contaminants generated by the connection assembly and the locking mechanism from entering the sealed chamber, particle contamination of the sealed chamber of the chamber by the connection assembly and the locking mechanism is reduced or even prevented, thereby

improving the cleanliness of the sealed chamber, improving the process result, and enhancing the process yield.

2. By providing the upper cover body and the lower cover body, further isolation of the connection assembly and the locking mechanism is achieved, further reducing the possibility of contamination of the sealed chamber of the chamber by the connection assembly and the locking mechanism, and improving the cleanliness of the sealed chamber.

3. By providing the outer cover body, an isolation space is formed on the periphery of the chamber, thereby preventing contaminants outside the chamber from entering the sealed chamber, improving the cleanliness of the sealed chamber; moreover, the outer cover body includes a gas inlet and an outer cover body exhaust port. By blowing clean gas into the outer cover body through the gas inlet and exhausting gas from the outer cover body through the outer cover body exhaust port, a gas circulation is formed within the outer cover body to discharge contaminants out of the outer cover body, improving the cleanliness within the outer cover body.

4. The outer cover body combined with the isolation assembly can further improve the cleanliness of the sealed chamber, improve the process result, and enhance the process yield.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and performance of the present application will be further described through the following embodiments and the accompanying drawings of the embodiments.

FIG. 1 shows a schematic structural diagram of an exemplary supercritical fluid drying device;

FIG. 2 shows a schematic perspective diagram of the supercritical fluid drying device according to Embodiment 1 of the present invention;

FIG. 3a, FIG. 3b, and FIG. 4 show structural schematic diagrams of the supercritical fluid drying device according to Embodiment 1 of the present invention;

FIG. 5 shows a perspective schematic diagram of the lower chamber body according to Embodiment 1 of the present invention;

FIG. 6 shows a perspective schematic diagram of the upper chamber body according to Embodiment 1 of the present invention;

FIG. 7 shows a structural schematic diagram of the heating assembly according to Embodiment 1 of the present invention;

FIG. 8 shows a structural schematic diagram of the supercritical fluid drying device according to Embodiment 1 of the present invention mounted on a device frame;

FIG. 9 shows a partial schematic exploded diagram of the supercritical fluid drying device according to Embodiment 1 of the present invention;

FIG. 10 shows a cross-sectional schematic diagram of the supercritical fluid drying device according to Embodiment 1 of the present invention;

FIG. 11 shows a perspective schematic diagram of the supercritical fluid drying device according to Embodiment 2 of the present invention;

FIG. 12 shows a structural schematic diagram of the supercritical fluid drying device according to Embodiment 2 of the present invention;

FIG. 13 shows a perspective schematic diagram of the outer cover body according to Embodiment 2 of the present invention;

FIG. 14 shows a perspective schematic diagram of the supercritical fluid drying device according to Embodiment 2 of the present invention mounted on a device frame;

FIG. 15 shows a partial exploded diagram of the outer cover body according to Embodiment 2 of the present invention; and

FIG. 16 shows a schematic cross-sectional diagram of the supercritical fluid drying device according to Embodiment 2 of the present invention.

PREFERRED EMBODIMENTS OF THE APPLICATION

The embodiments of the present invention are described through specific examples, and those skilled in the art can easily understand other advantages and effects of the present invention from the content disclosed in this specification. The present invention can also be implemented or applied through other different specific embodiments, and various modifications or changes can be made to the details in this

disclosure based on different viewpoints and applications without departing from the spirit of the present invention.

It should be noted that the accompanying drawings of the present disclosure only schematically illustrate the basic concept of the present invention, so the accompanying drawings only show components related to the present invention rather than being drawn according to the number, shape, and size of components in actual implementation. The form, quantity, and proportion of each component in actual implementation may be arbitrarily changed, and the layout of the components may also be more complicated.

In the following description involving the accompanying drawings, the same numbers in different accompanying drawings represent the same or similar elements unless otherwise indicated. The implementation manners described in the following exemplary embodiments do not represent all implementation manners consistent with the present invention. On the contrary, the embodiments are merely examples of devices consistent with some aspects of the present invention as detailed in the appended claims.

The terms used in the present disclosure are only for the purpose of describing specific embodiments and are not intended to limit the present disclosure. The singular forms "a," "said," and "the" used in the present disclosure and the appended claims are also intended to include plural forms unless the context clearly indicates otherwise. It should also be understood that the term "and/or" used herein refers to and includes any or all possible combinations of one or more associated listed items.

In the description of the present disclosure, unless otherwise specified and defined, it should be noted that the terms "mount," "interconnect," and "connect" should be understood in a broad sense, for example, the connection may be a mechanical connection or an electrical connection, may be an internal communication between two elements, and may be a direct connection or an indirect connection through an intermediate medium. For those skilled in the art, the specific meanings of the terms described above can be understood according to specific circumstances.

It should be understood that although the terms "first," "second," "third," etc. may be used in the present disclosure to describe various information, the information should not be limited to these terms. These terms are only used to distinguish the same type of information from each other.

Embodiment 1

FIG. 1 shows a structural schematic diagram of an exemplary supercritical fluid drying device, comprising a chamber 10, a connection assembly 20, locking mechanisms 30, and a lifting mechanism 40. Wherein, the chamber 10 includes an upper chamber body 101 and a lower chamber body 102, and the lower chamber body 102 is disposed below the upper chamber body 101. The lifting mechanism 40 is disposed below the lower chamber body 102, for driving the lower chamber body 102 to move in the vertical direction (i.e., the H direction in FIG. 1). The connection assembly 20 includes connecting members 201 and fixing members 202. The upper chamber body 101 and the lower chamber body 102 are respectively provided with through-connecting holes. The connecting members 201 pass through the upper chamber body 101 and the lower chamber body 102 via the connecting holes, and first ends of the connecting members 201 are fixed to the lower chamber body 102 via the fixing members 202. The locking mechanisms 30 are disposed above the upper chamber body 101. Each locking mechanism 30 includes driving portions 302 and a locking block 301 located on both sides of each connecting member 201. The driving portions 302 are used for driving the locking blocks 301 so that the locking blocks 301 on both sides of the connecting members 201 move towards or away from each other in the horizontal direction on the upper chamber body 101 to lock or unlock the connecting members 201. During the movement of the locking blocks 301 in the horizontal direction, the lower surfaces of the locking blocks 301 and the upper surface of the upper chamber body 101 (the regions shown by the dashed boxes A in FIG. 1) inevitably rub against each other, and thus particles are easily generated due to friction. In one aspect, these particles can enter the interior of the chamber 10 (i.e., inside the chamber) through the gaps between the connecting holes and the connecting members 201; in another aspect, when the chamber 10 is in an open state, these particles may also enter the interior of the chamber 10 through the opening between the upper chamber body 101 and the lower chamber body 102. If these particles enter the chamber, the substrate to be dried in the chamber will be contaminated and the process result will be affected.

Therefore, at least to solve the problem described above, Embodiment 1 provides a supercritical fluid drying device.

As shown in FIG. 2 to FIG. 4, FIG. 2 shows a perspective schematic diagram of the supercritical fluid drying device of Embodiment 1, FIG. 3a, FIG. 3b, and FIG. 4 show structural schematic diagrams of the supercritical fluid drying device of Embodiment 1, wherein in FIG. 3a, a chamber 1 is in an open state; in FIG. 3b, the

chamber 1 is in a closed state; in FIG. 4, the chamber 1 is in the open state, and a connection assembly 2 and first retractable isolation members 51 are omitted. As shown in FIG. 3a and FIG. 3b, the supercritical fluid drying device in Embodiment 1 comprises: the chamber 1, the connection assembly 2, locking mechanisms 3, and an isolation assembly 5. The chamber 1 includes an upper chamber body 11 and a lower chamber body 12. The lower chamber body 12 is disposed below the upper chamber body 11 and is configured to be movable relative to the upper chamber body 11 in the vertical direction (i.e., in the H direction), so that the upper chamber body 11 and the lower chamber body 12 can be closed to form a sealed chamber. Exemplarily, in this embodiment, a lifting assembly 4 is further provided below the lower chamber body 12. The lower chamber body 12 is driven by the lifting assembly 4 to move up in the vertical direction until the lower chamber body 12 and the upper chamber body 11 are closed to form the sealed chamber. The sealed chamber is a process chamber in the supercritical fluid drying process, i.e., the substrate to be dried is placed in the sealed chamber for drying treatment. After the drying treatment is completed, the lower chamber body 12 is driven by the lifting assembly 4 to move down in the vertical direction to open the sealed chamber, so that the substrate can be taken out. The connection assembly 2 is used for connecting the upper chamber body 11 and the lower chamber body 12, and the locking mechanisms 3 are used for locking or unlocking the connection assembly 2. The isolation assembly 5 is configured to prevent contaminants generated by the connection assembly 2 and the locking mechanisms 3 from entering the sealed chamber when the upper chamber body 11 and the lower chamber body 12 are closed, and/or to prevent contaminants from entering an open space between the upper chamber body 11 and the lower chamber body 12 corresponding to the sealed chamber when the upper chamber body 11 and the lower chamber body 12 are not closed, so as to prevent contamination of the chamber of the chamber 1 by the connection assembly 2 and the locking mechanisms 3.

It should be noted that the "open space" in the present invention refers to the space between the upper chamber body 11 and the lower chamber body 12 corresponding to the sealed chamber. After the upper chamber body 11 and the lower chamber body 12 are closed, the open space correspondingly forms the sealed chamber of the chamber 1. After contaminants enter the open space, the contaminants usually remain in the sealed chamber of the chamber 1 after the chamber 1 is closed, which can contaminate the sealed chamber. Therefore, contaminants entering the open space can also be understood as entering the sealed chamber.

With continued reference to FIG. 3a and FIG. 3b, the connection assembly 2 includes connecting members 21 and fixing members 22. The upper chamber body 11

and the lower chamber body 12 are respectively provided with corresponding connecting holes. The connecting members 21 connect the upper chamber body 11 and the lower chamber body 12 through the connecting holes. The fixing members 22 are used for fixedly securing the connecting members 21 to the chamber 1. As shown in FIG. 4, exemplarily, in Embodiment 1, the upper chamber body 11 is provided with upper connecting holes 110 penetrating in the vertical direction, and the lower chamber body 12 is provided with lower connecting holes 120 penetrating in the vertical direction. The connecting members 21 are inserted into the upper connecting holes 110 and the lower connecting holes 120, penetrating the upper chamber body 11 and the lower chamber body 12. Wherein, a clearance fit is provided between the connecting members 21 and the upper connecting holes 110, and an interference fit is provided between the connecting members 21 and the lower connecting holes 120.

Since the interior of the sealed chamber is under high temperature and high pressure during the substrate drying process to maintain the supercritical atmosphere inside, in order to reduce the risk of deformation of the connecting members 21 in the high-temperature and high-pressure environment, it is necessary to fixedly secure the connecting members 21 to the chamber 1 via the fixing members 22. As shown in FIG. 3a and FIG. 3b, the fixing members 22 are located below the lower chamber body 12 for fixing the connecting members 21 to the lower chamber body 12. Exemplarily, as shown in FIG. 5, which shows a perspective schematic diagram of the lower chamber body 12 of the supercritical fluid drying device of Embodiment 1, the arrow H in FIG. 5 indicates the vertical direction. In this embodiment, the fixing members 22 are located below the lower chamber body 12 and are connected to the lower portions of the connecting members 21 located below the lower chamber body 12, for fixedly securing the connecting members 21 to the lower chamber body 12. The lower portions of the connecting members are provided with slots, and the fixing members 22 include U-shaped clamps that are clamped onto the slots of the lower portions of the connecting members and fixed to the bottom of the lower chamber body 12.

With continued reference to FIG. 3a and FIG. 3b, the locking mechanisms 3 are disposed on the upper chamber body 11 and are disposed above the upper chamber body 11. Each locking mechanism 3 includes locking blocks 31 located on both sides of each connecting member 21. The locking blocks 31 include a first locking block 311 and a second locking block 312 respectively located on both sides of the connecting member 21, for moving towards or away from each other in the horizontal direction on the upper chamber body 11 to lock or unlock the connecting member 21. Wherein, the first locking blocks 311 and the second locking blocks 312 are respectively connected to locking driving members 32, which may be, for example, a

pneumatic cylinder, a linear motor, etc., for driving the first locking blocks 311 and the second locking blocks 312 to move towards or away from each other in the horizontal direction.

As shown in FIG. 2, FIG. 3a, and FIG. 3b, the isolation assembly 5 includes first retractable isolation members 51. The first retractable isolation members 51 are located between the upper chamber body 11 and the lower chamber body 12 and are sleeved on the connecting members 21. Each first retractable isolation member 51 includes a hollow cylindrical component, such as a bellows. After being sleeved on the connecting members 21, the first retractable isolation members 51 can physically isolate the portions of the connecting members 21 located between the upper chamber body 11 and the lower chamber body 12 from the open space or the sealed chamber of the chamber 1. Gaps are present between the first retractable isolation members 51 and the connecting members 21. Therefore, even if particles are generated by friction between the lower surfaces of the first locking blocks 311 and the second locking blocks 312 and the upper surface of the upper chamber body 11, and the particles fall into the gaps between the connecting members 21 and the upper connecting holes 110, further, the particles may fall into the interior of the first retractable isolation members 51, i.e., the gaps between the first retractable isolation members 51 and the connecting members 21, but will not fall into the open space or the sealed chamber between the upper chamber body 11 and the lower chamber body 12, thereby preventing the particles from contaminating the sealed chamber of the chamber 1. As shown in FIG. 3a and FIG. 3b, the upper ends and the lower ends of the bellows are respectively provided with mounting portions 511, such as flanges, for fixed connection with the upper chamber body 11 and the lower chamber body 12.

During the supercritical drying process, the upper chamber body 11 and the lower chamber body 12 need to be closed to form the sealed chamber. To prevent the first retractable isolation members 51 located inside the chamber 1 from affecting the closure of the upper chamber body 11 and the lower chamber body 12, as shown in FIG. 3a, FIG. 3b, and FIG. 4, in Embodiment 1, accommodation holes 1101 are further provided. The accommodation holes 1101 are disposed in the lower portion of the upper chamber body 11 or the upper portion of the lower chamber body 12, for accommodating the first retractable isolation members 51 when the upper chamber body 11 and the lower chamber body 12 are closed to form the sealed chamber. Specifically, the accommodation holes 1101 are disposed in the lower portion of the upper chamber body 11. As shown in FIG. 3b, when the upper chamber body 11 and the lower chamber body 12 are closed to form the sealed chamber, the first retractable

isolation members 51 are accommodated in the accommodation holes 1101 located in the lower portion of the upper chamber body 11.

As shown in FIG. 6, which shows a perspective schematic diagram of the upper chamber body of the supercritical fluid drying device according to Embodiment 1, preferably, in this embodiment, the accommodation holes 1101 are provided at the lower portions of the upper connecting holes 110 (please refer to the upper connecting holes 110 in FIG. 4). The first retractable isolation members 51 are sleeved on the connecting members 21, and the radial dimension of the first retractable isolation members 51 is larger than the radial dimension of the connecting members 21. The diameter of the accommodation holes 1101 is larger than the diameter of the connecting holes. Specifically, as shown in FIG. 4 and FIG. 6, the diameter of the accommodation holes 1101 is larger than the diameter of the upper connecting holes 110, so the upper chamber body 11 forms step portions 1104 at the junctions of the two types of holes. Mounting holes 1103 are provided on the step portions 1104 for mounting the flanges at the top of the first retractable isolation members 51. Mounting grooves 1102 are provided on the side walls of the accommodation holes 1101 for avoiding the flanges of the first retractable isolation members 51 when the flanges at the top of the first retractable isolation members 51 are mounted on and fixed to the step portions 1104, and can also serve as a mounting guide.

With continued reference to FIG. 3a and FIG. 3b, in this embodiment, the isolation assembly 5 further includes an upper cover body 52, disposed above the upper chamber body 11 and fixedly secured to the top of the upper chamber body 11, for covering the locking mechanisms 3 and the upper portions of the connecting members 21 located above the upper chamber body 11. Although the first retractable isolation members 51 can prevent particles from entering the sealed chamber through the upper connecting holes 110, the chamber 1 is not always in the closed state during the entire process. The chamber 1 needs to be opened to place the substrate to be dried or to take out the dried substrate from the open space between the upper chamber body 11 and the lower chamber body 12. When the chamber 1 is in a non-closed state, particles may enter the open space between the upper chamber body 11 and the lower chamber body 12 through the opening between the upper chamber body 11 and the lower chamber body 12, and then contaminate the sealed chamber after the chamber 1 is closed. In this embodiment, the upper cover body 52 is provided on the upper chamber body 11, forming an isolation space within the upper cover body 52, physically isolating the locking mechanisms 3 and the upper portions of the connecting members 21 located above the upper chamber body 11. Therefore, particles generated by friction between the locking blocks 31 and the upper surface of the upper chamber body 11 are isolated

within the upper cover body 52, thereby preventing the particles from entering the open space between the upper chamber body 11 and the lower chamber body 12 through the opening between the upper chamber body 11 and the lower chamber body 12.

In Embodiment 1, four connecting members 21 are included, respectively distributed near the four corners of the chamber 1. Correspondingly, one first locking block 311 and one second locking block 312 are provided on both sides of each connecting member 21, and the first locking block 311 and the second locking block 312 are respectively connected to one locking driving member 32. It should be understood that, as shown by arrow B in FIG. 2, the supercritical fluid supplied to the sealed chamber enters the chamber from a central region above the upper chamber body 11, so a pipeline for supplying the supercritical fluid to the chamber needs to be provided in the central region above the upper chamber body 11. To avoid the pipeline, as shown in FIG. 2, in this embodiment, two upper cover bodies 52 with openings facing downward are included, respectively forming two isolation spaces. Each upper cover body 52 respectively covers the region where two connecting members 21 and corresponding locking mechanisms 3 are located. In other possible embodiments, one upper cover body 52 is provided above the region where each connecting member 21 and corresponding locking mechanism 3 are located. Optionally, when the pipeline for supplying supercritical fluid to the chamber is not provided above the upper chamber body 11, the upper cover body 52 may also be a single cover body covering the top of the upper chamber body 11, forming a relatively large isolation space.

In addition, as shown in FIG. 2, in this embodiment, the upper cover bodies 52 are further provided with upper cover body transparent windows 522 to facilitate observation of the working status of components such as the connecting members 21 and the locking mechanism 3 covered within the upper cover bodies 52.

Optionally, in other possible embodiments, each upper cover body 52 is further provided with an upper cover body exhaust port. The upper cover body exhaust port can be connected to an exhaust assembly (e.g., an exhaust fan) for exhausting gas from the upper cover body 52, thereby removing particles isolated within the upper cover body 52 and improving the cleanliness within the upper cover body 52.

As shown in FIG. 2, FIG. 3a, and FIG. 3b, in this embodiment, the isolation assembly 5 further includes lower cover bodies 53, disposed below the lower chamber body 12 and fixedly secured to the bottom of the lower chamber body 12, for covering the lower portions of the connecting members (i.e., the portions of the connecting members 21 located below the lower chamber body 12) and the fixing members 22.

As described above, the fixing members 22 are located below the lower chamber body 12 for fixing the connecting members 21 to the lower chamber body 12. At the contact regions between the fixing members 22 and the connecting members 21, particles may be generated due to friction. When the upper chamber body 11 and the lower chamber body 12 are in the non-closed state, the particles may enter the open space between the upper chamber body 11 and the lower chamber body 12 through the opening between the upper chamber body 11 and the lower chamber body 12, thereby contaminating the sealed chamber. Therefore, by providing the lower cover bodies 53, isolation spaces are formed in the regions where the lower portions of the connecting members 21 and the fixing members 22 are located, so that particles generated here are accommodated within the isolation spaces and cannot enter the open space between the upper chamber body 11 and the lower chamber body 12.

As shown in FIG. 2 to FIG. 6, in this embodiment, a plurality of heating assemblies 6 are further included, fixed on the outer wall of the chamber 1 for heating the chamber 1. As shown in FIG. 7, which shows a structural schematic diagram of the heating assembly of Embodiment 1, each heating assembly 6 includes a heating plate 61, a thermal insulation component 62, and a heating assembly isolation cover 63. The heating plate 61 may be an aluminum plate with heating wires, fixed on the outer wall of the chamber 1. The surface of each heating plate 61 in contact with the chamber 1 is an inner side, and the surface opposite to the inner side is an outer side. The outer side of each heating plate 61 is covered with the thermal insulation component 62 to reduce heat loss and provide thermal insulation. Each heating assembly isolation cover 63 is mounted over the outer wall of the chamber 1 via connecting members 64, such as bolts, accommodating the heating plate 61 and the thermal insulation component 62 into the internal space of the heating assembly isolation cover 63. Thus, contaminants that may be generated by the heating plate 61 and the thermal insulation component 62 are also isolated within the heating assembly isolation cover 63, and thus cannot enter the open space or the sealed chamber between the upper chamber body 11 and the lower chamber body 12.

As shown in FIG. 8, which shows a structural schematic diagram of the supercritical fluid drying device according to Embodiment 1 mounted on a device frame, this embodiment adopts a scheme where the upper chamber body 11 is fixed and the lower chamber body 12 moves up in the vertical direction. Therefore, the upper chamber body 11 needs to be fixedly mounted on the device frame. In other embodiments, a scheme where the lower chamber body 12 is fixed and the upper chamber body 11 moves down in the vertical direction may also be adopted. Correspondingly, the lower chamber body 12 needs to be fixedly mounted on the

device frame. The device frame includes a base 81 and side frames 82, and the upper chamber body 11 is fixedly mounted on the upper portions of the side frames 82.

FIG. 9 shows a partial exploded schematic diagram of the supercritical fluid drying device according to Embodiment 1. As shown in FIG. 6, FIG. 8, and FIG. 9, in this embodiment, the upper chamber body 11 includes an upper chamber body main body 111 and a top cover 112. The top cover 112 is located above the upper chamber body main body 111 and extends outward in the horizontal direction from the top of the upper chamber body main body 111. The outline of the top cover 112 shown in the figure is roughly rectangular, and the top cover 112 is specifically a rectangular frame surrounding the periphery of the top of the rectangular upper chamber body main body 111.

It should be understood that, under the premise of ensuring that the sealed chamber is large enough to accommodate the substrate for drying treatment, generally, the smaller the sealed chamber space, the higher the drying treatment efficiency, the less supercritical fluid consumption, and the smaller the volume of the supercritical fluid drying device. In this embodiment, in one aspect, the upper chamber body 11 needs to be provided with mounting components to be mounted on the side frames 82; in another aspect, components such as the locking blocks 31 and the locking driving members 32 are also provided above the upper chamber body 11. Therefore, without increasing the space of the sealed chamber, the top cover 112 having a coverage area larger than the coverage area of the upper chamber body main body 111 is provided above the upper chamber body main body 111. The top cover 112 extends outward from the top of the upper chamber body main body 111 in the horizontal direction to the periphery, forming chamber mounting portions 1120 on both sides, so as to facilitate mounting the upper chamber body 11 on the device frame.

Further, in this embodiment, the top cover 112 includes a top cover base 1121 and a top cover extension portion 1122. The top cover extension portion 1122 is disposed around the top cover base 1121 and extends outward from the top cover base 1121 in the horizontal direction. The bottom of the upper cover body 52 is mounted on the top cover extension portion 1122. Wherein, the upper chamber body main body 111 and the top cover base 1121 may be integrally formed as a single piece, and the top cover extension portion 1122 is detachable relative to the top cover base 1121. In one aspect, when the upper chamber body 11 is mounted, the upper chamber body main body 111 and the top cover base 1121 of the top cover 112 can be integrally mounted on the device frame first, and then the top cover extension portion 1122 can be mounted. This facilitates mounting the upper chamber body 11 within the limited space of the device

frame. In another aspect, the top cover extension portion 1122 can increase the coverage area of the top cover 112, which can increase the mounting space and facilitate mounting the upper cover body 52. Optionally, as shown in FIG. 9, in this embodiment, the locking driving members 32 on one side of the connecting members 21 can also be mounted on the top cover extension portion 1122. Furthermore, in this embodiment, the integrally formed upper chamber body main body 111 and top cover base 1121 can be made of materials resistant to high temperature and high pressure to meet the process requirements of the supercritical drying process. The detachable top cover extension portion 1122 extends around the top cover base 1121 and is less affected by the high-pressure and high-temperature environment in the sealed chamber. Therefore, the requirements for the material's high-temperature and high-pressure resistance are not high, and the top cover extension portion 1122 can be made of ordinary materials with relatively low cost, thereby reducing the manufacturing cost of the supercritical fluid drying device. In the case where the space of the device frame is sufficient and reducing manufacturing cost is not considered, a scheme where the upper chamber body main body 111, the top cover base 1121, and the top cover extension portion 1122 are integrally formed can also be adopted.

With continued reference to FIG. 8, in this embodiment, the lifting assembly 4 is mounted on the base 81 of the device frame. The lifting assembly 4 includes a lifter 41 and an elevating actuator 42. The lifter 41 is disposed below the lower chamber body 12. A lifting stage 411 is provided at the upper end of the lifter 41 for supporting the lower chamber body 12. The lifter 41 moves in the vertical direction under the drive of the elevating actuator 42, thereby driving the lower chamber body 12 to move up and down in the vertical direction.

Exemplarily, in this embodiment, the elevating actuator 42 includes a motor, the lifter 41 includes a lead screw, and the lifting assembly 4 further includes a linear guide rail, a timing belt, and timing pulleys. FIG. 10 shows a cross-sectional schematic diagram of the lifting assembly 4 of Embodiment 1. As shown in FIG. 8 and FIG. 10, the lifting assembly 4 includes a lifting base plate 40 fixed to the base 81 of the device frame. A guide rail mounting plate 401 extending upward from the lifting base plate 40 is provided on the lifting base plate 40, and a linear guide rail 43 is disposed on the guide rail mounting plate 401. Exemplarily, the output end of the motor (please refer to the elevating actuator 42 in FIG. 8) is connected to the timing pulleys, and is connected to the timing pulleys at the lower end of the lead screw via the timing belt. The motor drives the lead screw to perform linear motion in the vertical direction (direction H in the figures) through the timing pulleys and the timing belt, and uses the

linear guide rail 43 as a guide to achieve the lifting and lowering of the lower chamber body 12.

Since the sealed chamber of the chamber 1 is under a high-temperature and high-pressure environment during the supercritical fluid drying process, the chamber 1 may deform. To prevent deformation of the chamber 1 from damaging the lifting assembly 4, in this embodiment, the lifting stage 411 and the lower chamber body 12 are of a separable type. That is, after the lower chamber body 12 is lifted to a predetermined position so that the upper chamber body 11 and the lower chamber body 12 are closed, the lifting stage 411 will be separated from the lower chamber body 12 and move down, and when the chamber 1 needs to be opened, the lifting stage 411 will move up again to support the lower chamber body 12. In other possible embodiments, the lifting stage 411 and the lower chamber body 12 may also be of a fixed type. In addition, as shown in FIG. 8 and FIG. 10, the upper end of the lead screw extends outward in the horizontal direction to form a lifting flange 410, so as to facilitate mounting the lifting stage 411 on the lead screw.

With continued reference to FIG. 8 and FIG. 10, in order to improve the stability of the lifting and lowering of the lower chamber body 12 and the stability of the chamber 1 during the process, the lifting assembly 4 further includes guide members 44. The upper ends of the guide members 44 are fixedly secured to the lower chamber body 12. The upper ends of the guide members 44 extend outward in the horizontal direction to form guide flanges 440, and the guide members 44 are connected to the lower chamber body 12 via the guide flanges 440. Guide frames 441 are provided on the lifting base plate 40. Each guide frame 441 includes side guide plates extending upward from the lifting base plate 40, and a horizontal guide plate connecting the upper ends of the side guide plates. A guide hole is provided on each horizontal guide plate, and a guide sleeve 442 is provided on the guide hole. The lower portions of the guide members 44 pass through the guide sleeves 442, forming stable guide mechanisms. In one aspect, during the process of the lifter 41 driving the lower chamber body 12 up and down, the guide members 44 work with the guide sleeves 442 to play a guiding role, making the lifting and lowering process more stable; in another aspect, during the drying process within the chamber 1, the guide members 44 working with the guide sleeves 442 can function as a limit stop, which is beneficial to reducing the shaking of the chamber 1.

It should be understood that the lifting assembly 4 in this embodiment is merely exemplary. In other possible embodiments, the lifting assembly 4 may also be implemented in other forms, such as using a gear transmission to drive the lifter 41 to

achieve lifting and lowering, or using a hydraulic transmission to achieve lifting and lowering, etc.

Embodiment 1 provides a supercritical fluid drying device. By providing the first retractable isolation members 51 between the connection assembly 2 and the sealed chamber of the chamber 1, the sealed chamber of the chamber 1 is isolated from the connection assembly 2 and the locking mechanisms 3, reducing or even avoiding particle contamination of the sealed chamber of the chamber 1 by the connection assembly 2 and the locking mechanisms 3, thereby improving the cleanliness of the sealed chamber, improving the process result, and enhancing the process yield. Furthermore, the supercritical fluid drying device in Embodiment 1 further comprises the upper cover body 52 and the lower cover bodies 53, achieving further isolation of the connection assembly 2 and the locking mechanisms 3, further reducing the possibility of contamination of the sealed chamber of the chamber 1 by the connection assembly 2 and the locking mechanisms 3, and further improving the cleanliness of the sealed chamber.

Embodiment 2

Embodiment 2 provides a supercritical fluid drying device. As shown in FIG. 11, which shows a perspective schematic diagram of the supercritical fluid drying device of Embodiment 2, compared with Embodiment 1, Embodiment 2 differs mainly in that the supercritical fluid drying device in Embodiment 2 further comprises an outer cover body 7. FIG. 12 shows a structural schematic diagram of the supercritical fluid drying device of Embodiment 2. As shown in FIG. 11 and FIG. 12, the outer cover body 7 is disposed on the periphery of the chamber 1, forming an isolation space with the chamber 1, for preventing contaminants outside the isolation space from entering the isolation space.

FIG. 13 shows a perspective schematic diagram of the outer cover body of Embodiment 2. As shown in FIG. 13, the outer cover body 7 is a cover body with an upward opening, including an outer cover body bottom plate 72, outer cover body side plates 71, and support members 73. As shown in FIG. 12 (the support members 73 are omitted for clarity), the outer cover body bottom plate 72 is disposed below the lower chamber body 12. The outer cover body side plates 71 extend upward from the edges of the outer cover body bottom plate 72 to the lower surface of the top of the upper chamber body 11, i.e., the top ends of the outer cover body side plates 71 abut against the lower surface of the top of the upper chamber body 11. The support members 73 (as shown by the support members 73 in FIG. 13) are disposed below the outer cover

body bottom plate 72 for supporting the outer cover body 7. Thus, the outer cover body 7 and the top of the upper chamber body 11 form an isolation space, so that contaminants (e.g., particles) outside the isolation space cannot enter the open space or the sealed chamber between the upper chamber body 11 and the lower chamber body 12, thereby preventing the sealed chamber from being contaminated by contaminants from the external environment.

With continued reference to FIG. 13, the outer cover body side plates 71 include first outer cover body side plates 711 and second outer cover body side plates 712, and the first outer cover body side plates 711 and the second outer cover body side plates 712 are adjacent to each other. FIG. 14 shows a perspective schematic diagram of the supercritical fluid drying device according to Embodiment 2 mounted on a device frame. As shown in FIG. 13 and FIG. 14, the outer cover body side plates 71 corresponding to the two sides of the side frames 82 are defined as the first outer cover body side plates 711. Wherein, the side frames 82 include vertical side frames 821 extending in the vertical direction and horizontal side frames 822 extending in the horizontal direction. The vertical side frames 821 and the horizontal side frames 822 are connected to each other to form a stable device frame structure.

Similar to Embodiment 1, in Embodiment 2, the upper chamber body 11 (as shown in FIG. 6) includes an upper chamber body main body 111 and a top cover 112. The top cover 112 is located above the upper chamber body main body 111 and extends outward from the top of the upper chamber body main body 111 in the horizontal direction to the periphery, forming chamber mounting portions 1120 on the two sides corresponding to the side frames 81 of the device frame. The top cover 112 includes a top cover base 1121 and a top cover extension portion 1122. The top cover extension portion 1122 is disposed around the top cover base 1121 and extends outward from the top cover base 1121 in the horizontal direction. In Embodiment 2, since the two sides of the top cover base 1121 (as shown by the top cover base 1121 in FIG. 6) corresponding to the side frames 82 extend relative to the upper chamber body main body 111 to form the chamber mounting portions 1120, sufficient installation space is provided. Therefore, the upper ends of the first outer cover body side plates 711 extend to the lower surface of the top cover base 1121. The remaining regions of the top cover base 1121 have limited extension space relative to the upper chamber body main body 111, and the installation space is limited. Therefore, the upper ends of the second outer cover body side plates 712 extend to the lower surface of the top cover extension portion 1122.

It should be understood that, similar to Embodiment 1, those skilled in the art can, under the teaching of the present disclosure, set the structure of the upper chamber body 11 according to actual installation requirements. Exemplarily, in other possible embodiments, the space around the top cover base 1121 extending relative to the upper chamber body main body 111 may be relatively large, providing sufficient installation space, and the top cover extension portion 1122 may not be required. Therefore, the upper ends of the first outer cover body side plates 711 and the second outer cover body side plates 712 both extend to the lower surface of the top cover base 1121; alternatively, the space around the top cover base 1121 extending relative to the upper chamber body main body 111 may be relatively small, and the installation space is insufficient. In this case, the upper ends of the first outer cover body side plates 711 and the second outer cover body side plates 712 both extend to the lower surface of the top cover extension portion 1122.

With continued reference to FIG. 11, in this embodiment, the second outer cover body side plates 712 further include an opening 713. In the vertical direction, the opening 713 is located between the upper chamber body 11 and the lower chamber body 12. Wherein, the opening 713 is used for allowing a substrate to enter and exit the open space between the upper chamber body 11 and the lower chamber body 12. For example, a substrate transfer robot can be used to transfer the substrate to be dried from the opening 713 into the open space between the upper chamber body 11 and the lower chamber body 12, or the dried substrate can be taken out from the open space between the upper chamber body 11 and the lower chamber body 12 through the opening 713. To prevent the opening 713 from affecting the isolation effect of the outer cover body 7, the opening 713 is usually provided with a door. When the substrate needs to enter or exit the chamber 1 through the opening 713, the door is opened; otherwise, the door is in a closed state to seal the opening 713.

With continued reference to FIG. 12, in this embodiment, the supercritical fluid drying device further comprises a substrate supporting portion 19 and transfer mechanisms 9. The substrate supporting portion 19, for example, a tray, is disposed on the upper surface of the lower chamber body 12, for supporting a substrate. The transfer mechanisms 9 are disposed outside the chamber 1, for transferring the substrate between the substrate supporting portion 19 and the open space. As described above, the open space refers to the space between the upper chamber body 11 and the lower chamber body 12 corresponding to the sealed chamber. After the upper chamber body 11 and the lower chamber body 12 are closed, the open space correspondingly forms the sealed chamber of the chamber 1. Each transfer mechanism 9 includes a transfer supporting portion 91 that can extend into the open space and a transfer driving portion

92 mounted outside the chamber 1. The transfer supporting portion 91 extends into the open space or retracts from the open space under the drive of the transfer driving portion 92.

Specifically, the substrate transfer robot outside the chamber 1 transfers the substrate to the open space between the upper chamber body 11 and the lower chamber body 12 through the opening 713 (as shown by the opening 713 in FIG. 11). The transfer supporting portions 91 extend into the open space between the upper chamber body 11 and the lower chamber body 12 under the drive of the transfer driving portions 92, receive the substrate from the substrate transfer robot, and then place the substrate on the substrate supporting portion 19. The substrate transfer robot withdraws from the open space. After the substrate placement is completed, the transfer supporting portions 91 retract from the open space under the drive of the transfer driving portions 92. After the drying process is completed, the transfer supporting portions 91 extend into the open space under the drive of the transfer driving portions 92, take out the dried substrate placed on the substrate supporting portion 19, the substrate transfer robot enters the open space through the opening 713, takes the substrate from the transfer supporting portion 91, and the substrate transfer robot takes the dried substrate out of the open space through the opening 713.

Since the transfer supporting portions 91 of the transfer mechanisms 9 need to enter and exit the open space between the upper chamber body 11 and the lower chamber body 12, in order to ensure the isolation effect of the outer cover body 7, the transfer mechanisms 9 should also be accommodated within the isolation space of the outer cover body 7. However, when the installation space of the device frame is limited, the space that the outer cover body 7 can accommodate is limited. Therefore, as shown in FIG. 12, in this embodiment, the transfer mechanisms 9 further include transfer mechanism mounting portions 93, and the transfer mechanisms 9 are mounted on the first outer cover body side plates 711 of the outer cover body 7 via the transfer mechanism mounting portions 93. Wherein, two transfer mechanisms 9 are provided, symmetrically disposed on the first outer cover body side plates 711 on both sides. As shown in FIG. 13 and FIG. 14, the outer cover body 7 further includes transfer mechanism isolation covers 74 disposed over the first outer cover body side plates 711 for covering the transfer mechanisms 9 (as shown by the transfer mechanisms 9 in FIG. 12). Each transfer mechanism 9 is correspondingly provided with one transfer mechanism isolation cover 74.

In addition, in this embodiment, the outer cover body 7 further includes an outer cover body transparent window 714. Exemplarily, as shown in FIG. 13, the outer cover

body transparent window 714 is provided on one second outer cover body side plate 712 to facilitate observing the working status of components such as the chamber 1 and the transfer mechanisms 9 inside the outer cover body 7 from outside the outer cover body 7.

With continued reference to FIG. 12, similar to Embodiment 1, in Embodiment 2, a lifting assembly 4 is provided below the lower chamber body 12, for driving the lower chamber body 12 to move in the vertical direction to close or open the sealed chamber. The lifting assembly 4 is a moving assembly, including moving components such as a lifter 41 and an elevating actuator 42. Contaminants are easily generated during the movement, such as particles from the moving components due to friction between the moving components, or lubricating grease that may be used on the moving components. Therefore, in order to prevent contaminants that may be generated by the lifting assembly 4 from contaminating the sealed chamber of the chamber 1, the lifting assembly 4 needs to be isolated outside the outer cover body 7. In this embodiment, the outer cover body bottom plate 72 of the outer cover body 7 is located above the lifting assembly 4.

Further, as shown in FIG. 16, which shows a cross-sectional schematic diagram of the supercritical fluid drying device according to Embodiment 2, since the lower chamber body 12 needs to move in the vertical direction (direction H in the figure) within the isolation space of the outer cover body 7 under the support of the lifter 41, the outer cover body bottom plate 72 needs to be provided with a first bottom plate opening 721 to allow the lifter 41 to pass through the first bottom plate opening 721 and enter the isolation space of the outer cover body 7. Therefore, in this embodiment, a second retractable isolation member 751, such as a bellows, is further included for forming isolation between the first bottom plate opening 721 and the interior of the outer cover body 7. Exemplarily, the second retractable isolation member 751 may be a bellows disposed between the outer cover body bottom plate 72 and the lifter 41. The upper portion of the lifter 41 is located within the isolation space of the outer cover body 7. The bellows is sleeved on the lifter 41. The upper end of the bellows is fixedly mounted on the lower surface of the lifting flange 410, and the lower end of the bellows is fixedly mounted on the upper surface of the outer cover body bottom plate 72. The bellows accommodates the first bottom plate opening 721 within the internal space of the bellows. Even if contaminants generated by the lifting assembly 4 pass through the first bottom plate opening 721, the contaminants will be isolated within the internal space of the bellows and cannot enter the interior of the outer cover body 7.

With continued reference to FIG. 16, in the case where the guide members 44 are provided, the outer cover body bottom plate 72 is further provided with second bottom plate openings 722 to allow the lower portions of the guide members 44 to pass through the second bottom plate openings 722 and be guided into the guide sleeves 442, so as to achieve the cooperation between the guide members 44 and the guide sleeves 442 below. Therefore, in this embodiment, third retractable isolation members 752 are further included, disposed between the second bottom plate openings 722 and the outer cover body 7, for forming isolation between the second bottom plate openings 722 and the interior of the outer cover body 7. The upper portions of the guide members 44 are located within the isolation space of the outer cover body 7. The third retractable isolation members 752, such as a bellows, are sleeved on the guide members 44. The upper ends of the bellows are fixedly mounted on the lower surfaces of the guide flanges 440, and the lower ends of the bellows are fixedly mounted on the upper surface of the outer cover body bottom plate 72. The bellows accommodate the second bottom plate openings 722 within the internal space of the bellows. Even if contaminants generated by the lifting assembly 4 pass through the second bottom plate openings 722, the contaminants will be isolated within the internal space of the bellows and cannot enter the interior of the outer cover body 7.

Optionally, in this embodiment, the outer cover body 7 further includes a gas inlet and an outer cover body exhaust port. The gas inlet can be connected to a gas inlet assembly, and clean gas, such as nitrogen or inert gas, is blown into the outer cover body 7 through the gas inlet. The outer cover body exhaust port can be connected to a gas exhaust assembly, and gas is exhausted from the outer cover body 7 through the outer cover body exhaust port. In this way, a gas circulation can be achieved within the isolation space of the outer cover body 7, discharging possible contaminants such as particles out of the outer cover body 7, thus further improving the cleanliness within the isolation space of the outer cover body 7. Exemplarily, as shown in FIG. 11 to FIG. 15, the outer cover body exhaust port (not shown) is disposed at the bottom of one transfer mechanism isolation cover 74, and the outer cover body exhaust port is externally connected to a gas exhaust pipe 76 for connection with the gas exhaust assembly. In other possible implementations, the outer cover body exhaust port may also be disposed at other positions on the outer cover body 7.

As shown in FIG. 15, which shows a partial exploded view of the outer cover body 7 in this embodiment, optionally, in order to improve the uniformity of the gas circulation within the outer cover body 7 and avoid dead zones in the gas circulation, in this embodiment, each first outer cover body side plate 711 includes a perforated plate 7111 and an outer plate 7112. By providing the perforated plates 7111, the

uniformity of the gas circulation during exhaust can be improved. The outer plates 7112 are disposed on the outer sides of the perforated plates 7111 for sealing the perforated plates 7111. A certain gap is present between each perforated plate 7111 and each outer plate 7112 to ensure that the gas within the outer cover body 7 can be discharged through the perforated plates 7111 and then through the outer cover body exhaust port. The transfer mechanisms 9 are mounted on the outer sides of the perforated plates 7111. The outer plates 7112 are provided with avoidance entrances for avoiding the transfer mechanisms 9. The transfer mechanism isolation covers 74 are disposed over the outer sides of the avoidance entrances, accommodating the transfer mechanisms 9 and the avoidance entrances within the isolation spaces of the transfer mechanism isolation covers 74. Contaminants within the outer cover body 7 can flow with the gas flow through the perforated plates 7111 and the avoidance entrances into the gas exhaust pipe 76, and finally be discharged from the outer cover body 7, thereby maintaining a relatively high cleanliness within the isolation space of the outer cover body 7.

Embodiment 2 provides a supercritical fluid drying device. By providing the outer cover body 7 on the periphery of the chamber 1, an isolation space is formed on the periphery of the chamber 1, thereby preventing contaminants outside the chamber 1 from entering the sealed chamber, improving the cleanliness of the sealed chamber. Moreover, the outer cover body 7 includes a gas inlet and an outer cover body exhaust port. By blowing clean gas into the outer cover body 7 through the gas inlet and exhausting gas from the outer cover body 7 through the outer cover body exhaust port, a gas circulation is formed within the outer cover body 7 to discharge contaminants out of the outer cover body 7, improving the cleanliness within the outer cover body 7. The outer cover body 7 combined with the isolation assembly 5 can further improve the cleanliness of the sealed chamber, improve the process result, and enhance the process yield.

In another embodiment of the present invention, a supercritical fluid drying device is also provided, which, compared with the supercritical fluid drying device in Embodiment 2, does not comprise the isolation assembly 5 of Embodiment 1. It should be understood that relying solely on the outer cover body 7 can also, to a certain extent, prevent the sealed chamber of the chamber 1 from being contaminated by external contaminants of the chamber 1, and those skilled in the art can make a reasonable choice according to actual needs.

The above embodiments are merely illustrative of the principles and effects of the present invention, and are not intended to limit the present invention. Anyone familiar

with the art can make modifications or changes to the embodiments described above without departing from the spirit and scope of the present invention. Therefore, all equivalent modifications or changes made by those having ordinary knowledge in the art without departing from the spirit and technical ideas disclosed in the present invention shall still be covered by the claims of the present invention.

What is claimed is:

1. A supercritical fluid drying device, comprising:

a chamber, including an upper chamber body and a lower chamber body, the lower chamber body being disposed below the upper chamber body and configured to be movable relative to the upper chamber body in the vertical direction, allowing the upper chamber body and the lower chamber body to be closed to form a sealed chamber;

a connection assembly and a locking mechanism, the connection assembly being used for connecting the upper chamber body and the lower chamber body, and the locking mechanism being used for locking or unlocking the connection assembly;

an isolation assembly, configured to prevent contaminants generated by the connection assembly and the locking mechanism from entering the sealed chamber when the upper chamber body and the lower chamber body are closed, and/or to prevent the contaminants from entering an open space between the upper chamber body and the lower chamber body corresponding to the sealed chamber when the upper chamber body and the lower chamber body are not closed.

2. The supercritical fluid drying device according to claim 1, wherein the connection assembly includes a connecting member, the upper chamber body is provided with an upper connecting hole, the lower chamber body is provided with a lower connecting hole corresponding to the upper connecting hole, and the connecting member is inserted into the upper connecting hole and the lower connecting hole for connecting the upper chamber body and the lower chamber body; the locking mechanism is disposed on the upper chamber body, the locking mechanism includes a driving mechanism and locking blocks located on both sides of the connecting member, and the locking blocks are configured to move towards or away from each other in the horizontal direction on the upper chamber body under the drive of the driving mechanism, to lock or unlock the connecting member; the isolation assembly includes a first retractable isolation member located between the upper chamber body and the lower chamber body, and the first retractable isolation member is sleeved on the connecting member.

3. The supercritical fluid drying device according to claim 2, wherein the supercritical fluid drying device further comprises an accommodation hole, the accommodation hole is provided in the lower portion of the upper chamber body or the upper portion of the lower chamber body, for accommodating the first retractable

isolation member when the upper chamber body and the lower chamber body are closed to form the sealed chamber.

4. The supercritical fluid drying device according to claim 2, wherein the isolation assembly further includes an upper cover body, disposed above the upper chamber body, for covering the locking mechanism and the upper portion of the connecting member located above the upper chamber body.

5. The supercritical fluid drying device according to claim 4, wherein the upper chamber body includes an upper chamber body main body and a top cover, the top cover is located above the upper chamber body main body, extends outward in the horizontal direction from the top of the upper chamber body main body, and the upper cover body is mounted on the top cover.

6. The supercritical fluid drying device according to claim 5, wherein the top cover includes a top cover base and a top cover extension portion, the top cover extension portion is disposed around the top cover base and extends outward in the horizontal direction from the top cover base, and the upper cover body is mounted on the top cover extension portion.

7. The supercritical fluid drying device according to claim 4, wherein the upper cover body further includes an upper cover body exhaust port, for exhausting gas from the upper cover body.

8. The supercritical fluid drying device according to claim 2, wherein the connection assembly further includes a fixing member, located below the lower chamber body, connected to the lower portion of the connecting member located below the lower chamber body, for fixedly securing the connecting member to the lower chamber body; the isolation assembly further includes a lower cover body, disposed below the lower chamber body, for covering the lower portion of the connecting member and the fixing member.

9. The supercritical fluid drying device according to claim 1, wherein the supercritical fluid drying device further comprises a heating assembly, the heating assembly includes a heating plate and a heating assembly isolation cover, the heating plate is fixed to the outer wall of the chamber, and the heating assembly isolation cover is disposed on the outer side of the heating plate for covering the heating plate.

10. The supercritical fluid drying device according to claim 1, wherein the supercritical fluid drying device further comprises an outer cover body, disposed on

the periphery of the chamber, forming an isolation space with the chamber, for preventing contaminants outside the isolation space from entering the isolation space.

11. The supercritical fluid drying device according to claim 10, wherein the outer cover body includes an outer cover body bottom plate and outer cover body side plates, the outer cover body bottom plate is disposed below the lower chamber body, and the outer cover body side plates extend upward from the periphery of the outer cover body bottom plate to the lower surface of the top of the upper chamber body.

12. The supercritical fluid drying device according to claim 11, wherein the outer cover body side plates include first outer cover body side plates and second outer cover body side plates, the first outer cover body side plates and the second outer cover body side plates are adjacent to each other, the second outer cover body side plates include an opening, the opening is located between the upper chamber body and the lower chamber body, for allowing a substrate to enter and exit the open space.

13. The supercritical fluid drying device according to claim 11, wherein the supercritical fluid drying device further comprises a lifting assembly, used for driving the lower chamber body to move in the vertical direction, allowing the upper chamber body and the lower chamber body to be closed to form the sealed chamber or opened to open the sealed chamber; the outer cover body bottom plate is disposed above the lifting assembly.

14. The supercritical fluid drying device according to claim 13, wherein the supercritical fluid drying device further comprises a second retractable isolation member, the lifting assembly includes a lifter and an elevating actuator, the lifter is used for driving the lower chamber body to move in the vertical direction under the drive of the elevating actuator; the outer cover body bottom plate includes a first bottom plate opening, for allowing the lifter to pass through the first bottom plate opening and enter the outer cover body; the second retractable isolation member is disposed between the first bottom plate opening and the outer cover body, for forming isolation between the first bottom plate opening and the interior of the outer cover body.

15. The supercritical fluid drying device according to claim 13, wherein the supercritical fluid drying device further comprises a third retractable isolation member, the lifting assembly includes a guide member and a guide sleeve, the upper end of the guide member is fixedly secured to the lower chamber body, and the lower end of the guide member is guided into the guide sleeve; the outer cover body bottom plate includes a second bottom plate opening, for allowing the guide member to pass through

the second bottom plate opening and be guided into the guide sleeve; the third retractable isolation member is disposed between the second bottom plate opening and the outer cover body, for forming isolation between the second bottom plate opening and the interior of the outer cover body.

16. The supercritical fluid drying device according to claim 12, wherein the supercritical fluid drying device further comprises a substrate supporting portion and a transfer mechanism, the substrate supporting portion is disposed on the lower chamber body, for supporting the substrate; the transfer mechanism is disposed on one first outer cover body side plate, for transferring the substrate between the substrate supporting portion and the open space; the outer cover body further includes a transfer mechanism isolation cover, and the transfer mechanism isolation cover is disposed over the outer side of the first outer cover body side plate to cover the transfer mechanism.

17. The supercritical fluid drying device according to claim 16, wherein the outer cover body further includes a gas inlet and an outer cover body exhaust port; the gas inlet is used for blowing gas into the outer cover body, and the outer cover body exhaust port is disposed on the transfer mechanism isolation cover, for exhausting gas from the outer cover body.

18. The supercritical fluid drying device according to claim 17, wherein each first outer cover body side plate includes a perforated plate and an outer plate, the perforated plate is provided with a plurality of through-holes, and the outer plate is disposed on the outer side of the perforated plate for sealing the perforated plate; the transfer mechanism isolation cover is disposed over the outer plate.

19. The supercritical fluid drying device according to claim 11, wherein the outer cover body further includes a gas inlet and an outer cover body exhaust port; the gas inlet is used for blowing gas into the outer cover body, and the outer cover body exhaust port is used for exhausting gas from the outer cover body.

20. A supercritical fluid drying device, comprising:

a chamber, including an upper chamber body and a lower chamber body, the lower chamber body being disposed below the upper chamber body and configured to be movable relative to the upper chamber body in the vertical direction, allowing the upper chamber body and the lower chamber body to be closed to form a sealed chamber;

an outer cover body, disposed at the periphery of the chamber, forming an isolation space with the chamber, for preventing contaminants outside the isolation space from entering the isolation space.

21. The supercritical fluid drying device according to claim 20, wherein the outer cover body includes an outer cover body bottom plate and outer cover body side plates, the outer cover body bottom plate is disposed below the lower chamber body, and the outer cover body side plates extend upward from the periphery of the outer cover body bottom plate to the lower surface of the top of the upper chamber body.

22. The supercritical fluid drying device according to claim 21, wherein the outer cover body side plates include first outer cover body side plates and second outer cover body side plates, the first outer cover body side plates and the second outer cover body side plates are adjacent to each other, the second outer cover body side plates include an opening, the opening is located between the upper chamber body and the lower chamber body, for allowing a substrate to enter and exit an open space between the upper chamber body and the lower chamber body corresponding to the sealed chamber.

23. The supercritical fluid drying device according to claim 21, wherein the supercritical fluid drying device further comprises a lifting assembly, used for driving the lower chamber body to move in the vertical direction, allowing the upper chamber body and the lower chamber body to be closed to form the sealed chamber or opened to open the sealed chamber; the outer cover body bottom plate is disposed above the lifting assembly.

24. The supercritical fluid drying device according to claim 23, wherein the supercritical fluid drying device further comprises a second retractable isolation member, the lifting assembly includes a lifter and an elevating actuator, the lifter is used for driving the lower chamber body to move in the vertical direction under the drive of the elevating actuator; the outer cover body bottom plate includes a first bottom plate opening, for allowing the lifter to pass through the first bottom plate opening and enter the outer cover body; the second retractable isolation member is disposed between the first bottom plate opening and the outer cover body, for forming isolation between the first bottom plate opening and the interior of the outer cover body.

25. The supercritical fluid drying device according to claim 23, wherein the supercritical fluid drying device further comprises a third retractable isolation member, the lifting assembly includes a guide member and a guide sleeve, the upper end of the guide member is fixedly secured to the lower chamber body, and the lower end of the

guide member is guided into the guide sleeve; the outer cover body bottom plate includes a second bottom plate opening, for allowing the guide member to pass through the second bottom plate opening and be guided into the guide sleeve; the third retractable isolation member is disposed between the second bottom plate opening and the outer cover body, for forming isolation between the second bottom plate opening and the interior of the outer cover body.

26. The supercritical fluid drying device according to claim 22, wherein the supercritical fluid drying device further comprises a substrate supporting portion and a transfer mechanism, the substrate supporting portion is disposed on the lower chamber body, for supporting the substrate; the transfer mechanism is disposed on one first outer cover body side plate, for transferring the substrate between the substrate supporting portion and the open space; the first outer cover body side plate further include a transfer mechanism isolation cover, and the transfer mechanism isolation cover is disposed over the outer side of the first outer cover body side plate to cover the transfer mechanism.

27. The supercritical fluid drying device according to claim 26, wherein the outer cover body further includes a gas inlet and an outer cover body exhaust port; the gas inlet is used for blowing gas into the outer cover body, and the outer cover body exhaust port is disposed on the transfer mechanism isolation cover, for exhausting gas from the outer cover body.

28. The supercritical fluid drying device according to claim 27, wherein each first outer cover body side plate includes a perforated plate and an outer plate, the perforated plate is provided with a plurality of through-holes, and the outer plate is disposed on the outer side of the perforated plate for sealing the perforated plate; the transfer mechanism isolation cover is disposed over the outer plate.

29. The supercritical fluid drying device according to claim 21, wherein the outer cover body further includes a gas inlet and an outer cover body exhaust port; the gas inlet is used for blowing gas into the outer cover body, and the outer cover body exhaust port is used for exhausting gas from the outer cover body.