DEGASSING CHAMBER AND DEGASSING METHOD

TECHNICAL FIELD

The embodiments of the present disclosure relate to a degassing chamber and a degassing method.

BACKGROUND

A wafer usually needs to be heated and cooled during the processing thereof. For example, in a degassing process, a wafer is firstly heated to a certain temperature to remove water vapor and other volatile substances, and then is cooled to a room temperature for subsequent processes.

SUMMARY

According to the embodiments of the present disclosure, a degassing chamber is provided. A heating device, a cooling device and a movable supporting device are disposed inside the degassing chamber;

the cooling device and the heating device are separated from each other and disposed opposite to each other; and

the movable supporting device is configured to carry a wafer and is capable of driving the wafer to move between the heating device and the cooling device, so that the wafer is capable of being heated and cooled, respectively.

For example, the degassing chamber further includes a movable shield. When the movable supporting device drives the wafer to move to a heating position where the wafer is capable of being heated by the heating device, the shield is capable of moving to a first position to expose the wafer to the heating device; and when the movable supporting device drives the wafer to move to a cooling position where the wafer is capable of being cooled by the cooling device, the shield is capable of moving to a second position between the heating device and the wafer to cover the wafer.

For example, the degassing chamber further includes a protective cover which is communicated with an interior of the degassing chamber, and the shield is placed inside the protective cover when being located at the first position.

For example, the degassing chamber further includes a rotating drive mechanism configured to drive the shield to rotate between the first position and the second position.

For example, the rotating drive mechanism includes a rotating connecting rod and a rotating motor,

the rotating connecting rod is vertically disposed on a side of the shield close to the protective cover and is connected to the shield and the rotating motor, respectively; and

the rotating motor is configured to drive the rotating connecting rod to rotate around an axis of the rotating connecting rod.

For example, the shield is foldable or extendable. When the moveable supporting device drives the wafer to move to the heating position, the shield is capable of being folded to move to the first position; and when the movable supporting device drives the wafer to move to the cooling position, the shield is capable of being extended to move to the second position.

For example, the heating device includes a heating plate, and a heating element is disposed in the heating plate; and the heating element is arranged in such a way that a density of the heating element gradually increases along a direction from a center of the heating plate to an edge of the heating plate.

For example, the heating element includes a heating wire wound into a flat spiral structure around an axis of the heating plate, and a gap between two adjacent loops of the heating wire gradually decreases along the direction from the center of the heating plate to the edge of the heating plate.

According to the embodiments of the present disclosure, there is a preset distance between a surface of the wafer and a surface of the heating plate, which are opposite to each other, when the wafer is located at the heating position.

For example, the preset distance is in a range of 0.05mm to 0.15mm.

For example, the cooling device includes a cooling plate, and a wafer cooling channel is disposed in the cooling plate for transporting a cooling medium.

For example, the heating device and the cooling device are disposed along a vertical direction, and the heating device is located above the cooling device.

For example, the movable supporting device includes at least three supporting pins and a lifting drive mechanism,

the at least three supporting pins are all vertically disposed and penetrate through the cooling device, and are configured to jointly support the wafer at a position between the

heating device and the cooling device; and

the lifting drive mechanism is configured to drive the at least three supporting pins to rise or descend.

For example, a chamber cooling channel for transporting a cooling medium is disposed at least in a chamber wall of the degassing chamber close to the heating device.

According to the embodiments of the present disclosure, a degassing method is further provided, and is performed in the degassing chamber provided by the embodiments of the present disclosure. The degassing method includes:

carrying the wafer by the movable supporting device, moving the wafer by the movable supporting device to a heating position where the wafer is capable of being heated by the heating device, and heating the wafer; and

moving the wafer by the movable supporting device to a cooling position where the wafer is capable of being cooled by the cooling device, and cooling the wafer.

For example, the degassing chamber includes a movable shield; and

the degassing method further includes:

when the wafer is driven by the movable supporting device to move to the heating position, moving the shield to a first position to expose the wafer to the heating device; and

when the wafer is driven by the movable supporting device to move to the cooling position, moving the shield to a second position between the heating device and the wafer to cover the wafer.

BRIEF DESCRIPTION OF THE DRAWINGS

To more clearly illustrate the technical solutions of the embodiments of the present disclosure, the drawings of the embodiments will be briefly introduced below. It is apparent that the drawings described below only relate to some embodiments of the present disclosure and do not limit the present disclosure.

Fig. 1 illustrates a degassing chamber according to a technique;

Fig. 2 illustrates a heating chamber according to a technique;

Fig. 3(a) illustrates a degassing chamber according to the embodiments of the present disclosure;

Fig. 3(b) is a sectional view of a heating plate of a heating device disposed in a degassing chamber according to the embodiments of the present disclosure;

Fig. 4(a) and Fig. 4(b) illustrate a degassing chamber according to the embodiments of

the present disclosure, where Fig. 4(a) is a schematic diagram of the degassing chamber in a heating state, and Fig. 4(b) is a schematic diagram of the degassing chamber in a cooling state;

Fig. 5(a) and Fig. 5(b) illustrate a degassing chamber according to the embodiments of the present disclosure, where Fig. 5(a) is a schematic diagram of the degassing chamber in a heating state, and Fig. 5(b) is a schematic diagram of the degassing chamber in a cooling state; and

Fig. 6 illustrates chamber walls of a degassing chamber according to the embodiments of the present disclosure.

DETAILED DESCRIPTION

To make the objectives, technical solutions and advantages of the embodiments of the present disclosure more clearly, the technical solutions of the embodiments of the present disclosure will be clearly and completely described below with reference to the accompanying drawings of the embodiments of the present disclosure. It is apparent that the described embodiments are only a part of the embodiments of the present disclosure, but not all of the embodiments. All other embodiments, which are derived by people with ordinary skills in the art based on the described embodiments of the present disclosure without creative work, are within the protection scope of the present disclosure.

Unless otherwise defined, technical terms or scientific terms used in the present disclosure should have general meanings that can be understood by people with ordinary skills in the technical field of the present disclosure. The words “first”, “second” and the like used in the present disclosure are not intended to indicate any order, quantity, or importance, but are used merely to distinguish between different components. The words “include”, “comprise” and the like indicate that an element or object before the words covers elements or objects or the equivalents thereof listed after the words, but do not exclude other elements or objects. The words “connect”, “couple” and the like are not restricted to physical or mechanical connection, but may include electrical connection, whether direct or indirect. The words “on”, “under”, “left”, “right” and the like are used merely to indicate relative positional relationships, and when an absolute position of an object described is changed, the relative positional relationships may also be changed accordingly.

Fig. 1 illustrates a degassing chamber. With reference to Fig. 1, a degassing chamber 101 is provided with a transparent dielectric window 103, a heating light source 102 is

disposed outside the degassing chamber 101 and close to the transparent dielectric window 103, a cooling device 104 is disposed inside the degassing chamber 101, and a wafer 105 is placed on the cooling device 104. The heating light source 102 radiates heat to the wafer 105 through the transparent dielectric window 103 to heat the wafer 105 in a heating process; and after the heating process is completed, the cooling device 104 is turned on to cool the wafer 105.

However, the degassing chamber illustrated in Fig. 1 has the following problems:

firstly, a surface temperature of the wafer 105 cannot be directly obtained during the heating process, and can only be measured indirectly by prior experiments before the formal heating process is performed. Therefore, it is not easy to perceive a change of the surface temperature of the wafer 105 that occurs with a change of the internal conditions of the degassing chamber 101, which results in poor temperature accuracy of the wafer;

secondly, the wafer 105 may volatilize substances during the heating process, and the volatilized substances may be deposited on the transparent dielectric window 103 and thus block part of the heat transfer, thereby reducing heating efficiency; and

thirdly, a temperature of the transparent dielectric window 103 may rise due to the radiation of the heating light source 102, and the transparent dielectric window 103 may still radiate heat to the wafer 105 during the cooling process, thereby reducing cooling efficiency.

Fig. 2 illustrates another degassing chamber. With reference to Fig. 2, a heating device 202 is disposed inside a chamber 201 to heat a wafer 203. However, the degassing chamber illustrated in Fig. 2 can only heat the wafer but does not have a cooling function. Therefore, the wafer 203 needs to be transported to another apparatus for being cooled, which results in low production efficiency.

To solve the above problems, a degassing chamber is provided according to the embodiments of the present disclosure. A heating device, a cooling device and a movable supporting device are disposed inside the degassing chamber. The cooling device and the heating device are separated from each other and disposed opposite to each other; and the movable supporting device is configured to carry a wafer, and is capable of driving the wafer to move between the heating device and the cooling device, so that the wafer can be heated and cooled, respectively.

According to the embodiments of the present disclosure, the heating device and the cooling device are both located in the degassing chamber, and the wafer is driven by the movable supporting device to move between the cooling device and the heating device so as

to be cooled and heated respectively, so that a heating process and a cooling process can be performed in the same chamber, thereby improving production efficiency.

In addition, according to the embodiments of the present disclosure, by disposing the heating device inside the chamber, the heating device can radiate heat to the wafer directly and closely, and there is no need for the heat to penetrate a component (e.g. the dielectric window 103 shown in Fig. 1) that is disposed between the heating device and the wafer for isolating a vacuum environment from an atmospheric environment, so that the problems of poor temperature accuracy of the wafer, low heating efficiency and low cooling efficiency caused by the dielectric window 103 in the degassing chamber shown in Fig. 1 can be avoided.

The degassing chamber according to the embodiments of the present disclosure will be described below in detail with reference to the accompanying drawings. Fig. 3(a) illustrates a degassing chamber according to the embodiments of the present disclosure. As shown in Fig. 3(a), a heating device 20, a cooling device 30, and a movable supporting device 80 are disposed inside a degassing chamber 10 according to the embodiments of the present disclosure. The cooling device 30 and the heating device 20 are separated from each other and disposed opposite to each other; and the movable supporting device 80 is configured to carry a wafer 50, and is capable of driving the wafer 50 to move between the heating device 20 and the cooling device 30, so that the wafer 50 can be heated and cooled, respectively.

The heating device 20 and the cooling device 30 are both located inside the degassing chamber 10, and the wafer 50 is driven by the movable supporting device 80 to move between the cooling device 30 and the heating device 20 so as to be cooled and heated respectively, so that a heating process and a cooling process can be performed in the same degassing chamber 10, thereby improving production efficiency. In addition, by disposing the heating device 20 inside the degassing chamber 10, the heating device 20 can radiate heat to the wafer directly and closely, and there is no need for the heat to penetrate a component (e.g. the dielectric window 103 shown in Fig. 1) that is disposed between the heating device 20 and the wafer 50 for isolating a vacuum environment from an atmospheric environment, so that the problems of poor temperature accuracy of the wafer, low heating efficiency and low cooling efficiency caused by the dielectric window 103 in the degassing chamber shown in Fig. 1 can be avoided.

Fig. 3(b) is a sectional view of a heating plate of the heating device disposed in the degassing chamber according to the embodiments of the present disclosure. According to

the embodiments of the present disclosure, as shown in Fig. 3(b), the heating device 20 includes a heating plate 20' provided therein with a heating element 21. Moreover, the heating element 21 is arranged in such a way that the density of the heating element 21 gradually increases along a direction from a center of the heating plate 20' to an edge of the heating plate 20'. In such case, on the one hand, the heating plate 20', which is of a disk-like structure, can achieve surface heating of a relatively large area. On the other hand, the above arrangement of the density of the heating element 21 can make up for a difference between a heat dissipation rate of the edge of the heating plate 20' and that of the center of the heating plate 20', thereby improving temperature uniformity in the heating process.

In the embodiments, the heating element 21 includes a heating wire, and the heating wire is wound into a flat spiral structure around an axis of the heating plate 20' (i.e. an axis O-O' shown in Fig. 3(b)), and a gap between two adjacent loops of the heating wire gradually decreases along the direction from the center of the heating plate 20' to the edge of the heating plate 20'. It should be noted that the structure, the section shape and the number of the heating element 21 in Figs. 3(a) and 3(b) are all exemplary, and the embodiments of the present disclosure are not limited thereto. In practical application, the structure, the section shape and the number of the heating element 21 may be set according to actual needs.

It should be noted that the embodiments of the present disclosure do not set any limitation on the specific shape of the degassing chamber 10, as long as the degassing chamber 10 is capable of accommodating the heating device 20 and the cooling device 30.

For example, as shown in Fig. 3(a), at least a surface of the heating plate 20' facing the wafer 50 is flat, so that the heating plate 20' may become a surface heating source with good uniformity. For example, an area of the surface of the heating plate 20' facing the wafer 50 is greater than or equal to a surface area of the wafer 50 to ensure heating efficiency and heating uniformity. For example, the surface of the heating plate 20' facing the wafer 50 and a surface of the heating plate 20' away from the wafer 50 are both flat, so as to facilitate the processing.

For example, as shown in Fig. 3(a), the cooling device 30 includes a cooling plate 30', and the cooling plate 30' is provided therein with a wafer cooling channel (not shown) for transporting a cooling medium, so as to cool the wafer 50. The cooling medium may be cooling water, cooling liquid, liquid nitrogen, or the like.

For example, at least a surface of the cooling plate 30' facing the wafer 50 is flat, so that the cooling plate 30' may become a surface cooling source with good uniformity. For

example, an area of the surface of the cooling plate 30' facing the wafer 50 is greater than or equal to the surface area of the wafer 50 to ensure cooling efficiency and cooling uniformity. For example, the surface of the cooling plate 30' facing the wafer 50 and a surface of the cooling plate 30' away from the wafer 50 are both flat, so as to facilitate the processing.

For example, as shown in Fig. 3(a), the heating plate 20' is fixed to a top wall of the degassing chamber 10 and the cooling plate 30' is fixed to a bottom wall of the degassing chamber 10, that is, the heating plate 20' and the cooling plate 30' are disposed along a vertical direction, and the heating plate 20' is located above the cooling plate 30'. In this way, the movable supporting device 80 may move up and down to drive the wafer to move close to the heating plate 20' or the cooling plate 30', so that the wafer can be heated and cooled conveniently. However, the embodiments of the present disclosure are not limited thereto, and a positional relationship between the cooling plate 30' and the heating plate 20' may be set as required.

For example, as shown in Fig. 3(a), the heating plate 20' is fixed to the top wall of the degassing chamber 10 through a first connector 61, and the cooling plate 30' is fixed to the bottom wall of the degassing chamber 10 through a second connector 62. The embodiments of the present disclosure do not set any limitation on the structures of the first connector 61 and the second connector 62, as long as the heating plate 20' can be stably fixed to the top wall of the degassing chamber 10 through the first connector 61, and the cooling plate 30' can be stably fixed to the bottom wall of the degassing chamber 10 through the second connector 62.

For example, the wafer 50 may be any wafer that needs to be degassed, such as a silicon wafer, which is not limited by the embodiments of the present disclosure. For example, the wafer 50 includes a substrate and a film layer or a pattern formed on the substrate. For example, the wafer 50 only includes a substrate, and no film layer or pattern is disposed on the substrate. For example, when the wafer 50 is placed into the degassing chamber 10, a surface of the wafer 50 on which the film layer or pattern is formed or a surface of the wafer 50 on which a film layer or a pattern is to be formed later faces upward, that is, facing the heating device 20.

The degassing chamber 10 according to the embodiments of the present disclosure further includes a movable shield. Specifically, Figs. 4(a), 4(b), 5(a) and 5(b) illustrate degassing chambers according to the embodiments of the present disclosure, respectively,

where Figs. 4(a) and 5(a) show the positions of the shields 40 in a heating state, Figs. 4(b) and 5(b) show the positions of the shields 40 in a cooling state, and the shield shown in Figs. 4(a) and 4(b) is different from that shown in Figs. 5(a) and 5(b) in terms of structure.

For example, the degassing chamber 10 according to the embodiments of the present disclosure has the heating state and the cooling state. In the heating state, the movable supporting device 80 drives the wafer 50 to move to a heating position (the positions of the wafer 50 shown in Figs. 4(a) and 5(a)) where the wafer 50 is capable of being heated by the heating device 20; and in the cooling state, the movable supporting device 80 drives the wafer 50 to move to a cooling position (the positions of the wafer 50 shown in Figs. 4(b) and 5(b)) where the wafer 50 is capable of being cooled by the cooling device 30.

Furthermore, when the wafer 50 is located at the heating position, the shield 40 may be moved to a first position, that is, the positions of the shields 40 shown in Figs. 4(a) and 5(a), so as to expose the wafer 50 to the heating plate 20'. At this time, the shield 40 does not block the heat radiated from the heating plate 20' to the wafer 50.

When the wafer 50 is located at the cooling position, the shield 40 may be moved to a second position between the heating plate 20' and the wafer 50, that is, the positions of the shields 40 shown in Figs. 4(b) and 5(b), so as to cover the wafer 50. In this way, the shield 40 can prevent the heating device 20 from radiating heat to the wafer 50 in the cooling process.

For example, when the wafer 50 is located at the heating position, the wafer 50 is in direct contact with the heating plate 20'. Alternatively, when the wafer 50 is located at the heating position, the wafer 50 and the heating plate 20' are close to each other but are not in direct contact, that is, there is a preset distance between a surface of the wafer 50 and a surface of the heating plate 20', which are opposite to each other. For example, the preset distance may be in a range of 0.05mm to 0.15mm, and in a further example, it may be about 0.1mm. In this way, the wafer 50 can be close enough to the heating plate 20' to be fully heated, and the volatilization of water vapor or other volatile substances in the wafer 50 may not be hindered; moreover, in the case where a surface of the wafer 50 is provided thereon with a pattern, the pattern can be prevented from being damaged by the direct contact with the heating plate 20'.

For example, as shown in Figs. 4(a) and 5(a), when the wafer 50 is located at the heating position, there is no component disposed between the wafer 50 and the heating plate 20', so that the heat from the heating plate 20' can be radiated to the wafer 50 directly.

For example, when the wafer 50 is located at the cooling position, an orthographic projection of the shield 40 on the heating plate 20' completely covers the heating plate 20', so that the shield 40 can cover the heating plate 20' completely, so as to effectively prevent the heating device 20 from radiating heat to the wafer 50 during the cooling process.

For example, when the wafer 50 is located at the cooling position, the wafer 50 is placed on the cooling plate 30' of the cooling device 30, that is, in direct contact with the cooling plate 30'. Thus, cooling efficiency and cooling uniformity can be improved.

For example, the shield 40 may be made of a material capable of reducing heat transfer. Stainless steel is usually used in the manufacture of various production equipment, such as the degassing chamber according to the embodiments of the present disclosure. For example, the shield 40 is also made of stainless steel, which simplifies material selection and material storage, thereby simplifying the manufacturing process.

For example, the shield 40 may be made of a heat-insulating material, such as a heat reflective material and a thermal insulation material. The heat reflective material is, for example, a plate coated with a high-reflectivity metal layer. The thermal insulation material is, for example, a thermal insulation resin, such as phenol resin and urethane resin.

For example, as shown in Figs. 4(a) and 4(b), the shield 40 is rigid, and the degassing chamber 10 includes a protective cover 41, which is communicated with an interior of the degassing chamber 10. For example, the shield 40 is placed inside the protective cover 41 when being located at the first position.

For example, the protective cover 41 and the degassing chamber 10 are formed integrally. For example, the protective cover 41 and the degassing chamber 10 are formed separately and are connected together through connectors such as bolts.

For example, as shown in Figs. 4(a) and 4(b), the degassing chamber 10 according to the embodiments of the present disclosure further includes a rotating drive mechanism for driving the shield 40 to rotate between the first position and the second position.

For example, the rotating drive mechanism includes a rotating connecting rod 42 and a rotating motor 43. The rotating connecting rod 42 is vertically disposed on a side of the shield 40 close to the protective cover 41 and is connected to the shield 40 and the rotating motor 43, respectively; and the rotating motor 43 is configured to drive the rotating connecting rod 42 to rotate around the axis thereof. Being driven by the rotating motor 43, the rotating connecting rod 42 drives the shield 40 to rotate to the first position inside the protective cover 41 or rotate out of the protective cover 41 to the second position.

It should be noted that the mechanism that drives the shield 40 to move is not limited to the rotating connecting rod 42 and the rotating motor 43, and any drive mechanism capable of driving the shield 40 to move between the first position and the second position is within the protection scope of the embodiments of the present disclosure.

For example, as shown in Figs. 5(a) and 5(b), the shield 40 is foldable or extendable, that is, the shield 40 may be switched between a folded state and an extended state. Moreover, when the wafer 50 is located at the heating position, the shield 40 may be folded to move to the first position, that is, in the folded state, so that the wafer 50 is exposed to the heating plate 20'; and when the wafer 50 is located at the cooling position, the shield 40 may be extended to move to the second position, that is, in the extended state, so as to shield the wafer 50 from the heating plate 20'.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the heating device 20 further includes a line 22 connected to the heating element 21. For example, the heating element 21 includes a resistance heating element (e.g. a heating wire), in which case the line 22 connected to the heating element 21 is an electric wire that transmits electric current to the resistance heating element. For example, the heating element 21 includes a liquid heating element, in which case the line 22 connected to the heating element 21 is a liquid transport tube that transports a high-temperature liquid to the liquid heating element.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the first connector 61 is hollow, and the line 22 connected to the heating element 21 passes through the first connector 61 and is led out of the degassing chamber 10. In such case, the first connector 61 not only has the function of fixing the heating plate 20' but also has the function of leading the line 22, which can simplify the structure of the degassing chamber 10. In addition, the first connector 61 may isolate an internal environment of the degassing chamber 10 from an external atmospheric environment.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the heating device 20 further includes a temperature measuring element 23 and a lead wire 24 connected to the temperature measuring element 23. For example, the temperature measuring element 23 is a thermocouple. The heating device 20 includes the temperature measuring element 23, so that a temperature of the heating plate 20' may be monitored in real time to facilitate real-time and accurate control of a heating temperature. It should be noted that only one temperature measuring element 23 is shown at the center of the heating plate 20' in the drawings, but the embodiments of the present disclosure are not limited thereto, and therefore, it is possible to

dispose a plurality of temperature measuring elements 23 at different positions of the heating plate 20', and perform temperature adjustments to the different positions of the heating plate 20' according to their respective monitored results of the plurality of temperature measuring elements 23, so as to achieve uniform heating.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the lead wire 24 connected to the temperature measuring element 23 passes through the first connector 61 and is led out of the degassing chamber 10, which simplifies the structure of the degassing chamber 10.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), a wafer cooling channel 31 for transporting a cooling medium is disposed in the cooling plate 30', and the cooling device 30 further includes a line 32 connected to the wafer cooling channel 31. For example, the cooling medium may be cooling water, cooling liquid, liquid nitrogen, or the like. In such case, the line 32 connected to the wafer cooling channel 31 is a transport tube for transporting the cooling medium to the wafer cooling channel 31.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the second connector 62 is hollow, and the line 32 connected to the wafer cooling channel 31 passes through the second connector 62 and is led out of the degassing chamber 10. In such case, the second connector 62 not only has the function of fixing the cooling plate 30' but also has the function of leading the line 32, which can simplify the structure of the degassing chamber 10. In addition, the second connector 62 may isolate the internal environment of the degassing chamber 10 from the external atmospheric environment.

To facilitate the manufacture of the degassing chamber 10, it is generally necessary to divide chamber walls of the degassing chamber 10 into a plurality of parts which are manufactured separately and then are connected together through connectors. Fig. 6 shows the chamber walls of the degassing chamber 10 according to the embodiments of the present disclosure, with the internal structures of the degassing chamber being omitted for convenience. For example, as shown in Fig. 6, the degassing chamber 10 is divided into an upper part 12 and a lower part 13, and the chamber walls corresponding to the upper part 12 and the lower part 13 are separately manufactured and then are connected together through connectors such as screws.

For example, in a process of connecting the plurality of parts of the degassing chamber 10 together through the connectors, a large number of sealing rings are needed to be used together with the connectors so as to turn the degassing chamber 10 into an airtight chamber. In addition, a large number of sealing rings are also needed to be used together with the

connectors in a process of connecting the degassing chamber 10 to other components (for example, the above protective cover 10, and a vacuum system 90, a vacuum measurement instrument 91 and an intake system 92 described below). However, the sealing rings are easily deformed when being heated, which affects the sealing effect. Therefore, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), in the embodiments of the present disclosure, for example, a chamber cooling channel 70 for transporting a cooling medium is disposed at least in a chamber wall of the degassing chamber 10 close to the heating device 20, so as to prevent the temperature of the chamber wall from rising due to the heat radiation from the heating device 20, thereby further preventing the sealing rings from being deformed when being heated. For example, the chamber cooling channel 70 is different from and independent of the cooling device 30. For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the chamber cooling channel 70 is disposed in a top wall of the degassing chamber 10. Alternatively, the chamber cooling channel 70 may be disposed in all of the chamber walls to better prevent the temperatures of the chamber walls from rising due to the heat radiation from the heating device 20. For example, as shown in Fig. 6, the chamber cooling channel 70 is disposed in upper, lower and side walls of the degassing chamber 10. For example, the chamber cooling channel 70 is configured to transport the cooling medium that includes cooling water, cooling liquid, liquid nitrogen, or the like.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the movable supporting device 80 includes at least three supporting pins 81 and a lifting drive mechanism, and the at least three supporting pins 81 are all vertically disposed and penetrate through the cooling plate 30’ for jointly supporting the wafer 50 at a position between the heating plate 20’ and the cooling plate 30’. For example, in the heating state, the supporting pins 81 pass through the cooling plate 30’ and rise to move the wafer 50 to the heating position, such as a position close to the heating plate 20’ or a position in contact with the heating plate 20’. For example, in the cooling state, the supporting pins 81 descend to move the wafer 50 to the cooling position, such as a position close to the cooling plate 30’ or a position on the cooling plate 30’.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the movable supporting device 80 further includes a lifting connecting rod 83 fixedly connected to the supporting pins 81; and a lifting motor 84 for driving the lifting connecting rod 83 to rise or descend. When the lifting motor 84 drives the lifting connecting rod 83 to rise or descend, the lifting connecting rod 83 drives the at least the three supporting pins 81 to rise or descend synchronously, so

that the supporting pins 81 may move the wafer 50 to a required process position. For example, the supporting device further includes a plate-shaped supporting tray 82, the supporting pins 81 are fixed to an upper surface of the supporting tray 82, and the lifting connecting rod 83 is connected to a lower surface of the supporting tray 82. By employing the plate-shaped supporting tray 82, the movement of the supporting pins 81 can be more stable and a plurality of supporting pins 81 can be disposed conveniently.

For example, as shown in Figs. 4(a), 4(b), 5(a) and 5(b), the degassing chamber 10 is provided with a valve 11, and becomes an airtight chamber after the valve 11 is closed. When the valve 11 is opened, the wafer 50 is moved into or out of the degassing chamber 10. When the valve 11 is closed, the wafer 50 is heated or cooled.

For example, the degassing chamber according to the embodiments of the present disclosure may further include the vacuum system 90, the vacuum measurement instrument 91, and the intake system 92 as required, which are connected to the degassing chamber 10 and will not be described herein.

A degassing method is further provided according to the embodiments of the present disclosure, and is performed in the above degassing chamber 10 according to the embodiments of the present disclosure. For example, the degassing method according to the embodiments of the present disclosure includes:

carrying the wafer 50 by the movable supporting device 80, moving the wafer 50 by the movable supporting device 80 to the heating position where the wafer 50 may be heated by the heating device 20, and heating the wafer 50; and

moving the wafer 50 by the movable supporting device 80 to the cooling position where the wafer 50 may be cooled by the cooling device 30, and cooling the wafer 50.

In the degassing method according to the embodiments of the present disclosure, the wafer 50 is driven by the movable supporting device 80 to move between the cooling device 30 and the heating device 20 in the degassing chamber 10, so that a heating process and a cooling process can be performed in the same chamber, thereby improving production efficiency. In addition, the heating device 20 can radiate heat to the wafer 50 directly and closely, and there is no need for the heat to penetrate a component (e.g. the dielectric window 103 shown in Fig. 1) that is disposed between the heating device 20 and the wafer 50 for isolating a vacuum environment from an atmospheric environment, so that the problems of poor temperature accuracy of the wafer, low heating efficiency and low cooling efficiency caused by the dielectric window 103 in the degassing chamber shown in Fig. 1 can be

avoided.

For example, the degassing chamber includes the movable shield 40; and the degassing method further includes:

when the wafer 50 is driven by the movable supporting device 80 to move to the heating position, moving the shield 40 to the first position to expose the wafer 50 to the heating device 20; and

when the wafer 50 is driven by the movable supporting device 80 to move to the cooling position, moving the shield 40 to the second position between the heating device 20 and the wafer 50 to cover the wafer 50.

In this way, the heating efficiency and the cooling efficiency can be guaranteed.

An example of the degassing method according to the embodiments of the present disclosure is given as follows. After the valve 11 is opened, the wafer 50 is moved into the degassing chamber 10 and is placed on the supporting pins 81, and the shield 40 is moved into the protective cover 41 or is folded; then the valve 11 is closed, and the degassing chamber 10 is turned into a vacuum state by using the vacuum system 90; an inert gas (e.g. N2, Ar, or the like) is introduced into the degassing chamber 10 by the intake system 92, the wafer 50 is moved by the supporting pins 81 to a position close to the heating plate 20', the heating device 20 is turned on to heat the wafer 50, and the temperature of the heating plate 20' may be monitored through the temperature measuring element 23 and may be adjusted in real time according to the monitored results during the heating process; after the heating processing is completed, the inert gas in the degassing chamber 10 is discharged by the vacuum system 90, an inert gas (e.g. N2, Ar, or the like) is introduced into the degassing chamber 10 by the intake system 92 again, the supporting pins 81 descend to place the wafer 50 on the cooling plate 30', the shield 40 is moved to a position between the heating plate 20' and the wafer 50, and the cooling device 30 is turned on to cool the wafer 50; and after the cooling process is completed, the wafer 50 is moved out of the chamber. It should be noted that the degassing method according to the embodiments of the present disclosure is not limited to the above example.

It should be noted that: (1) only the structures related to the embodiments of the present disclosure are shown in the drawings, and other structures may be designed with reference to common designs; (2) for the purpose of clarity, the components are not drawn according to the actual scales in the drawings that are used to illustrate the embodiments of the present disclosure; and (3) the technical features in the embodiments of the present disclosure may

be combined with each other if no conflict is incurred.

What is described above is merely the exemplary embodiments of the present disclosure and is not intended to limit the protection scope of the present disclosure. The protection scope of the present disclosure is defined by the claims appended hereto.

What is claimed is:

1. A degassing chamber, comprising a heating device, a cooling device, and a movable supporting device, which are disposed inside the degassing chamber; wherein,

the cooling device and the heating device are separated from each other and disposed opposite to each other; and

the movable supporting device is configured to carry a wafer and is capable of driving the wafer to move between the heating device and the cooling device, so that the wafer is capable of being heated and cooled, respectively.

2. The degassing chamber of claim 1, further comprising a shield that is movable, wherein when the movable supporting device drives the wafer to move to a heating position where the wafer is capable of being heated by the heating device, the shield is capable of moving to a first position to expose the wafer to the heating device; and when the movable supporting device drives the wafer to move to a cooling position where the wafer is capable of being cooled by the cooling device, the shield is capable of moving to a second position between the heating device and the wafer to cover the wafer.

3. The degassing chamber of claim 2, further comprising a protective cover which is communicated with an interior of the degassing chamber, wherein the shield is placed inside the protective cover when being located at the first position.

4. The degassing chamber of claim 2 or claim 3, further comprising a rotating drive mechanism configured to drive the shield to rotate between the first position and the second position.

5. The degassing chamber of claim 4, wherein the rotating drive mechanism comprises a rotating connecting rod and a rotating motor,

the rotating connecting rod is vertically disposed on a side of the shield close to the protective cover and is connected to the shield and the rotating motor, respectively; and

the rotating motor is configured to drive the rotating connecting rod to rotate around an axis of the rotating connecting rod.

6. The degassing chamber of claim 2 or claim 3, wherein the shield is foldable or

extendable, and when the moveable supporting device drives the wafer to move to the heating position, the shield is capable of being folded to move to the first position; and when the movable supporting device drives the wafer to move to the cooling position, the shield is capable of being extended to move to the second position.

7. The degassing chamber of claim 1, wherein the heating device comprises a heating plate, and a heating element is disposed in the heating plate; and the heating element is arranged in such a way that a density of the heating element gradually increases along a direction from a center of the heating plate to an edge of the heating plate.

8. The degassing chamber of claim 7, wherein the heating element comprises a heating wire wound into a flat spiral structure around an axis of the heating plate, and a gap between two adjacent loops of the heating wire gradually decreases along the direction from the center of the heating plate to the edge of the heating plate.

9. The degassing chamber of claim 7, wherein there is a preset distance between a surface of the wafer and a surface of the heating plate, which are opposite to each other, when the wafer is located at the heating position.

10. The degassing chamber of claim 9, wherein the preset distance is in a range of 0.05mm to 0.15mm.

11. The degassing chamber of claim 1, wherein the cooling device comprises a cooling plate, and a wafer cooling channel is disposed in the cooling plate for transporting a cooling medium.

12. The degassing chamber of claim 1, wherein the heating device and the cooling device are disposed along a vertical direction, and the heating device is located above the cooling device.

13. The degassing chamber of claim 12, wherein the movable supporting device comprises at least three supporting pins and a lifting drive mechanism,

the at least three supporting pins are all vertically disposed and penetrate through the

cooling device, and are configured to jointly support the wafer at a position between the heating device and the cooling device; and

the lifting drive mechanism is configured to drive the at least three supporting pins to rise or descend.

14. The degassing chamber of claim 1, wherein,

a chamber cooling channel for transporting a cooling medium is disposed at least in a chamber wall of the degassing chamber close to the heating device.

15. A degassing method, which is performed in the degassing chamber of any of claims 1 to 14, comprising:

carrying the wafer by the movable supporting device, moving the wafer by the movable supporting device to a heating position where the wafer is capable of being heated by the heating device, and heating the wafer; and

moving the wafer by the movable supporting device to a cooling position where the wafer is capable of being cooled by the cooling device, and cooling the wafer.

16. The degassing method of claim 15, wherein,

the degassing chamber comprises a shield that is movable; and

the degassing method further comprises:

when the wafer is driven by the movable supporting device to move to the heating position, moving the shield to a first position to expose the wafer to the heating device; and

when the wafer is driven by the movable supporting device to move to the cooling position, moving the shield to a second position between the heating device and the wafer to cover the wafer.