

CARRYING APPARATUS OF SEMICONDUCTOR HEAT TREATMENT DEVICE, AND SEMICONDUCTOR HEAT TREATMENT DEVICE

5 **Field**

[0001] The present disclosure relates to the technical field of semiconductor devices, in particular to a carrying apparatus of a semiconductor heat treatment device, and the semiconductor heat treatment device.

10 **Background**

[0002] In a semiconductor heat treatment device, temperature uniformity in a process module has a significant impact on the yield of a plurality of wafers placed in the process module at intervals. Therefore, how to accurately detect a temperature of each wafer is extremely important for a semiconductor process.

15 **[0003]** As shown in FIG. 1, a semiconductor vertical furnace device includes a loadlock 11 and a process module 12 located above the loadlock 11. A quartz tube 121 is arranged in the process module 12. A boat 13 used for carrying a plurality of wafers is capable of rising and falling, so that the boat may fall into the loadlock 11 during loading and unloading of the wafers and may rise into the quartz tube 121, carrying the wafers, in the process. The boat 13 may carry
20 a plurality of wafers. The plurality of wafers are placed in the boat 13 at intervals in a vertical direction. A temperature measuring apparatus 14 is mounted in the quartz tube 121. An interior of the quartz tube 121 is divided into a plurality of temperature measuring regions in the vertical direction. The temperature measuring apparatus 14 is provided with a temperature measuring thermocouple corresponding to each temperature measuring region. Each temperature
25 measuring thermocouple is used for measuring a temperature of each temperature measuring region in a one-to-one correspondence manner. In order to avoid interference between the temperature measuring apparatus 14 and the rising and falling of the boat 13, the temperature measuring apparatus 14 may only be mounted at an edge position, located on outer sides of the boat 13, in the quartz tube 121. This causes the temperature measuring apparatus 14 to be far
30 away from the wafers. As a result, there is a large error between a temperature measured by the temperature measuring apparatus 14 and an actual temperature of the wafer. Therefore, before the semiconductor vertical furnace device is put into operation, a thermocouple (TC) wafer that may measure a temperature and has a shape similar to that of the wafer needs to be placed in the boat 13, and the semiconductor process is simulated. The temperature measured by the TC

wafer is regarded as the actual temperature of the wafer, and is compared with the temperature measured by the temperature measuring apparatus 14 to obtain the error between the temperature measured by the temperature measuring apparatus 14 and the actual temperature of the wafer. Therefore, after the semiconductor vertical furnace device is put into operation, the temperature measured by the temperature measuring apparatus 14 is compensated through the obtained error, to obtain the actual temperature of the wafer.

[0004] However, in the above temperature measurement method, the temperature measuring apparatus 14 needs to be used in cooperation with the TC wafer, resulting in higher costs. The obtained error sample is relatively small and has low accuracy, which is only for reference and cannot accurately compensate for the temperature measured by temperature measuring apparatus 14, causing a relatively low yield of the wafer. In addition, after long-term use, an internal environment of the quartz tube 121 may change. For example, after multiple deposition processes are performed, process by-products will be deposited on an inner wall of the quartz tube 121, and changes in the internal environment of the quartz tube 121 will have an impact on the error. At this time, it is necessary to stop the semiconductor vertical furnace device for correction, and an error is recalculated, resulting in a low utilization rate of the semiconductor vertical furnace device.

Summary

[0005] The present disclosure aims at providing a carrying apparatus of a semiconductor heat treatment device, and the semiconductor heat treatment device in order to at least solve one of the technical problems in the prior art, which may improve the accuracy of temperature measurement on wafers, without cooperative use of other temperature measuring elements, so as to improve a yield of the wafers, reduce costs, and improve a utilization rate of the semiconductor heat treatment device.

[0006] In order to achieve the objective of the present disclosure, a carrying apparatus of a semiconductor heat treatment device is provided, including a carrying main body; the carrying main body includes a plurality of carrying positions for carrying wafers, and the plurality of carrying positions are arranged at intervals in an axial direction of the carrying main body; the carrying apparatus further includes a temperature measuring apparatus; the temperature measuring apparatus includes a support member and a plurality of temperature measuring assemblies; the support member is connected to the carrying main body, and is located on outer sides of edges of the carrying positions of the carrying main body; and

[0007] the plurality of temperature measuring assemblies are arranged on the support member

at intervals in the axial direction of the carrying main body, and each temperature measuring assembly has a temperature measuring end extending to an inner side of the edge of each carrying position and is used for detecting a temperature of a sub-region corresponding to the temperature measuring end.

5 **[0008]** Optionally, the temperature measuring ends and centers of the carrying positions are opposite in the axial direction of the carrying main body.

[0009] Optionally, each temperature measuring assembly includes an extending component and a temperature measuring component; one end of the extending component is connected to the support member, and the other end is used as each temperature measuring end extending to
10 the inner side of the edge of each carrying position;

[0010] the temperature measuring component is arranged in the extending component, and is located at the temperature measuring end; and a connecting wire of the temperature measuring component is led out through the extending component and the support member in sequence.

[0011] Optionally, each temperature measuring component includes a thermocouple; the
15 thermocouple includes a first electrode, a second electrode, a first connector, a second connector, a first conductive element, a second conductive element, and an insulation component; the first electrode and the second electrode are arranged in the extending component at an interval and are located at the temperature measuring end; the first connector and the second connector are arranged in the extending component at an interval; the first conductive element and the second
20 conductive element are arranged in the support member at an interval; the first electrode is electrically connected with the first conductive element through the first connector; the second electrode is electrically connected with the second conductive element through the second connector; and

[0012] the insulation component is arranged in the extending component and the support
25 member, and is used for electrically insulating the first conductive element from the second conductive element and electrically insulating the first connector from the second connector.

[0013] Optionally, the insulation component includes an insulation sleeve; a first channel and a second channel electrically insulated from each other are arranged in the insulation sleeve; the first channel is used for allowing the first conductive element and the first connector to pass;
30 and the second channel is used for allowing the second conductive element and the second connector to pass.

[0014] Optionally, a limiting component is arranged on the support member; and the limiting component cooperates with the carrying main body and is used for limiting the support member from rotating relative to the carrying main body.

[0015] Optionally, the limiting component is arranged on the support member; a limiting slot is formed in the carrying main body; the limiting component is arranged in the limiting slot; and an outer circumferential surface of the limiting component cooperates with an inner circumferential surface of the limiting slot so that the limiting component is limited from rotating relative to the limiting slot.

[0016] Optionally, a fixing structure is arranged on the support member; a fixing portion is arranged on the carrying main body; and the carrying apparatus further includes a fixing assembly for detachably connecting the fixing structure to the fixing portion.

[0017] Optionally, the fixing structure includes a convex arranged on the support member; a fixing hole for allowing the convex to pass is formed in the fixing portion; an external thread is arranged on an outer circumferential wall of the fixing portion;

[0018] the fixing assembly includes a fixing member, a first elastic member, a second elastic member, a pressing member, and an elastic sealing member;

[0019] a fixing slot is formed in the fixing member; an internal thread cooperating with the external thread is arranged on an inner circumferential wall of the fixing slot; the first elastic member, the second elastic member, the pressing member, and the elastic sealing member are stacked in the fixing slot in sequence from bottom to top and all sleeve the support member; and the elastic sealing member is located between the pressing member and one end of the fixing portion extending into the fixing slot.

[0020] The present disclosure further provides a semiconductor heat treatment device, including a loading chamber, a process module, and the carrying apparatus provided by the present disclosure. The loading chamber and the processor module communicate with each other; and the carrying apparatus is able to move between the loading chamber and the process module.

[0021] The present disclosure has the following beneficial effects:

[0022] According to the carrying apparatus of the semiconductor heat treatment device provided by the present disclosure, the plurality of temperature measuring assemblies are arranged on the support member at intervals in the axial direction of the carrying main body. Each temperature measuring assembly has the temperature measuring end extending to the inner side of the edge of each carrying position to detect the temperature of the sub-region corresponding to the temperature measuring end. Since the above-mentioned temperature measuring ends extend to the inner sides of the edges of the carrying positions, distances between the temperature measuring ends and the wafers carried by the carrying positions in the corresponding sub-regions may be reduced, so that the error between measured temperature

values of the temperature measuring assemblies and the actual temperatures of the wafers may be reduced, and the accuracy of temperature measurement on the wafers may be improved. Therefore, the measured temperature values of the temperature measuring assemblies may reflect the actual temperatures of the wafers, without cooperative use with other temperature measuring elements, which improves the yield of the wafers, reduces the cost, and increases the utilization rate of the semiconductor heat treatment device. In addition, the support member of the temperature measuring apparatus is connected with the carrying main body, and is located on the outer sides of the edges of the carrying positions of the carrying main body, so that the temperature measuring apparatus may move as the carrying main body moves, which avoids interference of the temperature measuring assemblies on the support member on the movement of the carrying main body, thereby guaranteeing normal transportation of the carrying apparatus in the semiconductor heat treatment device.

[0023] By virtue of the foregoing carrying apparatus provided by the present disclosure, the semiconductor heat treatment device provided by the present disclosure may improve the accuracy of temperature measurement on the wafers, without cooperative use with other temperature measuring elements, which improves the yield of the wafers, reduces the cost, and increases the utilization rate of the semiconductor heat treatment device. In addition, interference of the temperature measuring assemblies on the support member on the movement of the carrying main body may also be avoided, thereby guaranteeing normal transportation of the carrying apparatus in the semiconductor heat treatment device.

Brief Description of the Drawings

[0024] FIG. 1 is a schematic structural diagram of an existing semiconductor vertical furnace device and a boat;

[0025] FIG. 2 is a schematic structural diagram of a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the present disclosure;

[0026] FIG. 3 is a schematic structural diagram illustrating that a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the present disclosure is located in a process module;

[0027] FIG. 4 is a schematic structural diagram illustrating that a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the present disclosure is located in a loading chamber;

[0028] FIG. 5 is a schematic structural diagram of a temperature measuring apparatus in a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the

present disclosure;

[0029] FIG. 6 is a schematic partially enlarged structural diagram of A in FIG. 5;

[0030] FIG. 7 is a schematic structural diagram of a temperature measuring apparatus in a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the present disclosure;

[0031] FIG. 8 is a schematic partially enlarged structural diagram of B in FIG. 7;

[0032] FIG. 9 is a schematic structural diagram illustrating that a limiting component cooperates with a flange plate in a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the present disclosure;

[0033] FIG. 10 is a schematic structural diagram of a carrying apparatus of a semiconductor heat treatment device provided by an embodiment of the present disclosure; and

[0034] FIG. 11 is a schematic partially enlarged structural diagram of C in FIG. 10.

[0035] Numerals in the drawings:

[0036] 11: loadlock; 12: process module; 121: quartz tube; 13: boat; 14: temperature measuring apparatus; 201: loading chamber; 202: process module; 203: process tube; 204: lifting device; 21: carrying main body; 211: sub-region; 22: support member; 23: temperature measuring assembly; 231: extending component; 232: temperature measuring component; 241: first conductive element; 242: second conductive element; 243: first connector; 244: second connector; 25: insulation component; 26: limiting component; 271: fixing portion; 272: fixing hole; 273: external thread; 28: fixing assembly; 281: fixing member; 282: fixing slot; 283: first elastic member; 284: second elastic member; 285: pressing member; 286: elastic sealing member; 29: convex; 30: flange plate; 31: heat preservation device; and 32: wafer.

Detailed Description of the Embodiments

[0037] In order to make those skilled in the art better understand the technical solutions of the present disclosure, a carrying apparatus of a semiconductor heat treatment device, and the semiconductor heat treatment device provided by the present disclosure will be described in detail below with reference to the accompanying drawings.

[0038] As shown in FIG. 2, the embodiment provides a carrying apparatus of a semiconductor heat treatment device, including a temperature measuring apparatus and a carrying main body 21. The carrying main body 21 includes a plurality of carrying positions used for carrying wafers 32, and the plurality of carrying positions are arranged at intervals in an axial direction of the carrying main body. Specifically, a plurality of layers of slots arranged at intervals in the axial direction of the carrying main body are formed in the carrying main body 21. One wafer

32 may be inserted into each layer of slot. A position of the slot for placing the wafer 32 is the above carrying position.

[0039] The temperature measuring apparatus includes a support member 22 and a plurality of temperature measuring assemblies 23. The support member 22 is connected with the carrying main body 21, and is located on outer sides of the above carrying positions of the carrying main body 21. Specifically, the above support member 22 is, for example, columnar, and extends in the axial direction of the carrying main body 21. The plurality of temperature measuring assemblies 23 are arranged on the support member 22 at intervals in the axial direction of the carrying main body 21, and each temperature measuring assembly 23 has a temperature measuring end extending to an inner side of the edge of each carrying position and is used for detecting a temperature of a sub-region corresponding to the temperature measuring end.

[0040] A whole region of the carrying main body 21 used for accommodating all the wafers 32 is divided into a plurality of sub-regions 211 in the axial direction of the carrying main body 21. The quantity of the sub-regions 211 is the same as the quantity of the temperature measuring assemblies 23. The temperature measuring ends of the temperature measuring assemblies 23 extend into the sub-regions 211 in a one-to-one correspondence manner to detect the temperatures of the sub-regions 211. For example, as shown in FIG. 2, the above whole region is averagely divided into five sub-regions 211. Correspondingly, there are five temperature measuring assemblies 23. The temperature measuring ends of the temperature measuring assemblies 23 extend into the sub-regions 211 in a one-to-one correspondence manner. Optionally, the temperature measuring end of each temperature measuring assembly 23 is located above the wafer 32 on an uppermost layer in the corresponding sub-region 211. However, the present disclosure is not limited to this. In practical applications, the temperature measuring end of each temperature measuring assembly 23 may also be located above or below any layer of wafer 32 in the corresponding sub-region. The present disclosure has no particular restriction on this.

[0041] It should be noted that there may be one or more wafers 32 in each sub-region 211. The present disclosure has no particular restriction on this. The temperatures of the corresponding sub-regions 211 detected by the temperature measuring assemblies 23 may be used for reflecting actual temperatures of the wafers 32 in the sub-regions 211.

[0042] It should also be noted that in the embodiment, the quantity of the sub-regions 211 is the same as the quantity of the temperature measuring assemblies 23. However, the present disclosure is not limited to this. In practical applications, one temperature measuring assembly 23 may also correspond to a plurality of sub-regions 211. Furthermore, quantities of sub-regions

211 corresponding to different temperature measuring assemblies 23 may be the same or different.

[0043] According to the carrying apparatus of the semiconductor heat treatment device provided by the embodiment, the plurality of temperature measuring assemblies 23 are all arranged on the support member 22 at intervals in the axial direction of the carrying main body 21. Each temperature measuring assembly 23 has the temperature measuring end extending to the inner side of the edge of each carrying position to detect the temperature of the sub-region 211 corresponding to the temperature measuring end. Since the above-mentioned temperature measuring ends extend to the inner sides of the edges of the carrying positions, distances between the temperature measuring ends and wafers carried by the carrying positions in the corresponding sub-regions 211 may be reduced, so that an error between measured temperature values of the temperature measuring assemblies 23 and the actual temperatures of the wafers 32 may be reduced, and the accuracy of temperature measurement on the wafers may be improved. Therefore, the measured temperature values of the temperature measuring assemblies 23 may reflect the actual temperatures of the wafers, without cooperative use with other temperature measuring elements, which improves the yield of the wafers, reduces the cost, and increases the utilization rate of the semiconductor heat treatment device. In addition, the support member 22 of the temperature measuring apparatus is connected with the carrying main body 21, and is located on the outer sides of the edges of the carrying positions of the carrying main body 21, so that the temperature measuring apparatus may move as the carrying main body 21 moves, which avoids interference of the temperature measuring assemblies 23 on the support member 22 on the movement of the carrying main body 21, thereby guaranteeing normal transportation of the carrying apparatus in the semiconductor heat treatment device.

[0044] The above-mentioned carrying apparatus provided by the embodiment may be, for example, applied to a semiconductor vertical furnace device. In this case, the axial direction of the carrying main body 21 is a vertical direction. However, a structure of the carrying apparatus is not limited to this. For example, the carrying apparatus may also be applied to a semiconductor horizontal furnace device, that is, the axial direction of the carrying apparatus 21 is parallel to a horizontal plane. It should be noted that in the carrying apparatus suitable for the semiconductor horizontal furnace device, the temperature measuring ends of the temperature measuring assemblies 23 extend towards the inner sides of the edges of the carrying positions of the carrying main body 21, and may extend to one sides (for example, left sides or right sides) of the sub-regions 211 in a one-to-one correspondence manner.

[0045] As shown in FIG. 3 and FIG. 4, the semiconductor vertical furnace device serving as

the semiconductor heat treatment device is taken as an example. The semiconductor vertical furnace device may be provided with a loading chamber 201 and a process module 202 which communicate with each other. The loading chamber 201 is located below the process module 202. The above carrying apparatus provided in the embodiment may load and unload the wafers 32 in the loading chamber 201, and the loading chamber 201 may be provided with a lifting device 204 used for driving the whole carrying apparatus to rise into the process module 202 or to fall into the loading chamber 201.

[0046] A process tube 203 may be arranged in the process module 202. Optionally, the process tube 203 may be made of quartz. The above carrying apparatus may rise into the process module 202 and enter an internal space of the process tube 203. In the carrying apparatus provided by the embodiment, the support member 22 of the temperature measuring apparatus is connected to the carrying main body 21, so that the temperature measuring apparatus may rise and fall as the carrying main body 21 rises and falls, that is, the temperature measuring apparatus may rise into the process module 202 or fall into the loading chamber 201 along with the carrying main body 21, thereby avoiding the interference of the temperature measuring assemblies 23 on the support member 22 on the movement of the carrying main body 21, which may ensure the normal transmission of the carrying apparatus in the semiconductor heat treatment device. However, the structure of the semiconductor vertical furnace device is not limited to this. For example, the loading chamber 201 may also be located above the process module 202.

[0047] In addition, a type of the semiconductor heat treatment device is not limited to the semiconductor vertical furnace device. For example, the semiconductor heat treatment device may also be the semiconductor horizontal furnace device. A loading chamber 201 and a process module 202 which communicate with each other may also be arranged in the semiconductor horizontal furnace device. At this time, the loading chamber 201 may be located on a right side of the process module 202 or on a left side of the process module 202. A transportation device may be arranged in the loading chamber 201. Since the carrying apparatus is placed on the transportation device, the transportation device may drive the carrying apparatus to translate left or right into the process module 202. In the carrying apparatus provided by the embodiment, the support member 22 of the temperature measuring apparatus is connected to the carrying main body 21, so that the temperature measuring apparatus may translate left and right with the left and right translation of the carrying main body 21. Thus, the interference of the temperature measuring components 23 on the support member 22 on the movement of the carrying main body 21 is avoided, thereby ensuring the normal transportation of the carrying apparatus in the

semiconductor heat treatment device.

[0048] As shown in FIG. 5 and FIG. 6, in a preferred embodiment of the present disclosure, each temperature measuring assembly 23 may include an extending component 231 and a temperature measuring component 232. One end of the extending component 231 is connected to the support member 22, and the other end is used as the above temperature measuring end extending to the inner side of the edge of each carrying position. The temperature measuring component 232 is arranged in the extending component 231, and is located at the temperature measuring end. A connecting wire (used as a signal transmission component) of the temperature measuring component 232 is led out through the extending component 231 and the support member 22 in sequence, to extend out of the process module 202. The above extending component 231 is used for supporting and protecting the temperature measuring component 232 arranged therein, and may also enable the temperature measuring component 232 to be located in a region closer to a center of the wafer 32.

[0049] Specifically, as shown in FIG. 5 and FIG. 6, both the support member 22 and the extending component 231 may be of hollow structures, and an internal space of the extending component 231 communicates with the internal space of the support member 22. The temperature measuring component 232 is arranged in the internal space of the extending component 231, and the connecting wire of the temperature measuring component 232 is led out through the internal space of the extending component 231 and the internal space of the support member 22 in sequence. The connecting wire of the temperature measuring component 232 serves as a signal transmission component to transmit an electrical signal generated by the temperature measuring component 232 during temperature detection to an external receiving and processing component (not shown in the figure). The receiving and processing component is used for processing the electrical signal generated by the temperature measuring component 232 during the temperature detection, so as to display a temperature measured by each temperature measuring component 232.

[0050] Optionally, a manufacturing material of the extending component 231 may include quartz.

[0051] In a preferred embodiment of the present disclosure, the temperature measuring ends of the temperature measuring components 232 may be opposite to centers of the carrying positions in the axial direction of the carrying main body 21. In this way, the temperature measuring ends of the temperature measuring components 232 may be opposite to circle centers of the wafers arranged on the carrying positions, so that temperature values measured by the temperature measuring components 232 may be closer to temperatures of the centers of the

wafers 32, which further improves the accuracy of measuring the temperatures of the wafers 32.

[0052] As shown in FIG. 6, in a preferred embodiment of the present disclosure, each temperature measuring component 232 may include a thermocouple. The thermocouple may include a first electrode, a second electrode, a first connector 243, a second connector 244, a first conductive element 241, a second conductive element 242, and an insulation component 25. The first electrode and the second electrode are arranged in the extending component 231 at an interval and are located at the temperature measuring end. The first connector 243 and the second connector 244 are arranged in the extending component 231 at an interval. The first conductive element 241 and the second conductive element 242 are arranged in the support member 22 at an interval. The first electrode is electrically connected with the first conductive element 241 through the first connector 243. The second electrode is electrically connected with the second conductive element 242 through the second connector 244. The first connector 243, the second connector 244, the first conductive element 241, and the second conductive element 242 are connecting wires of the temperature measuring component 232 for signal transmission.

[0053] The insulation component 25 is arranged in the extending component 231 and the support member 22, and is used for electrically insulating the first conductive element 241 from the second conductive element 242 and electrically insulating the first connector 243 from the second connector 244.

[0054] The first electrode and the second electrode are electrically conducted. The first conductive element 241 and the second conductive element 242 are electrically conducted in the external receiving and processing component. When there is a difference in temperatures of the two electrically conducted positions, an electrodynamic potential will be generated in a loop where the first electrode and the second electrode are located. The receiving and processing component may receive the electrodynamic potential and process the electrodynamic potential, so that the temperatures measured by the temperature measuring components 232 may be displayed.

[0055] By virtue of the above insulation component 25, the first conductive element 241 and the second conductive element 242, as well as the first connector 243 and the second connector 244 are electrically insulated, so that electrical conduction at other positions of the loop where the first electrode and the second electrode are located, except the above two electrically conducted positions, may be avoided. Thus, the accuracy of the electrodynamic potential generated on the loop may be guaranteed, and the temperature measurement accuracy of the temperature measuring apparatus is improved.

[0056] Optionally, a manufacturing material of the first electrode and a manufacturing

material of the second electrode may include precious metal.

[0057] Preferably, the manufacturing material of the first electrode may be a platinum-rhodium alloy, and the manufacturing material of the second electrode may be platinum.

5 **[0058]** Optionally, a proportion of rhodium in the platinum rhodium may range from 10% to 13%, and a proportion of platinum may range from 90% to 87%.

[0059] Preferably, the proportion of the rhodium in the platinum rhodium may be 13%, and the proportion of the platinum may be 87%.

10 **[0060]** Optionally, a manufacturing material of the first connector 243 may include precious metal. Preferably, the manufacturing material of the first connector 243 may be a platinum-rhodium alloy.

[0061] Optionally, a manufacturing material of the second connector 244 may include precious metal. Preferably, the manufacturing material of the second connector 244 may be a platinum-rhodium alloy.

15 **[0062]** Optionally, a manufacturing material of the first conductive element 241 may include precious metal. Preferably, the manufacturing material of the first conductive element 241 may be a platinum-rhodium alloy.

20 **[0063]** Optionally, a manufacturing material of the second conductive element 242 may include precious metal. Preferably, the manufacturing material of the second conductive element 242 may be a platinum-rhodium alloy.

[0064] Optionally, the manufacturing material of the first connector 243 and the manufacturing material of the first conductive element 241 may be the same, while the manufacturing material of the second connector 244 and the manufacturing material of the second conductive element 242 may be the same.

25 **[0065]** As shown in FIG. 6, in a preferred embodiment of the present disclosure, the insulation component 25 may include an insulation sleeve. A first channel and a second channel electrically insulated from each other are arranged in the insulation sleeve. The first channel is used for allowing the first conductive element 241 and the first connector 243 to pass. The second channel is used for allowing the second conductive element 242 and the second
30 connector 244 to pass. Thus, electrical insulation may be achieved between the first conductive element 241 and the second conductive element 242, as well as between the first connector 243 and the second connector 244.

[0066] As shown in FIG. 7, in a preferred embodiment of the present disclosure, a limiting component 26 is arranged on the support member 22. The limiting component 26 cooperates

with the carrying main body 21 and is used for limiting the support member 22 from rotating relative to the carrying main body 21. In this way, changes in relative positions between the temperature measuring components 232 on the support member 22 and the carrying positions may be avoided, thereby improving the stability of temperature measurement of the temperature measuring apparatus.

[0067] As shown in FIG. 8 and FIG. 9, in a preferred embodiment of the present disclosure, the limiting component 26 may be arranged on the support member 22. Specifically, the limiting component 26 is provided with a through hole sleeving the support member 22. A limiting slot is formed in the carrying main body 21. The limiting component 26 is arranged in the limiting slot. An outer circumferential surface of the limiting component 26 cooperates with an inner circumferential surface of the limiting slot so that the limiting component 26 is limited from rotating relative to the limiting slot. thereby limiting the support member 22 from rotating relative to the carrying main body 21.

[0068] As shown in FIG. 9, optionally, a flange plate 30 may be arranged at a bottom of the carrying main body 21, and the above limiting slot may be formed in an edge of the flange plate 30.

[0069] As shown in FIG. 2, optionally, a heat preservation device 31 may be arranged on the flange plate 30 to preserve heat of the wafers 32 carried on the carrying main body 21 in the semiconductor heat treatment process, thereby avoiding rapid heat dissipation of the wafers 32 carried on the carrying main body 21 in the semiconductor heat treatment process.

[0070] Optionally, a height of the limiting component 26 may be between 8 mm and 10 mm.

[0071] Optionally, a length of the limiting component 26 may be between 12 mm and 16 mm.

[0072] Optionally, a width of the limiting component 26 may be between 12 mm and 16 mm.

[0073] As shown in FIG. 11, in a preferred embodiment of the present disclosure, a fixing structure may be arranged on the support member 22. A fixing portion 271 may be arranged on the carrying main body 21. As shown in FIG. 10, the carrying apparatus may further include a fixing assembly 28 for detachably connecting the fixing structure to the fixing portion 271, to detachably fix the support member 22 on the carrying main body 21. The fixing structure and the fixing portion 271 are detachably connected by the fixing assembly 28, so that the support member 22 is detachably fixed on the carrying main body 21, which may conveniently maintain or replace the temperature measuring apparatus.

[0074] As shown in FIG. 11, in a preferred embodiment of the present disclosure, the fixing structure may include a convex 29 arranged on the support member 22. A fixing hole 272 for allowing the convex 29 to pass is formed in the fixing portion 271. An external thread 273 is

arranged on an outer circumferential wall of the fixing portion 271. The fixing assembly 28 may include a fixing member 281, a first elastic member 283, a second elastic member 284, a pressing member 285, and an elastic sealing member 286. A fixing slot 282 is formed in the fixing member 281. An internal thread cooperating with the external thread 273 is arranged on an inner circumferential wall of the fixing slot 282. The first elastic member 283, the second elastic member 284, the pressing member 285, and the elastic sealing member 286 are stacked in the fixing slot 282 in sequence from bottom to top and all sleeve the support member 22. The elastic sealing member 286 is located between the pressing member 285 and one end of the fixing portion 271 extending into the fixing slot 282.

[0075] As shown in FIG. 10 and FIG. 11, the fixing portion 271 may be arranged on the flange plate 30 at the bottom of the carrying main body 21. The fixing portion 271 extends downward along the flange plate 30, and the fixing hole 272 for allowing the convex 29 to pass is formed therein. The external thread 273 is arranged on the outer circumferential wall of the fixing portion. The internal thread on the inner circumferential wall of the fixing slot 282 is in threaded fit with the external thread 273 on the outer circumferential wall of the fixing portion 271, so that the fixing member 281 is detachably connected to the fixing portion 271. The first elastic member 283 is arranged at the bottom of the fixing slot 282 and sleeves the support member 22. The second elastic member 284 is stacked on the first elastic member 283 and sleeves the support member 22. The pressing member 285 is stacked on the second elastic member 284 and sleeves the support member 22. The elastic sealing member 286 is stacked on the pressing member 285, sleeves the support member 22, and is located between the pressing member 285 and the end of the fixing portion 271 extending into the fixing slot 282. By means of the threaded fit between the fixing member 281 and the fixing portion 271, the first elastic member 283, the second elastic member 284, the pressing member 285, and the elastic sealing member 286 are pressed and fixed in the fixing slot 282. The first elastic member 283, the second elastic member 284, the pressing member 285, and the elastic sealing member 286 all sleeve the support member 22, so that the support member 22 is clamped therein through the first elastic member 283, the second elastic member 284, the pressing member 285, and the elastic sealing member 286, thus detachably fixing the support member 22 on the carrying main body 21 and avoiding the support member 22 from shaking relative to the fixing hole 272 and the fixing slot 282. Thus, the changes in the relative positions between the temperature measuring components 232 on the support member 22 and the carrying positions may be avoided, thereby improving the stability of temperature measurement of the temperature measuring apparatus.

[0076] Optionally, the elastic sealing member 286 may include an O-shaped rubber ring.

[0077] Optionally, a manufacturing material of the first elastic member 283 may include poly tetra fluoroethylene (PTFE).

5 **[0078]** Optionally, a manufacturing material of the second elastic member 284 may include PTFE.

[0079] Optionally, a manufacturing material of the pressing member 285 may include stainless steel.

10 **[0080]** As shown in FIG. 2 and FIG. 3, as another technical solution, an embodiment of the present disclosure also provides a semiconductor heat treatment device, including a loading chamber 201, a process module 202, and the carrying apparatus as provided in the embodiments of the present disclosure. The loading chamber 201 and the process module 202 are interconnected with each other, and the carrying apparatus is able to move between the loading chamber 201 and the process module 202.

15 **[0081]** In conclusion, by virtue of the above carrying apparatus provided by the embodiments of the present disclosure, the semiconductor heat treatment device provided by the embodiment of the present disclosure may improve the accuracy of temperature measurement on the wafers, without cooperative use with other temperature measuring elements, which improves the yield of the wafers, reduces the cost, and increases the utilization rate of the semiconductor heat treatment device. In addition, interference of the temperature measuring assemblies on the
20 support member on the movement of the carrying main body may also be avoided, thereby guaranteeing normal transportation of the carrying apparatus in the semiconductor heat treatment device.

[0082] It may be understood that the above implementations are merely exemplary implementations used to illustrate the principles of the present disclosure, but the present
25 disclosure is not limited thereto. For those of ordinary skill in the art, various modifications and improvements may be made without departing from the spirit and essence of the present disclosure, and these modifications and improvements are also deemed to fall within the protection scope of the present disclosure.

WHAT IS CLAIMED IS:

1. A carrying apparatus of a semiconductor heat treatment device, comprising a carrying main body, wherein the carrying main body comprises a plurality of carrying positions for carrying
5 wafers, and the plurality of carrying positions are arranged at intervals in an axial direction of the carrying main body; the carrying apparatus further comprises a temperature measuring apparatus; the temperature measuring apparatus comprises a support member and a plurality of temperature measuring assemblies; the support member is connected to the carrying main body, and is located on outer sides of edges of the carrying positions of the carrying main body; and
10 the plurality of temperature measuring assemblies are arranged on the support member at intervals in the axial direction of the carrying main body, and each temperature measuring assembly has a temperature measuring end extending to an inner side of the edge of each carrying position and is used for detecting a temperature of a sub-region corresponding to the temperature measuring end.
- 15 2. The carrying apparatus of the semiconductor heat treatment device according to claim 1, wherein the temperature measuring ends and centers of the carrying positions are opposite in the axial direction of the carrying main body.
3. The carrying apparatus of the semiconductor heat treatment device according to claim 1 or 2, wherein each temperature measuring assembly comprises an extending component and a
20 temperature measuring component; one end of the extending component is connected to the support member, and the other end of the extending component is used as each temperature measuring end extending to the inner side of the edge of each carrying position;
the temperature measuring component is arranged in the extending component, and is located at the temperature measuring end; and a connecting wire of the temperature measuring
25 component is led out through the extending component and the support member in sequence.
4. The carrying apparatus of the semiconductor heat treatment device according to claim 3, wherein each temperature measuring component comprises a thermocouple; the thermocouple comprises a first electrode, a second electrode, a first connector, a second connector, a first
30 conductive element, a second conductive element, and an insulation component; the first electrode and the second electrode are arranged in the extending component at an interval and are located at the temperature measuring end; the first connector and the second connector are arranged in the extending component at an interval; the first conductive element and the second

conductive element are arranged in the support member at an interval; the first electrode is electrically connected with the first conductive element through the first connector; the second electrode is electrically connected with the second conductive element through the second connector; and

5 the insulation component is arranged in the extending component and the support member, and is used for electrically insulating the first conductive element from the second conductive element and electrically insulating the first connector from the second connector.

10 5. The carrying apparatus of the semiconductor heat treatment device according to claim 4, wherein the insulation component comprises an insulation sleeve; a first channel and a second channel electrically insulated from each other are arranged in the insulation sleeve; the first channel is used for allowing the first conductive element and the first connector to pass; and the second channel is used for allowing the second conductive element and the second connector to pass.

15 6. The carrying apparatus of the semiconductor heat treatment device according to claim 1, wherein a limiting component is arranged on the support member; and the limiting component cooperates with the carrying main body and is used for limiting the support member from rotating relative to the carrying main body.

20 7. The carrying apparatus of the semiconductor heat treatment device according to claim 6, wherein the limiting component is arranged on the support member; a limiting slot is formed in the carrying main body; the limiting component is arranged in the limiting slot; and an outer circumferential surface of the limiting component cooperates with an inner circumferential surface of the limiting slot so that the limiting component is limited from rotating relative to the limiting slot.

25 8. The carrying apparatus of the semiconductor heat treatment device according to claim 1, wherein a fixing structure is arranged on the support member; a fixing portion is arranged on the carrying main body; and the carrying apparatus further comprises a fixing assembly for detachably connecting the fixing structure to the fixing portion.

30 9. The carrying apparatus of the semiconductor heat treatment device according to claim 8, wherein the fixing structure comprises a convex arranged on the support member; a fixing hole for allowing the convex to pass is formed in the fixing portion; an external thread is arranged on an outer circumferential wall of the fixing portion;

the fixing assembly comprises a fixing member, a first elastic member, a second elastic

member, a pressing member, and an elastic sealing member;

5 a fixing slot is formed in the fixing member; an internal thread cooperating with the external thread is arranged on an inner circumferential wall of the fixing slot; the first elastic member, the second elastic member, the pressing member, and the elastic sealing member are stacked in the fixing slot in sequence from bottom to top and all sleeve the support member; and the elastic sealing member is located between the pressing member and one end of the fixing portion extending into the fixing slot.

10 10. A semiconductor heat treatment device, comprising a loading chamber, a process module, and the carrying apparatus according to any one of claims 1 to 9, wherein the loading chamber and the processor module communicate with each other; and the carrying apparatus is able to move between the loading chamber and the process module.