CLEANING DEVICE AND WET PROCESSING APPARATUS

FIELD OF THE INVENTION

The present application relates to the technical field of semiconductor manufacturing, and more particularly, to a cleaning device and a wet processing apparatus.

BACKGROUND

The basic processes of photolithography generally include three major steps: photoresist coating, exposure, and development. The purpose of the photoresist coating process is to form a thin, uniform, and defect-free photoresist layer on the surface of a substrate. Exposure transfers the pattern on a photomask onto the photoresist layer by means of an exposure lamp or other radiation sources. After exposure, the device or circuit pattern is recorded on the photoresist layer in the form of exposed and unexposed regions. After development, the pattern of the photomask is fixed on the photoresist layer. After the photolithography process, an etching process or an ion implantation process can be performed using the photoresist layer as a mask. After etching or ion implantation, the photoresist on the substrate surface needs to be removed.

A commonly used chemical solution for removing photoresist by wet cleaning is Sulfuric Acid-Hydrogen Peroxide Mixture (SPM). The cleaning steps are as follows: hydrogen peroxide is injected into a sulfuric acid solution, and the hydrogen peroxide reacts exothermically with sulfuric acid to form the high-temperature SPM chemical solution; the SPM chemical solution is sprayed onto the surface of the photoresist, and the SPM chemical solution reacts with the photoresist to remove the photoresist; thereafter, the substrate surface is rinsed with deionized water; finally, the substrate surface is dried with nitrogen gas. Recent research results show that heating sulfuric acid to a high temperature (e.g., above 180°C) is conducive to removing photoresist after high-dose ion implantation.

Therefore, it is necessary to provide a cleaning device and a wet processing apparatus to solve the problem of how to heat sulfuric acid to a high temperature.

SUMMARY

An object of the present invention is to solve the problem of how to heat sulfuric acid to a high temperature.

To solve the above problem, an embodiment of the present invention provides a cleaning device comprising:

a swing arm, having an accommodation cavity;

a nozzle, arranged at a first end of the swing arm, and configured to output fluid;

a fluid conveying device, arranged inside the accommodation cavity, including a flow channel configured to allow a first fluid to pass through, the flow channel being in communication with the nozzle so as to convey the first fluid to the nozzle;

a heating device, arranged inside the accommodation cavity, and configured to heat the first fluid inside the flow channel.

An embodiment of the present invention provides a wet processing apparatus, comprising:

a chamber;

a substrate supporting device, arranged inside the chamber, and configured to support a substrate;

the above-described cleaning device, the nozzle of the cleaning device being configured to supply fluid to the substrate.

In the cleaning device provided by the present application, the fluid conveying device and the heating device are integrated together inside the accommodation cavity of the swing arm. The fluid conveying device includes a flow channel, and the heating device is configured to heat the first fluid inside the flow channel, so that the first fluid can be heated to a high temperature to meet process requirements.

Other features and corresponding beneficial effects of the present invention are

set forth in the latter part of the specification, and it should be understood that at least part of the beneficial effects will become apparent from the description of the present specification.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and performance of the present application are further described by the following embodiments and the accompanying drawings of the embodiments.

FIG. 1 is a cross-sectional view of a cleaning device according to an embodiment of the present application;

FIG. 2 is a partial cross-sectional view of a cleaning device according to an embodiment of the present application;

FIG. 3a is a cross-sectional view taken along section line AA in FIG. 2;

FIGS. 3b and 3c are schematic views of one arrangement of a fluid conveying device and a heating device of a cleaning device according to an embodiment of the present application;

FIG. 4 is a cross-sectional view of a cleaning device according to another embodiment of the present application;

FIG. 5 is a cross-sectional view taken along section line BB in FIG. 4;

FIG. 6 is a schematic view of one arrangement of a reflective layer and a thermal insulation member of a cleaning device according to an embodiment of the present application;

FIG. 7 is a schematic structural view of a wet processing apparatus according to an embodiment of the present application;

FIG. 8 is a flow chart of a process for supplying SPM chemical solution to a substrate using a cleaning device according to an embodiment of the present application.

EMBODIMENTS OF THE INVENTION

The embodiments of the present invention are described below with specific examples, and those skilled in the art can easily understand other advantages and effects of the present invention from the content disclosed in the present specification. Although the description of the present invention will be introduced in conjunction with preferred embodiments, this does not mean that the features of the present invention are limited to these embodiments. On the contrary, the purpose of introducing the invention in conjunction with the embodiments is to cover other selections or modifications that may be extended based on the claims of the present invention. To provide a thorough understanding of the present invention, the following description will contain many specific details. The present invention may also be practiced without these details. In addition, in order to avoid confusion or obscuring the focus of the present invention, some specific details will be omitted in the description. It should be noted that the embodiments in the present invention and the features in the embodiments may be combined with each other, provided no conflict arises.

It should be noted that, in the present specification, similar reference numerals and letters denote similar items in the following accompanying drawings, and therefore, once an item is defined in one accompanying drawing, it is not necessary to further define and explain the item in subsequent accompanying drawings.

The technical solutions of the present invention will be clearly and completely described below with reference to the accompanying drawings. Obviously, the described embodiments are part of the embodiments of the present invention, rather than all of the embodiments. Based on the embodiments of the present invention, all other embodiments obtained by those of ordinary skill in the art without creative efforts shall fall within the protection scope of the present invention.

In the description of the present invention, it should be noted that the terms "center," "upper," "lower," "left," "right," "vertical," " horizontal," "inner," "outer," and the like indicate orientations or positional relationships based on the orientations or positional relationships shown in the accompanying drawings, and are only for the convenience of describing the present invention and simplifying the description, rather than indicating or implying that the referred device or element must have a specific

orientation, be constructed and operated in a specific orientation, and thus should not be construed as limiting the present invention. In addition, the terms "first," "second," and "third," are used for descriptive purposes only and should not be construed as indicating or implying relative importance.

In the description of the present invention, it should be noted that, unless otherwise explicitly specified and limited, the terms "mount," "interconnect," and "connect," shall be understood broadly. For example, the connection may be a fixed connection, a detachable connection, or an integral connection; the connection may be a mechanical connection or an electrical connection; the connection may be a direct connection, an indirect connection through an intermediate medium, or an internal connection between two elements. Those of ordinary skill in the art can understand the specific meanings of the above terms in the present invention according to specific situations.

To further clarify the objects, technical solutions, and advantages of the present invention, the embodiments of the present invention will be further described in detail below with reference to the accompanying drawings.

FIG. 1 is a cross-sectional view of a cleaning device according to an embodiment of the present application; FIG. 2 is a partial cross-sectional view of a cleaning device according to an embodiment of the present application; and FIG. 3a is a cross-sectional view taken along section line AA in FIG. 2;

According to FIGS. 1 to 3a, the present application provides a cleaning device 1, comprising a swing arm 100, a nozzle 200, a fluid conveying device 300, and a heating device 400. The nozzle 200 is arranged at a first end of the swing arm 100. The swing arm 100 has an accommodation cavity. The fluid conveying device 300 is arranged inside the accommodation cavity of the swing arm 100. The fluid conveying device 300 includes a flow channel 330 configured to allow a first fluid to pass through. The flow channel 330 includes a fluid inlet 310 and a fluid outlet 320. The fluid outlet 320 of the flow channel 330 is in communication with the nozzle 200 so as to convey the first fluid to the nozzle 200. The heating device 400 is arranged inside the accommodation cavity of the swing arm 100 and configured to heat the first fluid inside the flow channel 330, so that the first fluid is heated to a target temperature, e.g., above

190°C, to meet process requirements. In the present embodiment, the fluid conveying device 300 has a housing 331 defining the above-mentioned flow channel 330. The first fluid may be sulfuric acid (H_2SO_4). The nozzle 200 may be made of a high-temperature-resistant, corrosion-resistant, and high-purity material, such as quartz, silicon carbide, or the like.

In some embodiments, the flow channel 330 is arranged around the outer periphery of the heating device 400. According to FIGS. 2 and 3a, the fluid conveying device 300 includes the housing 331, and the housing 331 includes an inner housing 3301 and an outer housing 3302. The flow channel 330 is formed by the space between the inner housing 3301 and the outer housing 3302. The heating device 400 is arranged inside the inner housing 3301, so that the flow channel 330 surrounds the outer periphery of the heating device 400. Specifically, the inner wall of the inner housing 3301 defines a groove 340, and the heating device 400 is integrated inside the groove 340, which can reduce heat loss of the heating device 400. In the example shown in FIGS. 1 to 3a, the flow channel 330 has a linear shape in appearance, and the cross-section of the flow channel 330 is circular-annular. In other embodiments, the flow channel 330 may have a spiral shape in appearance. In other embodiments, as shown in FIG. 3b, the heating device 400 may be arranged to surround the outer periphery of the fluid conveying device 300; alternatively, as shown in FIG. 3c, the heating device 400 is arranged at a side of the fluid conveying device 300. In the example shown in FIGS. 3b and 3c, the housing 331 is a single-layer housing, the flow channel 330 is enclosed by the housing 331, and the heating device 400 is arranged outside the housing 331.

In some embodiments, according to FIGS. 2 and 3a, the cleaning device 1 further comprises brackets 500 configured to support the heating device 400 inside the accommodation cavity of the swing arm 100. Specifically, the brackets 500 support the heating device 400 inside the groove 340.

In some embodiments, the heating device 400 includes at least one heating lamp, such as an infrared lamp.

In the example shown in FIGS. 1 to 3a, the heating device 400 includes one heating lamp. One bracket 500 is mounted at each of the two ends of the heating lamp

to clamp the heating lamp, so as to support the heating lamp inside the groove 340. When the heating lamp needs to be replaced, the heating lamp can be removed from the brackets 500.

FIG. 4 is a cross-sectional view of a cleaning device according to another embodiment of the present application; FIG. 5 is a cross-sectional view taken along section line BB in FIG. 4.

In the example shown in FIGS. 4 and 5, a heating device 400′ includes two heating lamps. One end of each heating lamp is mounted on the bottom wall of the groove 340, and the other end of each heating lamp is supported by a bracket 500′. It should be noted that, with respect to FIGS. 1 to 5, identical elements or elements having identical functions are denoted by identical reference numerals, and repeated description is omitted.

In some embodiments, according to FIG. 1, the cleaning device 1 further comprises a first temperature sensor 610, a second temperature sensor 620, a flow meter 700, and a controller 800. The first temperature sensor 610 is configured to detect the temperature of the first fluid before the first fluid enters the flow channel 330. The second temperature sensor 620 is configured to detect the temperature of the first fluid flowing out of the flow channel 330. The first temperature sensor 610 and the second temperature sensor 620 may be of a resistance temperature detector, a thermistor, a thermocouple, or the like. Specifically, the first temperature sensor 610 is arranged on a first fluid supply pipe 350, and the second temperature sensor 620 is arranged at the fluid outlet 320. A description of the first fluid supply pipe 350 will be given later.

The flow meter 700 is configured to detect the flow rate of the first fluid introduced into the flow channel 330. The controller 800 is connected to the flow meter 700, the heating device 400, the first temperature sensor 610, and the second temperature sensor 620, respectively, and is configured to obtain the temperature difference ΔT according to a target temperature T of the first fluid flowing out of the flow channel 330 and the temperature T1 of the first fluid detected by the first temperature sensor 610, where ΔT = T minus T1, and control power of the heating device 400 according to the temperature difference ΔT and the flow rate of the first fluid detected by the flow meter 700. The present application imposes no limitation on

connection manners between the controller 800 and the flow meter 700, the heating device 400, the first temperature sensor 610, and the second temperature sensor 620, which may be wired connections or wireless connections.

In some embodiments, the calculation formula for heating power of the heating device 400 is: $P = C \times \rho \times Q \times \Delta T$, where P is the heating power of the heating device 400; C is the specific heat capacity of the first fluid; ρ is the density of the first fluid; Q is the flow rate of the first fluid introduced into the flow channel 330; ΔT is the above-mentioned temperature difference, i.e., the difference between a target temperature T of the first fluid flowing out of the flow channel 330 and the temperature T1 of the first fluid detected by the first temperature sensor 610, i.e., ΔT = T minus T1. When the flow rate of the first fluid is constant, the temperature T1 of the first fluid before entering the flow channel 330 is detected by the first temperature sensor 610, and the corresponding heating power P is determined based on the difference between the above-described target temperature T and the temperature T1, i.e., ΔT = T minus T1, so that the heating device 400 heats the first fluid inside the flow channel 330. Further, the temperature T2 of the first fluid flowing out of the flow channel 330 is detected by the second temperature sensor 620, so as to determine whether the temperature T2 reaches the target temperature T.

In some embodiments, according to FIG. 2, the cleaning device 1 further comprises a third temperature sensor 630 arranged on the fluid conveying device 300. Specifically, the third temperature sensor 630 is arranged on the outer housing 3302 of the fluid conveying device 300, and can timely detect whether the surface temperature of the outer housing 3302 is too high. When the third temperature sensor 630 detects that the temperature of the outer housing 3302 is too high, the third temperature sensor 630 sends an over-temperature signal to an alarm device, and the alarm device issues an alarm. The third temperature sensor 630 may be of a resistance temperature detector, a thermistor, a thermocouple, or the like.

In some embodiments, the cleaning device 1 further comprises a reflective layer. The reflective layer is configured to reflect light emitted by the heating device 400 (specifically, a heating lamp) back into the flow channel 330 when the light passes through the flow channel 330 and reaches the reflective layer. The reflected light acts on the first fluid inside the flow channel 330, thereby effectively utilizing the

irradiation light of the heating lamp. The reflective layer may be aluminum foil. Specifically, according to FIG. 2, when the heating device 400 is arranged inside the inner housing 3301 of the fluid conveying device 300, the reflective layer (not shown in FIG. 2) may be arranged on the outer periphery of the outer housing 3302, or the reflective layer may be arranged on the inner periphery of the swing arm 100.

FIG. 6 is a schematic view of one arrangement of a reflective layer and a thermal insulation member of a cleaning device according to an embodiment of the present application. In FIG. 6, the fluid conveying device 300 includes the housing 331, the flow channel 330 is enclosed by the housing 331, and the heating device 400 is arranged outside the housing 331. For convenience of description, the housing 331 of the fluid conveying device 300 is divided into two parts, namely 331a and 331b. The upper half of the housing 331 facing away from the heating device 400 is denoted as housing 331a, indicated by a solid outline; the lower half of the housing 331 close to the heating device 400 is denoted as housing 331b, indicated by a dashed outline. The region divided by the dashed outline represents a light-transmitting region, which enables the light emitted by the heating device 400 to smoothly pass through the housing 331b into the flow channel 330, so as to heat the first fluid inside the flow channel 330. When the heating device 400 is arranged outside the housing 331, the reflective layer 940 may be arranged not only on the inner periphery of the swing arm 100, but also on the side of the fluid conveying device 300 facing away from the heating device 400. For example, as shown in FIG. 6, the reflective layer 940 is arranged on the housing 331a of the fluid conveying device 300 facing away from the heating device 400. In this case, the arrangement length of the reflective layer 940 is half of the perimeter of the housing 331, provided that the reflective layer 940 does not block the light emitted by the heating device 400 toward the flow channel 330. In FIG. 6, solid arrows represent incident light of the heating device 400, and dashed arrows represent reflected light. In other embodiments, the arrangement length of the reflective layer 940 may be less than half of the perimeter of the housing 331, or may be greater than half of the perimeter of the housing 331 to a certain extent. It should be noted that the structure of the reflective layer 940 shown in FIG. 6 is only an example, and the present embodiment imposes no special limitation on the arrangement length of the reflective layer 940.

In some embodiments, the cleaning device 1 further comprises a thermal insulation member 910 covering at least a partial region of the outer side of the fluid conveying device 300 to perform thermal insulation and heat preservation. According to FIG. 2, when the heating device 400 is arranged inside the inner housing 3301 of the fluid conveying device 300, the thermal insulation member 910 may cover the entire outer periphery of the outer housing 3302, and the thermal insulation member 910 may also cover the entire inner periphery or outer periphery of the swing arm 100. According to FIG. 6, when the heating device 400 is arranged outside the fluid conveying device 300, the thermal insulation member 910 may cover not only the entire inner periphery or outer periphery of the swing arm 100, but also part of the outer side of the fluid conveying device 300. Specifically, the thermal insulation member 910 covers the side of the fluid conveying device 300 facing away from the heating device 400. For example, as shown in FIG. 6, the thermal insulation member 910 covers the housing 331a of the fluid conveying device 300 facing away from the heating device 400. In this case, the arrangement length of the thermal insulation member 910 is half of the perimeter of the housing 331, provided that the thermal insulation member 910 does not affect heat transfer from the heating device 400 to the interior of the flow channel 330. The thermal insulation member 910 may be quartz wool. In other embodiments, the arrangement length of the thermal insulation member 910 may be less than half of the perimeter of the housing 331, or may be greater than half of the perimeter of the housing 331 to a certain extent. It should be noted that the structure of the thermal insulation member 910 shown in FIG. 6 is only an example, and the present embodiment imposes no special limitation on the arrangement length of the thermal insulation member 910. When the cleaning device 1 comprises the reflective layer 940, the thermal insulation member 910 covers the outer periphery of the reflective layer 940.

In some embodiments, according to FIG. 2, the swing arm 100 of the cleaning device 1 includes a body 920, the above-mentioned accommodation cavity is located inside the body 920, and the body 920 is made of stainless steel material.

In some embodiments, the swing arm 100 of the cleaning device 1 further includes an anti-corrosion layer 930 covering the outer periphery of the body 920 to prevent the body 920 from being corroded by acid gas in a process environment. The material of

the anti-corrosion layer 930 is Perfluoroalkoxy Alkane (PFA) or Polytetrafluoroethylene (PTFE).

In some embodiments, according to FIG. 1, the cleaning device 1 further comprises a column 110 arranged at a second end of the swing arm 100 and configured to drive the swing arm 100 to lift and rotate. A pipeline passage 111 is arranged inside the column 110 to allow a pipeline or wire to pass through, such as a power cord of the heating device 400 and a pipeline connected to the flow channel 330.

In some embodiments, according to FIG. 1, the cleaning device 1 further comprises the first fluid supply pipe 350, a first control valve 351, a pre-heater 352, a bypass branch pipe 360, and a second control valve 361. The first fluid supply pipe 350 is in communication with the fluid inlet 310 and configured to supply the first fluid to the flow channel 330 through the fluid inlet 310. The first control valve 351 is in communication with the first fluid supply pipe 350, arranged between the pre-heater 352 and the fluid inlet 310, and configured to control the on/off of the first fluid supply pipe 350. The pre-heater 352 is in communication with the first fluid supply pipe 350 and configured to heat the first fluid before the first fluid enters the flow channel 330, e.g., to about 170°C. The bypass branch pipe 360 is in communication with the first fluid supply pipe 350 and connected between the pre-heater 352 and the first control valve 351, and configured to allow the first fluid heated by the pre-heater 352 to flow into the bypass branch pipe 360 when the first control valve 351 is closed, so as to maintain a stable temperature of the first fluid. The first fluid in the bypass branch pipe 360 flows back to a liquid storage device for storing the first fluid. In some examples, the liquid storage device may also serve as a liquid supply source of the first fluid supply pipe 350. The second control valve 361 is in communication with the bypass branch pipe 360 and configured to control the on/off of the bypass branch pipe 360. Wherein, the above-mentioned flow meter 700 is arranged on the first fluid supply pipe 350. The pre-heater 352 may be an existing heater. In addition, the working process of this part will be described in detail in the process flow later.

In some embodiments, according to FIG. 7, the cleaning device 1 further comprises a fluid branch 210 configured to supply a second fluid to the nozzle 200. Further, according to FIGS. 2 and 7, the nozzle 200 includes a converging portion 220. The converging portion 220 is in communication with the fluid outlet 320 of the flow

channel 330 and the fluid branch 210, and has a compact structure. The first fluid output from the flow channel 330 of the fluid conveying device 300 and the second fluid output from the fluid branch 210 are mixed in the converging portion 220 and then flow out of the nozzle 200. In the present example, the converging portion 220 is integrated in the nozzle 200; in other examples, the converging portion 220 and the nozzle 200 may also be separate components. In the present embodiment, the second fluid may be hydrogen peroxide (H_2O_2).

When the first fluid is sulfuric acid and the second fluid is hydrogen peroxide, the sulfuric acid and the hydrogen peroxide are mixed in the converging portion 220 to form SPM chemical solution, and then the SPM chemical solution flows out of the nozzle 200. The SPM chemical solution is suitable, for example, for removing photoresist formed on the surface of a substrate 1000. In the present application, the sulfuric acid inside the flow channel 330 can be heated by the heating device 400 to above 190°C. Moreover, the ultra-high-temperature sulfuric acid generates heat when mixed with room-temperature hydrogen peroxide, so that the SPM chemical solution is heated to a temperature higher than 190°C, for example, above 200°C, when reaching the nozzle 200. Thus, the photoresist formed on the surface of the substrate 1000 can be removed, the photoresist removal efficiency can be significantly improved, and the consumption of the SPM chemical solution can be saved.

In some embodiments, according to FIGS. 2 and 7, the cleaning device 1 further comprises an exhaust passage 230. The exhaust passage 230 is in communication with the converging portion 220 of the nozzle 200 and configured to exhaust bubbles generated when sulfuric acid and hydrogen peroxide are mixed in the converging portion 220. The exhaust passage 230 may be arranged at the top or the side of the nozzle 200.

According to FIG. 7, the present application provides a wet processing apparatus, comprising a chamber 2, a substrate supporting device 3, and the above-described cleaning device 1. The substrate supporting device 3 is arranged inside the chamber 2 and configured to support the substrate 1000. The nozzle 200 of the cleaning device 1 is configured to supply fluid to the substrate 1000, the fluid may be a mixed fluid formed by mixing the first fluid and the second fluid, such as the SPM chemical solution.

FIG. 8 is a flow chart of a process for supplying the SPM chemical solution to a substrate using a cleaning device according to an embodiment of the present application.

Exemplarily, according to FIGS. 1 to 8, based on the cleaning device 1 of the above-described wet processing apparatus, the process flow for supplying the SPM chemical solution to the substrate 1000 is described as follows:

Step S01: The substrate supporting device 3 rotates the substrate 1000;

Step S02: The fluid branch 210 is opened to supply hydrogen peroxide (H_2O_2) to the substrate 1000;

Step S03: The first control valve 351 is opened, and the second control valve 361 is closed, so as to open the first fluid supply pipe 350 and close the bypass branch pipe 360;

Step S04: Sulfuric acid (H_2SO_4) is supplied to the first fluid supply pipe 350, so that the sulfuric acid in the first fluid supply pipe 350 enters the flow channel 330 from the fluid inlet 310;

Step S05: The heating lamp is turned on to heat the sulfuric acid inside the flow channel 330;

Step S06: The sulfuric acid heated by the heating lamp enters the converging portion 220 through the fluid outlet 320, and is mixed with hydrogen peroxide to form the SPM chemical solution; the SPM chemical solution is supplied to the substrate 1000 through the nozzle 200 to perform SPM treatment on the substrate 1000;

Step S07: After the SPM treatment on the substrate 1000 is completed, the heating lamp is turned off;

Step S08: The first control valve 351 is closed, and the second control valve 361 is opened, so as to shut off the first fluid supply pipe 350, so that the sulfuric acid heated by the pre-heater 352 flows into the bypass branch pipe 360 to maintain stable temperature of the sulfuric acid; the sulfuric acid in the bypass branch pipe 360 flows

back into the liquid storage device. In this process, the pre-heater 352 is always in a heating state to avoid temperature fluctuation of the sulfuric acid caused by start-stop operations;

Step S09: The fluid branch 210 is closed to stop supplying hydrogen peroxide to the substrate 1000.

The embodiments of the present application have been described above, but the present application is not limited to the above-described embodiments, and various modifications can be made without departing from the spirit of the present application.

Finally, it should be noted that the above embodiments are only used to illustrate the technical solutions of the present invention, rather than limiting the present invention. Although the present invention has been described in detail with reference to the foregoing embodiments, those of ordinary skill in the art should understand that they can still modify the technical solutions described in the foregoing embodiments, or make equivalent substitutions for some or all of the technical features of the embodiments; and these modifications or substitutions do not make the essence of the corresponding technical solutions depart from the scope of the technical solutions of the embodiments of the present invention.

What is claimed is:

1. A cleaning device, comprising:

a swing arm, having an accommodation cavity;

a nozzle, arranged at a first end of the swing arm, and configured to output fluid;

a fluid conveying device, arranged inside the accommodation cavity, including a flow channel configured to allow a first fluid to pass through, the flow channel being in communication with the nozzle so as to convey the first fluid to the nozzle;

a heating device, arranged inside the accommodation cavity, and configured to heat the first fluid inside the flow channel.

2. The cleaning device according to claim 1, wherein the flow channel is arranged around the outer periphery of the heating device.

3. The cleaning device according to claim 2, wherein the fluid conveying device includes a housing, the housing includes an inner housing and an outer housing, the flow channel is formed by the space between the inner housing and the outer housing, and the heating device is arranged inside the inner housing.

4. The cleaning device according to claim 1, wherein the fluid conveying device includes a housing, the flow channel is enclosed by the housing, and the heating device is arranged outside the housing.

5. The cleaning device according to claim 1, further comprising:

a first temperature sensor, configured to detect the temperature of the first fluid before entering the flow channel;

a flow meter, configured to detect the flow rate of the first fluid introduced into the flow channel;

a controller, connected to the flow meter, the heating device, and the first temperature sensor, respectively, and configured to obtain the temperature difference

according to a target temperature of the first fluid flowing out of the flow channel and the temperature of the first fluid detected by the first temperature sensor, and control power of the heating device according to the temperature difference and the flow rate of the first fluid detected by the flow meter.

6. The cleaning device according to claim 5, wherein the calculation formula for heating power of the heating device is $P = C \times \rho \times Q \times \Delta T$;

where P is the heating power of the heating device;

C is the specific heat capacity of the first fluid;

ρ is the density of the first fluid;

Q is the flow rate of the first fluid introduced into the flow channel;

ΔT is the difference between the target temperature and the temperature of the first fluid detected by the first temperature sensor.

7. The cleaning device according to claim 5, further comprising:

a second temperature sensor, configured to detect the temperature of the first fluid flowing out of the flow channel.

8. The cleaning device according to claim 7, further comprising:

a third temperature sensor, configured to detect the surface temperature of the fluid conveying device.

9. The cleaning device according to claim 1, wherein the cleaning device further comprises a bracket configured to support the heating device inside the accommodation cavity.

10. The cleaning device according to claim 1, wherein the heating device includes at least one heating lamp.

11. The cleaning device according to claim 10, further comprising:

a reflective layer, configured to reflect light emitted by the heating lamp back into the flow channel when the light passes through the flow channel and reaches the reflective layer.

12. The cleaning device according to claim 1, further comprising:

a thermal insulation member, covering at least a partial region of the outer side of the fluid conveying device.

13. The cleaning device according to claim 1, further comprising:

a first fluid supply pipe, in communication with the flow channel;

a first control valve, in communication with the first fluid supply pipe, and configured to control the on/off of the first fluid supply pipe;

a pre-heater, in communication with the first fluid supply pipe, and configured to heat the first fluid before the first fluid enters the flow channel.

14. The cleaning device according to claim 13, further comprising:

a bypass branch pipe, in communication with the first fluid supply pipe, connected between the pre-heater and the first control valve, and configured to allow the first fluid heated by the pre-heater to flow into the bypass branch pipe when the first control valve is closed;

a second control valve, in communication with the bypass branch pipe, and configured to control the on/off of the bypass branch pipe.

15. The cleaning device according to claim 1, wherein the swing arm includes:

a body, the accommodation cavity being located inside the body, and the body being made of stainless steel material.

16. The cleaning device according to claim 15, wherein the swing arm further includes:

an anti-corrosion layer, covering the outer periphery of the body.

17. The cleaning device according to claim 16, wherein the material of the anti-corrosion layer is PFA or PTFE.

18. The cleaning device according to claim 1, further comprising:

a fluid branch, configured to supply a second fluid to the nozzle;

wherein the nozzle includes a converging portion, and the converging portion is in communication with the flow channel and the fluid branch, so that the first fluid and the second fluid are mixed in the converging portion and then flow out of the nozzle.

19. The cleaning device according to claim 18, further comprising:

an exhaust passage, in communication with the converging portion.

20. A wet processing apparatus, comprising:

a chamber;

a substrate supporting device, arranged inside the chamber, and configured to support a substrate;

the cleaning device according to any one of claims 1 to 19, the nozzle of the cleaning device being configured to supply fluid to the substrate.