## [CLAIMS]

[Claim 1]

A substrate processing apparatus comprising:

a reaction tube configured to accommodate a substrate;

a lid part configured to close a furnace opening formed at the reaction tube;

a pipe connected to a side wall around the furnace opening of the reaction tube;

a heater provided on an outer periphery of the side wall and constituted by a plurality of heater units divided along a circumferential direction of the side wall;

a plurality of temperature sensors configured to respectively measure temperatures at a plurality of positions different from each other at the side wall along the circumferential direction of the side wall; and

a controller configured to control the heater based on measured values of the plurality of the temperature sensors,

wherein at least one of the plurality of the heater units constitutes a first heater unit configured to heat the pipe together with a portion of the side wall around where the pipe is connected to the side wall, and

at least another one of the plurality of the heater units constitutes a second heater unit configured to heat another portion of the side wall other than where the pipe is connected to the side wall.

[Claim 2]

The substrate processing apparatus of claim 1, wherein the controller is

configured to individually control electric power supplied to the first heater unit and the second heater unit to heat the side wall and the pipe.

[Claim 3]

The substrate processing apparatus of claim 1, wherein the plurality of the temperature sensors comprises:

a first temperature sensor configured to measure a temperature of the portion of the side wall heated by the first heater unit; and

a second temperature sensor configured to measure a temperature of the another portion of the side wall heated by the second heater unit.

[Claim 4]

The substrate processing apparatus of claim 3, wherein the controller is configured to control electric power supplied to the first heater unit so that a measured value of the first temperature sensor to be equal to a first temperature and to control electric power supplied to the second heater unit so that a measured value of the second temperature sensor to be equal to a second temperature lower than the first temperature.

[Claim 5]

The substrate processing apparatus of claim 1, wherein the first heater unit is configured to heat a plurality of pipes comprising the pipe together with a plurality of portions of the side wall around where the plurality of the pipes comprising the pipe is connected to the side wall.

[Claim 6]

The substrate processing apparatus of claim 1, wherein the pipe comprises at least one selected from a group consisting of a gas supply pipe configured to supply a process gas into the reaction tube, a gas exhaust pipe configured to exhaust an inner atmosphere of the reaction tube and a temperature sensor protection pipe of a tubular shape configured to protect a temperature sensor inserted into the reaction tube.

[Claim 7]

The substrate processing apparatus of claim 1, wherein the first heater unit comprises:

a first heating wire provided along the circumferential direction of the side wall to face the side wall; and

a second heating wire provided in vicinity of the pipe along an extending direction of the pipe.

[Claim 8]

The substrate processing apparatus of claim 7, wherein the controller is configured to individually control electric power supplied to the first heating wire and the second heating wire to heat the side wall and the pipe.

[Claim 9]

The substrate processing apparatus of claim 7, wherein the first heater unit

comprises a pipe temperature sensor configured to measure a temperature of the pipe, and

the controller is configured to heat the pipe by controlling electric power supplied to the second heating wire based on a measured value of the pipe temperature sensor.

[Claim 10]

The substrate processing apparatus of claim 7, wherein the first heater unit further comprises a sheet of a high thermal conductivity provided between the second heating wire and the pipe.

[Claim 11]

The substrate processing apparatus of claim 7, wherein the first heater unit further comprises a storage part formed as a single body in a block shape and configured to accommodate the first heating wire and the second heating wire, and

a thermal conductivity of the storage part is equal to or lower than 0.3 W / m · K.

[Claim 12]

The substrate processing apparatus of claim 1, wherein the reaction tube is made of quartz, and

the heater comprises a heating wire wherein a peak wavelength of heat rays radiated by the heating wire when generating heat at 80 °C to 100 °C is 5 μm to 10 μm.

[Claim 13]

The substrate processing apparatus of claim 1, wherein the controller is configured to control electric power supplied to the heater such that the measured values of the plurality of temperature sensors are equal to or lower than 120 °C.

[Claim 14]

The substrate processing apparatus of claim 1, further comprising a gas supply system configured to supply a gas containing hydrogen peroxide into the reaction tube,

wherein the controller is configured to control electric power supplied to the heater such that the measured values of the plurality of temperature sensors are equal to or higher than 80 °C and are lower than 112 °C.

[Claim 15]

A heater unit provided in a substrate processing apparatus comprising a reaction tube configured to accommodate a substrate, a lid part configured to close a furnace opening formed at the reaction tube, and a pipe connected to a side wall around the furnace opening of the reaction tube,

wherein a plurality of heater units, divided along a circumferential direction of the side wall and provided on an outer periphery of the side wall, comprises the heater unit,

the heater unit comprising:

a first heating wire provided along the circumferential direction of the side wall

to face the side wall; and

a second heating wire provided in vicinity of the pipe along an extending direction of the pipe.

[Claim 16]

A method of manufacturing a semiconductor device, comprising the steps of:

providing a substrate processing apparatus comprising a reaction tube configured to accommodate a substrate, a lid part configured to close a furnace opening formed at the reaction tube, a pipe connected to a side wall around the furnace opening of the reaction tube; a heater provided on an outer periphery of the side wall and constituted by a plurality of heater units divided along a circumferential direction of the side wall, and a plurality of temperature sensors configured to respectively measure temperatures at a plurality of positions different from each other at the side wall along the circumferential direction of the side wall;

accommodating the substrate in the reaction tube; and

heating the substrate,

wherein the side wall is heated by controlling electric power supplied to the heater based on measured values of the plurality of the temperature sensors in the step of heating the substrate, and

at least one of the plurality of the heater units constitutes a first heater unit configured to heat the pipe together with a portion of the side wall around where the pipe is connected to the side wall, and

at least another one of the plurality of the heater units constitutes a second

heater unit configured to heat another portion of the side wall other than where the pipe is connected to the side wall.