

CLAIMS

[Claim 1] A substrate processing apparatus for processing a substrate, comprising:

a substrate holder configured to hold and rotate the substrate;

5 a liquid supply mechanism configured to supply a liquid from a liquid nozzle onto the substrate;

a dry fluid supply mechanism configured to supply a dry fluid from a dry fluid nozzle onto the substrate;

a nozzle movement mechanism configured to move the liquid nozzle and the dry fluid nozzle; and

10 a controller configured to control operations of the substrate holder, the liquid supply mechanism, and the dry fluid supply mechanism,

wherein the controller is configured to:

issue a command to the substrate holder to rotate the substrate at a first speed;

15 issue a command to the liquid supply mechanism to form a liquid film on an entire surface of the substrate by supplying the liquid from the liquid nozzle positioned above a center of the substrate onto the substrate for a predetermined time;

issue a command to the liquid supply mechanism to stop a supply of the liquid;

20 issue a command to the substrate holder, after rotating the substrate at the first speed, to rotate the substrate at a second speed;

issue a command to the substrate holder, after rotating the substrate at the second speed, to rotate the substrate at a third speed, and issue a command to the dry fluid supply mechanism, while rotating the substrate at the third speed, to supply the dry fluid from the dry fluid nozzle positioned above the center of the substrate onto the substrate for a predetermined time; and

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issue a command to the nozzle movement mechanism while continuing to supply the dry fluid from the dry fluid nozzle to move the dry fluid nozzle from the

center of the substrate toward a peripheral portion of the substrate,

wherein the substrate processing apparatus further comprises an inert gas supply mechanism configured to supply an inert gas from an inert gas nozzle onto the substrate,

wherein the controller is configured to issue a command to the inert gas supply
5 mechanism in a state in which the dry fluid is supplied onto the substrate, and the substrate is rotating at a fourth speed to supply the inert gas from the inert gas nozzle onto the substrate, and

wherein the controller is configured to issue a command to the nozzle movement mechanism to move the inert gas nozzle from the center of the substrate toward the
10 peripheral portion of the substrate.

[Claim 2] The substrate processing apparatus according to claim 1, wherein the second speed is faster than the first speed.

15 [Claim 3] The substrate processing apparatus according to claim 1, wherein the controller is configured to issue a command to the nozzle movement mechanism, when the dry fluid nozzle is arranged above the peripheral portion of the substrate, to dry the peripheral portion of the substrate by stopping a movement of the dry fluid nozzle for a predetermined time.

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[Claim 4] The substrate processing apparatus according to claim 1, wherein the inert gas nozzle is arranged behind the dry fluid nozzle with respect to a direction of movement of the dry fluid nozzle and the inert gas nozzle.

25 [Claim 5] The substrate processing apparatus according to claim 1, wherein the nozzle movement mechanism comprises one arm configured to hold the liquid nozzle, the dry fluid nozzle, and the inert gas nozzle.

[Claim 6] The substrate processing apparatus according to claim 1, wherein the first speed comprises a liquid film formation speed for forming a liquid film on the substrate, and a thin film formation speed for thinning a center of the liquid film,

wherein the controller is configured to issue a command to the substrate holder
5 after rotating the substrate at the liquid film formation speed to rotate the substrate at the thin film formation speed, and

wherein the thin film formation speed is faster than the liquid film formation speed.

10 [Claim 7] The substrate processing apparatus according to claim 1, wherein the nozzle movement mechanism comprises a heater arranged adjacent to the dry fluid nozzle.

[Claim 8] The substrate processing apparatus according to claim 1, wherein the dry fluid supply mechanism further comprises a conductive dry fluid supply line
15 connected to the dry fluid nozzle.

[Claim 9] The substrate processing apparatus according to claim 1, further comprising:

a ventilation mechanism arranged above the substrate holder; and
20 an exhaust duct,

wherein the ventilation mechanism and the exhaust duct are configured to form a down flow of air.

[Claim 10] The substrate processing apparatus according to claim 1, wherein the
25 dry fluid is a liquid organic solvent.

[Claim 11] The substrate processing apparatus according to claim 1, wherein the dry fluid is a gas containing a gaseous organic solvent, and

wherein a content of the organic solvent in the dry fluid is 8% to 30%.

[Claim 12] The substrate processing apparatus according to claim 1, wherein the substrate processing apparatus comprises a cover arranged around the substrate held by
5 the substrate holder, and

 wherein the cover is configured to rotate in the same direction and at the same speed as the substrate.

[Claim 13] The substrate processing apparatus according to claim 12, wherein the
10 substrate holder comprises a plurality of chucks configured to hold the peripheral portion of the substrate, and

 wherein the cover is fixed to the chucks.

[Claim 14] The substrate processing apparatus according to claim 12, comprising a
15 cover rotation mechanism configured to rotate the cover,

 wherein the cover rotation mechanism comprises:

 a cover motor; and

 a transmission device configured to transmit a rotational force of the cover motor to the cover.

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[Claim 15] A non-transitory computer-readable storage medium storing a program for use in a substrate processing apparatus for processing the substrate, the program operating on a computer, the program causes the computer to execute:

 a step of issuing a command to a substrate holder to rotate the substrate at a first
25 speed, the step of issuing a command to a liquid supply mechanism to form a liquid film onto an entire surface of the substrate by supplying a liquid from a liquid nozzle positioned above a center of the substrate onto the substrate for a predetermined time;

 a step of issuing a command to the liquid supply mechanism to stop a supply of

the liquid;

a step of issuing a command to the substrate holder to rotate the substrate at a second speed after rotating the substrate at the first speed;

5 a step of issuing a command to the substrate holder to rotate the substrate at a third speed after rotating the substrate at the second speed, the step of issuing a command to a dry fluid supply mechanism while rotating the substrate at the third speed to supply a dry fluid from a dry fluid nozzle onto the substrate for a predetermined time;

10 a step of issuing a command to a nozzle movement mechanism while continuing to supply the dry fluid from the dry fluid nozzle to move the dry fluid nozzle from the center of the substrate toward a peripheral portion of the substrate, and

wherein the program causes the computer to execute a step of issuing a command to the inert gas supply mechanism in a state in which the dry fluid is supplied onto the substrate, and the substrate is rotating at a fourth speed to supply the inert gas from the inert gas nozzle onto a front surface of the substrate.

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[Claim 16] A substrate processing method, comprising:

forming a liquid film onto an entire surface of a substrate by rotating the substrate at a first speed to supply a liquid from a liquid nozzle positioned above a center of the substrate onto the substrate for a predetermined time;

20 stopping a supply of the liquid;

rotating the substrate at a second speed after rotating the substrate at the first speed;

25 supplying a dry fluid from a dry fluid nozzle positioned above the center of the substrate onto the substrate for a predetermined time while rotating the substrate at a third speed after rotating the substrate at the second speed;

moving the dry fluid nozzle from the center of the substrate toward a peripheral portion of the substrate while continuing to supply the dry fluid from the dry fluid nozzle, and

comprising supplying an inert gas from an inert gas nozzle onto the substrate while moving the dry fluid nozzle and the inert gas nozzle from the center of the substrate toward the peripheral portion of the substrate.

- 5 [Claim 17] The substrate processing method according to claim 16, wherein supplying the inert gas from the inert gas nozzle onto the substrate comprises injecting the inert gas behind the dry fluid injection position with respect to a direction of movement of the dry fluid nozzle and the inert gas nozzle.