CLAIMS

1. A substrate processing apparatus, comprising:

a chamber;

an upper assembly located above a processing space in the chamber, the upper assembly including

a ceiling plate located above the processing space,

a base member located on the ceiling plate, and

at least one actuator configured to lift the ceiling plate and urge the ceiling plate against the base member;

at least one temperature sensor configured to measure a temperature of the ceiling plate; and

a controller, wherein the controller is configured to control the at least one actuator based on the temperature of the ceiling plate measured by the at least one temperature sensor.

2. A substrate processing apparatus, comprising:

a chamber;

an upper assembly located above a processing space in the chamber, the upper assembly including

a ceiling plate located above the processing space,

a base member located on the ceiling plate, and

at least one actuator configured to lift the ceiling plate and urge the ceiling plate against the base member;

at least one temperature sensor configured to measure a temperature distribution of the ceiling plate; and

a controller,

wherein the at least one actuator includes a plurality of actuators,

the plurality of actuators are configured to urge a plurality of portions in a plane of the ceiling plate against the base member, and

the controller is configured to control the plurality of actuators based on the temperature distribution of the ceiling plate measured by the at least one temperature sensor.

3. The substrate processing apparatus according to claim 2, wherein

the controller is configured to control, based on the temperature distribution of the ceiling plate measured by the at least one temperature sensor and a specified temperature distribution for the ceiling plate, the plurality of actuators to cause the temperature distribution of the ceiling plate to approach the specified temperature distribution.

4. The substrate processing apparatus according to claim 2, wherein the plurality of portions are arranged in at least one circle about a central axis of the ceiling plate.

5. A substrate processing apparatus, comprising:

a chamber;

an upper assembly located above a processing space in the chamber, the upper assembly including

a ceiling plate located above the processing space,

a base member located on the ceiling plate, and

at least one actuator configured to lift the ceiling plate and urge the ceiling plate against the base member;

at least one temperature sensor configured to measure a temperature of the ceiling plate; and

a controller,

wherein the upper assembly further includes a heat transfer sheet between the ceiling plate and the base member, and

the controller is configured to control the at least one actuator to increase a contact pressure of the ceiling plate against the heat transfer sheet when the temperature of the ceiling plate measured by the at least one temperature sensor is higher than a target temperature, and

control the at least one actuator to decrease the contact pressure of the ceiling plate against the heat transfer sheet when the temperature of the ceiling plate measured by the at least one temperature sensor is lower than the target temperature.

6. A substrate processing apparatus, comprising:

a chamber;

an upper assembly located above a processing space in the chamber, the upper assembly including a ceiling plate located above the processing space,

a base member located on the ceiling plate, and

at least one actuator configured to lift the ceiling plate and urge the ceiling plate against the base member;

at least one temperature sensor configured to measure a temperature of the ceiling plate; and

a controller,

wherein the upper assembly further includes a heat transfer sheet between the ceiling plate and the base member, and

the controller is configured to control the at least one actuator to adjust a contact pressure of the ceiling plate against the heat transfer sheet to set the temperature of the ceiling plate to a first target temperature during a first process in the chamber, and

control the at least one actuator to adjust the contact pressure of the ceiling plate against the heat transfer sheet to set the temperature of the ceiling plate to a second target temperature different from the first target temperature during a second process in the chamber.

7. The substrate processing apparatus according to claim 6, wherein

the first process is plasma processing of a substrate in the chamber,

the second process is plasma cleaning of the chamber,

the second target temperature is higher than the first target temperature, and

the contact pressure during the second process is lower than the contact pressure during the first process.

8. The substrate processing apparatus according to any one of claims 1 to 7, wherein

the at least one actuator includes an actuator connected to a center of the ceiling plate and configured to urge the center of the ceiling plate against the base member.

9. The substrate processing apparatus according to claim 1, 5, 6, or 7, wherein

the at least one actuator includes a plurality of actuators, and

the plurality of actuators are configured to urge a plurality of portions in a plane of the ceiling plate against the base member.

10. The substrate processing apparatus according to claim 9, wherein the plurality of portions are arranged in at least one circle about a central axis of the ceiling plate.

11. The substrate processing apparatus according to any one of claims 1 to 7, wherein

the at least one actuator includes a rod and a drive configured to move the rod vertically, and

the rod has a lower end engaged with the ceiling plate and extends upward.

12. The substrate processing apparatus according to claim 11, wherein the drive is located in the base member.

13. The substrate processing apparatus according to claim 11, wherein the at least one actuator includes an air cylinder.

14. The substrate processing apparatus according to any one of claims 1 to 7, wherein the upper assembly further includes a clamp holding a periphery of the ceiling plate and a periphery of the base member.

15. The substrate processing apparatus according to any one of claims 1 to 4, wherein the upper assembly further includes a heat transfer sheet between the ceiling plate and the base member.

16. The substrate processing apparatus according to any one of claims 1 to 7, wherein the base member has a refrigerant channel.

17. The substrate processing apparatus according to any one of claims 1 to 7, wherein

the substrate processing apparatus is a capacitively coupled plasma processing apparatus and further comprises a substrate support located in the chamber, and

the ceiling plate and the base member are included in an upper electrode in the capacitively coupled plasma processing apparatus.