DESCRIPTION

TITLE OF THE INVENTION:
PLASMA PROCESSING APPARATUS AND CONTROL METHOD

Field
[0001] Exemplary embodiments disclosed herein relate to a plasma processing apparatus and a control method.

Background
[0002] Patent Literature 1 below discloses "a plasma processing apparatus comprising: a focus ring installed outside a substrate mounted on a mounting table including a temperature control mechanism, and configured to be in contact with the mounting table via a heat transfer sheet, wherein a heat insulating layer having a heat conductivity lower than that of the focus ring is provided on a surface of the focus ring at a side of the heat transfer sheet among the surfaces of the focus ring.".

[0003] Patent Literature 2 below discloses "a stage comprising: an electrostatic chuck configured to support a substrate and an edge ring; and a base configured to support the electrostatic chuck, wherein the electrostatic chuck includes: a first region having a first upper surface and configured to support the substrate placed on the first upper surface; a second region having a second upper surface, provided integrally around the first region, and configured to support the edge ring placed on the second upper surface; a first electrode provided in the first region and configured to apply a DC voltage; a second electrode provided in the second region and configured to apply a DC voltage; and a third electrode configured to apply a bias power.".

Citation List
Patent Literature
[0004] Patent Literature 1: Japanese Patent Application Laid-open No. 2016-39344

Patent Literature 2: Japanese Patent Application Laid-open No. 2020-205379

Summary
Technical Problem
[0005] Embodiments of the present disclosure provide a technique for improving a heat conductivity between at least one of a substrate and an edge ring and a placing pedestal.

Solution to Problem

[0006] According to a first aspect of the present disclosure, there is provided
a plasma processing apparatus including a plasma processing chamber, a pedestal, a temperature adjuster, an electrostatic chuck, a first electrostatic electrode layer, a second electrostatic electrode layer, a first electrostatic adsorption power supply, a second electrostatic adsorption power supply, and an adsorptive sheet. The pedestal disposed in the plasma processing chamber and configured such that a flow path for a heat transfer medium is formed inside. The temperature adjuster configured to circulate the heat transfer medium through the flow path and to regulate a temperature of the heat transfer medium. The electrostatic chuck disposed on an upper surface of the pedestal and configured to have a substrate placing portion on which a substrate is placed and an edge ring placing portion on which an edge ring surrounding the substrate is placed. The first electrostatic electrode layer configured to be disposed in the substrate placing portion. The second electrostatic electrode layer configured to be disposed in the edge ring placing portion. The first electrostatic adsorption power supply configured to be electrically connected to the first electrostatic electrode layer. The second electrostatic adsorption power supply configured to be electrically connected to the second electrostatic electrode layer. The adsorptive sheet disposed at least one of between the substrate placing portion and the substrate placed on the substrate placing portion, or between the edge ring placing portion and the edge ring placed on the edge ring placing portion, and configured to change in adhesive strength by changing temperature.

[0006a] According to a second aspect of the present disclosure, there is provided a control method for a plasma processing apparatus, the plasma processing apparatus including: a plasma processing chamber; a pedestal disposed in the plasma processing chamber and including a flow path for a heat transfer medium is formed inside; a temperature adjuster for circulating the heat transfer medium through the flow path and to regulate a temperature of the heat transfer medium; an electrostatic chuck disposed on an upper surface of the pedestal and including a substrate placing portion on which a substrate is placed and an edge ring placing portion on which an edge ring surrounding the substrate is disposed; a first electrostatic electrode layer disposed in the substrate placing portion; a second

electrostatic electrode layer disposed in the edge ring placing portion; a first electrostatic adsorption power supply—electrically connected to the first electrostatic electrode layer; a second electrostatic adsorption power supply electrically connected to the second electrostatic electrode layer; and an adsorptive sheet disposed at least one of between the substrate placing portion and the substrate placed on the substrate placing portion, or between the edge ring placing portion and the edge ring placed on the edge ring placing portion, and changing in adhesive strength by changing temperature, the control method including: a step of controlling a temperature of the heat transfer medium by the temperature adjuster so that adhesive strength of the adsorptive sheet increases when plasma processing is performed in the plasma processing chamber; and a step of applying a clamping voltage from the first electrostatic adsorption power supply to the first electrostatic electrode layer or from the second electrostatic adsorption power supply to the second electrostatic electrode layer.

Advantageous Effects of Invention

[0007] According to embodiments of the present disclosure, the heat conductivity between at least one of the substrate and the edge ring and the placing pedestal can be improved.

Brief Description of Drawings

[0008] FIG. 1 is a diagram illustrating a configuration example of a capacitively coupled plasma processing apparatus.

FIG. 2 is a diagram illustrating an example of a configuration of a substrate support.

FIG. 3A is a graph illustrating an example of change in adhesive strength of an adsorptive sheet.

FIG. 3B is a diagram illustrating an example of adhesion of an object by the adsorptive sheet.

FIG. 4A is a diagram illustrating an example of an annular adsorptive sheet which is cut out in a plurality of separate regions.

FIG. 4B is a diagram illustrating an example of an annular adsorptive sheet which is cut out in a plurality of separate regions.

FIG. 5 is a diagram illustrating improvement in heat conductivity of a ring assembly according to an embodiment.

FIG. 6 is a diagram illustrating improvement in heat

an adsorptive sheet disposed at least one of between the substrate placing portion and the substrate placed on the substrate placing portion, or between the edge ring placing portion and the edge ring placed on the edge ring placing portion, and configured to change in adhesive strength by changing temperature,

the control method comprising:

a step of controlling a temperature of the heat transfer medium by the temperature adjuster so that adhesive strength of the adsorptive sheet increases when plasma processing is performed in the plasma processing chamber; and

a step of applying a clamping voltage from the first electrostatic adsorption power supply to the first electrostatic electrode layer or from the second electrostatic adsorption power supply to the second electrostatic electrode layer.

Reference Signs List

[0092] 1 plasma processing apparatus

2 controller

2a computer

2a1 processing unit

2a2 storage

2a3 communication interface

10 plasma processing chamber

10a side wall

10b ceiling plate

10e gas discharge port

10s plasma processing space

11 substrate support

13 shower head

13a gas supply port

13b gas diffusion chamber