

SUMMARY

[0005] According to a first aspect of the present invention, there is provided a plasma processing apparatus includes a placing table and a voltage application unit. The placing table includes a focus ring placed thereon and a first electrode and a second electrode provided therein so as to face the focus ring to electrostatically attract the focus ring. The voltage application source is configured to apply, to the first electrode, a first direct current (DC) voltage which cyclically alternates between different polarities with a first predetermined period, and to simultaneously apply, to the second electrode, a second DC voltage which cyclically alternates between different polarities with a second predetermined period. The first DC voltage and second DC voltage are independent and may be same or different and the first predetermined period and the second predetermined period may be same or different.

[0005a] According to a second aspect of the present invention, there is provided an electrostatic attraction method comprising: applying, to a first electrode provided in a placing table including a focus ring placed thereon so as to face the focus ring to electrostatically attract the focus ring, a first direct current (DC) voltage which cyclically alternates between different polarities with a first predetermined period; and simultaneously applying, to a second electrode provided in the placing table, a second DC voltage which cyclically alternates between different polarities with a second predetermined period; wherein the first DC voltage and second DC voltage are independent and may be same or different and the first predetermined period and the second predetermined period may be same or different.

[0005b] According to a third aspect of the present invention, there is provided a non-transitory computer-readable storage medium that stores an electrostatic attraction program which, when executed, causes a computer to execute a processing including: applying, to a first electrode provided in a placing table including a focus ring placed thereon so as to face the focus ring to electrostatically attract the focus ring, a first direct current (DC) voltage which cyclically alternates between different polarities with a first predetermined period; simultaneously applying, to a second electrode provided in the placing table, a second DC voltage which cyclically alternates between different polarities with a second predetermined period, wherein the first DC voltage and second DC voltage are independent and may be same or different and the first predetermined period and the second predetermined period may be same or different.

[0006] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a cross-sectional view illustrating a schematic configuration of a plasma processing apparatus according to an exemplary embodiment.

[0008] FIG. 2 is a view illustrating an exemplary installation aspect of an electrode plate.

[0009] FIG. 3 is a diagram schematically illustrating migration of charges according to a technique in the related art.

[0010] FIG. 4 is a graph illustrating an example of a result of a test of measuring a leakage amount of a heat transfer gas according to a technique in the related art.

[0011] FIG. 5 is a diagram schematically illustrating a change pattern of an applied voltage.

[0012] FIG. 6 is a diagram schematically illustrating migration of charges according to the exemplary embodiment.

WHAT IS CLAIMED IS:

1. A plasma processing apparatus comprising:

a placing table including a focus ring placed thereon and a first electrode and a second electrode provided therein so as to face the focus ring to electrostatically attract the focus ring; and

a voltage application source configured to apply, to the first electrode, a first direct current (DC) voltage which cyclically alternates between different polarities with a first predetermined period, and to simultaneously apply, to the second electrode, a second DC voltage which cyclically alternates between different polarities with a second predetermined period,

wherein the first DC voltage and second DC voltage are independent and may be same or different and the first predetermined period and the second predetermined period may be same or different.

2. The plasma processing apparatus of claim 1, wherein the placing table includes a plurality of electrodes, including the first and second electrodes, provided in a radial direction of the focus ring.

3. The plasma processing apparatus of claim 2, wherein the voltage application source is configured to change the polarities of the voltages applied to the plurality of electrodes, including the first and second electrodes, at once or sequentially one by one.

4. The plasma processing apparatus of claim 2, wherein the voltage application source is configured to apply voltages of different polarities to the plurality of electrodes, including the first and second electrodes, in each cycle.

5. An electrostatic attraction method comprising:

applying, to a first electrode provided in a placing table including a focus ring placed thereon so as to face the focus ring to electrostatically attract the focus ring, a first direct current (DC) voltage which cyclically alternates between different polarities with a first predetermined period; and

simultaneously applying, to a second electrode provided in the placing table, a second DC voltage which cyclically alternates between different polarities with a second predetermined period;

wherein the first DC voltage and second DC voltage are independent and may be same or different and the first predetermined period and the second predetermined period may be same or different.

6. A non-transitory computer-readable storage medium that stores an electrostatic attraction program which, when executed, causes a computer to execute a processing including:

applying, to a first electrode provided in a placing table including a focus ring placed thereon so as to face the focus ring to electrostatically attract the focus ring, a first direct current (DC) voltage which cyclically alternates between different polarities with a first predetermined period;

simultaneously applying, to a second electrode provided in the placing table, a second DC voltage which cyclically alternates between different polarities with a second predetermined period,

wherein the first DC voltage and second DC voltage are independent and may be same or different and the first predetermined period and the second predetermined period may be same or different.