

Claims

1. An electrostatic attraction method comprising:
applying voltages to one or more electrodes disposed
5 in a substrate support while reversing polarities of the
voltages for each process cycle for plasma treatment,
wherein said one or more electrodes are disposed in an outer
peripheral portion of the substrate support at at least a
position corresponding to a ring member placed on the
10 substrate support to surround a substrate serving as a
plasma treatment target placed on the substrate support,
wherein said each process cycle is a cycle of
performing the plasma treatment on a predetermined number of
substrates when the plasma treatment is performed
15 consecutively on substrates while exchanging the substrates,
and said each process cycle is a cycle of performing a set
of the plasma treatment and post-treatment when the plasma
treatment is performed and the post-treatment is
subsequently performed on each of the substrates.
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2. The electrostatic attraction method of claim 1,
wherein said one or more electrodes include two or more
electrodes disposed along a radial direction of the ring
member.
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3. The electrostatic attraction method of claim 2,

wherein the polarities of the voltages applied to adjacent electrodes are different from each other.

4. The electrostatic attraction method of claim 1,
5 wherein the post-treatment is dry cleaning performed in a state where no substrate is placed on the substrate support.

5. The electrostatic attraction method of claim 4,
wherein the polarities of the voltages applied to said one
10 or more electrodes are switched between the plasma treatment and the dry cleaning.

6. The electrostatic attraction method of any one of claims 1 to 5, wherein, before substrate processing is
15 started, a voltage polarity application pattern is determined for said each process cycle for plasma treatment to be performed based on a threshold and charge transfer information corresponding to a type of the plasma treatment to be performed, thereby changing the polarities of the
20 voltages applied to said one or more electrodes.

7. A plasma processing apparatus comprising:
a substrate support on which a substrate serving as a plasma treatment target is placed and a ring member is
25 placed to surround the substrate;
one or more electrodes disposed in an outer peripheral

portion of the substrate support at at least a position corresponding to the ring member; and

a voltage application unit configured to apply voltages to said one or more electrodes while reversing the polarities of the voltages for each process cycle for plasma treatment,

wherein said each process cycle is a cycle of performing the plasma treatment on a predetermined number of substrates when the plasma treatment is performed consecutively on substrates while exchanging the substrates, and said each process cycle is a cycle of performing a set of the plasma treatment and post-treatment when the plasma treatment is performed and the post-treatment is subsequently performed on each of the substrates.

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8. The plasma processing apparatus of claim 7, wherein said one or more electrodes include two or more electrodes disposed along a radial direction of the ring member.

20 9. The plasma processing apparatus of claim 8, wherein the voltage application unit is configured to apply voltages with different polarities to adjacent electrodes.

10. The plasma processing apparatus of claim 7, wherein the post-treatment is dry cleaning performed in a state where no substrate is placed on the substrate support.

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11. The plasma processing apparatus of claim 10, wherein the voltage application unit is configured to switch the polarities of the voltages applied to said one or more electrodes between the plasma treatment and the dry cleaning.

12. The plasma processing apparatus of any one of claims 7 to 11, further comprising a control unit that, before substrate processing is started, determines a voltage polarity application pattern for said each process cycle for plasma treatment to be performed, based on a threshold and charge transfer information corresponding to a type of the plasma treatment to be performed, and controls the voltage application unit to switch the polarities of the voltages applied to said one or more electrodes based on the determined application pattern.

13. The plasma processing apparatus of any one of claims 7 to 11, wherein said one or more electrodes include one electrode disposed annually at an inner peripheral side and another electrode disposed annually at an outer peripheral side along a radial direction of the ring member.

14. The plasma processing apparatus of claim 8 or 9, wherein the voltage application unit is configured to apply voltages with different polarities but the same absolute

value to adjacent electrodes.

15. The plasma processing apparatus of claim 13, wherein,
when the plasma treatment and the post-treatment are
5 repeatedly performed as said each process cycle, the voltage
application unit is configured to apply voltages with
different polarities but the same absolute value to the two
electrodes during the plasma treatment of the substrate, and
switches the polarities of the voltages applied to the two
10 electrodes during the post-treatment immediately following
the plasma treatment.

16. The plasma processing apparatus of claim 15, wherein
the voltage application unit is configured to apply voltages
15 with the same polarity as that of the preceding post-
treatment to the two electrodes during the plasma treatment
immediately following the post-treatment.

17. The plasma processing apparatus of claim 15, wherein
20 the post-treatment is dry cleaning.

18. The plasma processing apparatus of claim 13, wherein,
when the plasma treatment is repeatedly performed on
substrates, the voltage application unit is configured to
25 apply voltages with different polarities but the same
absolute value to the two electrodes during the plasma

treatment of the substrate, and switches the polarities of the voltages applied to the two electrodes each time plasma treatment is performed on a predetermined number of substrates.

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19. The plasma processing apparatus of claim 13, wherein, when the plasma treatment is repeatedly performed on substrates, the voltage application unit is configured to apply voltages with different polarities but the same absolute value to the two electrodes during the plasma treatment of the substrate, and switches the polarities of the voltages applied to the two electrodes each time plasma treatment is performed on a single substrate.

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