

CLAIMS

1. A plasma processing method for plasma-processing a substrate with a plasma processing apparatus having a substrate support and an upper electrode inside a chamber,

the method comprising:

- placing the substrate on the substrate support;
- supplying a processing gas for processing the substrate to the chamber;
- supplying a radio frequency to the upper electrode or the substrate support to generate plasma from the processing gas inside the chamber;
- periodically applying a first pulse voltage to the substrate support during a period in which the radio frequency is being continuously supplied; and
- periodically applying a second pulse voltage to the upper electrode during the period in which the radio frequency is being continuously supplied,

wherein the method further comprises periodically applying the first pulse voltage by:

- starting application of the first pulse voltage at a first point in time;
- ending application of the first pulse voltage at a second point in time after the first point in time;
- re-starting application of the first pulse voltage at a third point in time after the second point in time; and
- re-ending application of the first pulse voltage at a fourth point in time after the third point in time,

wherein the method further comprises periodically applying the second pulse voltage by:

- starting application of the second pulse voltage at the second point in time;
- ending application of the second pulse voltage at a point in time between the second point in time and the third point in time;

re-starting application of the second pulse voltage at the fourth point in time,
and

wherein a time interval from the first point in time to the second point in time is equal to or shorter than a time interval from the second point in time to the third point in time.

2. The plasma processing method according to claim 1, wherein in the generating the plasma, the radio frequency is supplied to the substrate support.

3. The plasma processing method according to claim 1, wherein in the periodically applying the first pulse voltage, negative voltage is applied to the substrate support as the first pulse voltage.

4. The plasma processing method according to claim 1, wherein in the periodically applying the second pulse voltage, negative voltage is applied to the upper electrode as the second pulse voltage.

5. A plasma processing apparatus comprising:
a chamber;
a substrate support provided inside the chamber and configured to support a substrate;
an upper electrode provided inside the chamber opposite the substrate support; and
a control unit, configured to execute:
placing a substrate on the substrate support,
supplying a processing gas for processing the substrate to the chamber,
supplying a radio frequency to the upper electrode or the substrate support
and generating plasma from the processing gas inside the chamber,

periodically applying a first pulse voltage to the substrate support during a period in which the radio frequency is being continuously supplied, and
periodically applying a second pulse voltage to the upper electrode during the period in which the radio frequency is being continuously supplied,
wherein the control unit is still further configured to periodically apply the first pulse voltage by:
starting application of the first pulse voltage at a first point in time;
ending application of the first pulse voltage at a second point in time after the first point in time;
re-starting application of the first pulse voltage at a third point in time after the second point in time; and
re-ending application of the first pulse voltage at a fourth point in time after the third point in time,
wherein the control unit is still further configured to periodically apply the second pulse voltage by:
starting application of the second pulse voltage at the second point in time;
ending application of the second pulse voltage at a point in time between the second point in time and the third point in time;
re-starting application of the second pulse voltage at the fourth point in time,
and
wherein a time interval from the first point in time to the second point in time is equal to or shorter than a time interval from the second point in time to the third point in time.

6. The plasma processing method according to claim 1, wherein in the ending application of the second pulse voltage, the application of the second pulse voltage ends at the third point in time.

7. The plasma processing apparatus according to claim 5, wherein in the generating the plasma, the radio frequency signal is supplied to the substrate support.

8. The plasma processing apparatus according to claim 5, wherein in the periodically applying the first pulse voltage, negative voltage is applied to the substrate support as the first pulse voltage.

9. The plasma processing apparatus according to claim 5, wherein in the periodically applying the second pulse voltage, negative voltage is applied to the substrate support as the second pulse voltage.

10. The plasma processing apparatus according to claim 5, wherein in the ending application of the second pulse voltage, the application of the second pulse voltage ends at the third point in time.