

fully grown, the electrons emitted from the upper electrode are accelerated toward the processing target object by supplying the negative DC voltage to the upper electrode. Accordingly, the accelerated electrons are bounced off in a direction approaching the upper electrode by the plasma sheath which is being grown in a direction away from the processing target object, *i.e.*, in the direction approaching the upper electrode. As a result, in the prior art, the electric discharge may occur at the upper electrode side due to the bounced electrons.

SUMMARY

[0011] In one exemplary embodiment, a power supply system includes a first high frequency power supply configured to supply a high frequency power for plasma generation to a lower electrode configured to mount a processing target object thereon; a DC power supply configured to supply a first negative DC voltage or a second negative DC voltage having an absolute value larger than that of the first DC voltage to an upper electrode provided to face the lower electrode; and a control unit configured to perform a power supply control process of repeating a supply of the high frequency power and a stop of the supply of the high frequency power alternately; stopping a supply of the first DC voltage and a supply of the second DC voltage for a first period, which is a time period from a beginning of the supply of the high frequency power within a period during which the high frequency power is being supplied; supplying the first DC voltage for a second period except the first period within the period during which the high frequency power is being supplied; and supplying the second DC voltage for a period during which the supply of the high frequency power is stopped.

[0011a] In another exemplary embodiment, there is provided a plasma processing apparatus, comprising: a processing vessel; a gas supply unit configured to supply a processing gas into the processing vessel; a lower electrode which is provided within the processing vessel and configured to mount a processing target object thereon; an upper electrode provided within the processing vessel to face the lower electrode; and a power supply system, wherein the power supply system includes: a high frequency power supply configured to supply a high frequency power for plasma generation to the lower electrode; a DC power supply configured to supply a first negative DC voltage or a second negative DC voltage having an absolute value larger than that of the first DC voltage to the upper electrode; and a control unit configured to perform a power supply control process of repeating a supply of the high frequency power and a stop of the supply of the high frequency power alternately; stopping a supply of the first DC voltage and a supply of the second DC voltage for a first period, which is a time period from a beginning of the supply of the high frequency power within a period during which the high frequency power is being supplied; supplying the first DC voltage for a second period except the first period within the period during which the high frequency power is being supplied; and supplying the second DC voltage for a period during which the supply of the high frequency power is stopped.

[0011b] In another exemplary embodiment, there is provided a power supply control method performed in a power supply system including a high frequency power supply configured to supply a high frequency power for plasma generation to a lower electrode configured to mount a processing target object thereon; and a DC power supply configured to supply a first negative DC voltage or a second negative DC voltage having an absolute value larger than that of the first DC voltage to an upper electrode provided to face the lower electrode, the method comprising:

performing a power supply control process of repeating a supply of the high frequency power and a stop of the supply of the high frequency power alternately; stopping a supply of the first DC voltage and a supply of the second DC voltage for a first period, which is a time period from a beginning of the supply of the high frequency power within a period during which the high frequency power is being supplied; supplying the first DC voltage for a second period except the first period within the period during which the high frequency power is being supplied; and supplying the second DC voltage for a period during which the supply of the high frequency power is stopped.

[0012] According to the exemplary embodiments, it is possible to provide a power supply system, a plasma processing apparatus and a power supply control method capable of