

CLAIMS

1. A system for controlling ion energy within a plasma chamber, comprising:
 - a sinusoidal radio frequency (RF) generator configured to generate a first sinusoidal signal;
 - an upper electrode coupled to the sinusoidal RF generator and configured to receive the first sinusoidal signal;
 - a nonsinusoidal RF generator including a sinusoidal waveform generator and a first filter, wherein the sinusoidal waveform generator is configured to generate a second sinusoidal signal, and the first filter is configured to receive the second sinusoidal signal and generate a nonsinusoidal signal having no off cycles;
 - a power amplifier coupled to the nonsinusoidal RF generator, the power amplifier configured to receive the nonsinusoidal signal and generate an amplified nonsinusoidal signal;
 - a second filter coupled to the power amplifier, the second filter configured to receive the amplified nonsinusoidal signal and generate a filtered nonsinusoidal signal having a series of pulses between consecutive off cycles, wherein the pulses of the filtered nonsinusoidal signal are nonsinusoidal; and
 - a chuck coupled to the second filter, wherein the chuck includes a lower electrode and is configured to face at least a portion of the upper electrode, the lower electrode is configured to receive the filtered nonsinusoidal signal to adjust ion energy at the chuck to be between a lower threshold and an upper threshold.
2. The system of claim 1, wherein the upper electrode is a surface inductor or a capacitive plate.
3. The system of claim 1, wherein the sinusoidal waveform generator is an oscillator.
4. The system of claim 1, wherein the power amplifier increases a magnitude of the nonsinusoidal signal.
5. The system of claim 1, wherein the lower threshold includes a lower value and the upper threshold includes an upper value, the upper value higher than the lower value.

6. The system of claim 1, wherein the second filter is configured to filter the amplified nonsinusoidal signal by using a filtering signal, wherein the filtered nonsinusoidal signal is a pulsed waveform, wherein the filtered nonsinusoidal signal has a same duty cycle as that of the filtering signal.
7. The system of claim 6, wherein the pulsed waveform has an on cycle and an off cycle, the pulsed waveform having a magnitude of zero during the off cycle of the pulsed waveform and a magnitude greater than zero during the on cycle of the pulsed waveform.
8. A system for controlling ion energy within a plasma chamber, comprising:
a sinusoidal radio frequency (RF) generator for generating a sinusoidal signal;
a chuck coupled to the sinusoidal RF generator for receiving the sinusoidal signal;
a nonsinusoidal radio frequency (RF) generator for generating a nonsinusoidal signal;
a power amplifier coupled to the nonsinusoidal RF generator, the power amplifier for amplifying the nonsinusoidal signal to generate an amplified signal;
a filter coupled to the power amplifier, the filter for filtering the amplified signal using a filtering signal to generate a filtered signal; and
an upper electrode coupled to the filter, the upper electrode facing the chuck, the upper electrode for receiving the filtered signal to facilitate achieving ion energy at the chuck to be between a lower threshold and an upper threshold.
9. The system of claim 8, wherein the upper electrode is a surface inductor or a capacitive plate.
10. The system of claim 8, wherein the nonsinusoidal RF generator includes a driver and a filter, the filter of the nonsinusoidal RF generator for filtering a sinusoidal RF signal that is generated by the driver to generate the nonsinusoidal signal.
11. The system of claim 8, wherein the power amplifier increases a magnitude of the nonsinusoidal signal.
12. The system of claim 8, wherein the lower threshold includes a lower value and the upper threshold includes an upper value, the upper value higher than the lower value.

13. The system of claim 8, wherein the filtered signal is a pulsed waveform, wherein the filtered signal has a same duty cycle as that of the filtering signal.

14. The system of claim 13, wherein the pulsed waveform has an on cycle and an off cycle, the pulsed waveform having a magnitude of zero during the off cycle and a magnitude greater than zero during the on cycle.

15. The system of claim 8, wherein the ion energy is determined based on a wafer bias at the chuck and a peak-to-peak voltage at the chuck.

16. A system for controlling ion energy within a plasma chamber, comprising:

- a first nonsinusoidal radio frequency (RF) generator for generating a first nonsinusoidal signal;

- a first power amplifier coupled to the first nonsinusoidal RF generator, the first power amplifier for amplifying the first nonsinusoidal signal to generate a first amplified signal;

- a first filter coupled to the first power amplifier, the first filter for filtering the first amplified signal using a first filtering signal to generate a first filtered signal;

- an upper electrode coupled to the first filter for receiving the first filtered signal;

- a second nonsinusoidal RF generator for generating a second nonsinusoidal signal;

- a second power amplifier coupled to the second nonsinusoidal RF generator, the second power amplifier for amplifying the second nonsinusoidal signal to generate a second amplified signal;

- a second filter coupled to the second power amplifier, the second filter for filtering the second amplified signal using a second filtering signal to generate a second filtered signal;

and

- a chuck coupled to the second filter for receiving the second filtered signal, the chuck facing the upper electrode, the chuck including a lower electrode, the lower electrode for receiving the second filtered signal to facilitate achieving ion energy at the chuck to be between a lower threshold and an upper threshold, the upper electrode for receiving the first filtered signal to facilitate achieving the ion energy at the chuck to be between the lower threshold and the upper threshold.

17. The system of claim 16, wherein the first nonsinusoidal RF generator includes a first driver and a first filter, the first filter of the first nonsinusoidal RF generator for filtering a sinusoidal RF signal that is generated by the first driver to generate the first nonsinusoidal signal, wherein the second nonsinusoidal RF generator includes a second driver and a second filter, the second filter of the second nonsinusoidal RF generator for filtering a sinusoidal RF signal that is generated by the second driver to generate the second nonsinusoidal signal.

18. The system of claim 16, wherein the first power amplifier increases a magnitude of the first nonsinusoidal signal, and wherein the second power amplifier increases a magnitude of the second nonsinusoidal signal.

19. The system of claim 16, wherein the first filtered signal is a first pulsed waveform, wherein the first filtered signal has a same duty cycle as that of the first filtering signal, wherein the second filtered signal is a second pulsed waveform, wherein the second filtered signal has a same duty cycle as that of the second filtering signal.

20. The system of claim 16, wherein the ion energy is determined based on a wafer bias at the chuck and a peak-to-peak voltage at the chuck.