# CLAIMS

What is claimed is:

1. A method of operating a plasma processing system having a space for receiving gas, an electrode portion and an RF driver, the RF driver being operable to provide a driving signal to the electrode portion, said method comprising:

providing a gas into the space;

providing the driving signal to the electrode portion, the driving signal being based on a first signal portion and a second signal portion; and

generating, from the gas, a plasma in the space,

wherein the plasma has a plasma sheath,

wherein the plasma sheath has a plasma sheath potential,

wherein the plasma sheath potential is based on the driving signal,

wherein the plasma sheath potential as a function of time based on a first plasma sheath potential function portion and a second plasma sheath potential function portion,

wherein the first plasma sheath potential function portion comprises a continuous sinusoidal portion having a first amplitude and a first frequency,

wherein the second plasma sheath potential function portion comprises a sinusoidal portion having a maximum amplitude interval, and a minimum amplitude interval and a duty cycle,

wherein the maximum amplitude interval has a second frequency, a first duration and a first interval amplitude,

wherein the minimum amplitude interval has a second duration and a second interval amplitude,

wherein the first interval amplitude is larger than the second interval amplitude,

wherein the duty cycle is the ratio of the first duration to the sum of the first duration and the second duration, and

wherein the second plasma sheath potential function portion is amplitude-modulated at a frequency equal to a harmonic of the first frequency.

2. The method of claim 1, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the first amplitude is more than the second amplitude.

3. The method of claim 2, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the first duration is less than or equal to the second duration.

4. The method of claim 3, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

5. The method of claim 2, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

6. The method of claim 1, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the first duration is less than or equal to the second duration.

7. The method of claim 6, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

8. The method of claim 1, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

9. The method of claim 1, wherein the harmonic is 1.

10. The method of claim 1, wherein the harmonic is greater than 1.

11. A method of operating a plasma processing system having a space therein arranged to receive a gas and an electromagnetic field generating portion operable to generate an electromagnetic field within the space, said method comprising:

providing a gas into the space; and

operating the electromagnetic field generating portion with a driving potential to generate an electromagnetic field within the space to transform at least a portion of the gas into plasma,

wherein the driving potential as a function of time is based on a first potential function portion and a second potential function portion,

wherein the first potential function portion comprises a first continuous sinusoidal portion having a first amplitude and a first frequency,

wherein the second potential function portion comprises a second sinusoidal portion having a maximum amplitude interval, a minimum amplitude interval and a duty cycle,

wherein the second sinusoidal portion has a higher amplitude during the maximum amplitude interval than during the minimum amplitude interval,

wherein the duty cycle is the ratio of the maximum amplitude interval to the sum of the maximum amplitude interval and the minimum amplitude interval,

wherein the second sinusoidal portion additionally has a second frequency,

wherein the second sinusoidal portion is amplitude-modulated at a frequency equal to a harmonic of the first frequency.

12. The method of claim 11, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the first amplitude is more than the second amplitude.

13. The method of claim 12, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the first duration is less than or equal to the second duration.

14. The method of claim 13, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

15. The method of claim 12, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

16. The method of claim 11, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the first duration is less than or equal to the second duration.

17. The method of claim 16, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

18. The method of claim 11, wherein said providing the driving signal to the electrode comprises providing the driving signal to the electrode such that the maximum amplitude interval is coincident with a maximum plasma sheath potential.

19. The method of claim 11, wherein the harmonic is 1.

20. The method of claim 11, wherein the harmonic is greater than 1.