CLAIMS

What is claimed is:

1. A method for performing synchronized radio frequency (RF) pulsing between a first RF signal and a second RF signal during substrate processing in a plasma processing chamber, comprising:

transitioning from low-to-high for said first RF signal;

thereafter waiting for a delay period after said transitioning from said low-to-high of said first RF signal;

thereafter transitioning from low-to-high for said second RF signal;

thereafter transitioning from high-to-low for said second RF signal, wherein said second RF signal is transitioned from said high-to-low before ~~said~~ a plasma transitions into an afterglow phase; and

thereafter transitioning from high-to-low for said first RF signal.

2. The method of claim 1 wherein said first RF signal is a primarily plasma-generating RF signal and said second RF signal is primarily an RF bias signal.

3. The method of claim 1 wherein said first RF signal is primarily an RF bias signal and said second RF signal is primarily a plasma-generating RF signal.

4. The method of claim 1 wherein said transitioning from high-to-low for said second RF signal is performed no later than said transitioning from high-to-low for said first RF signal.

5. The method of claim 1 wherein a generator source of said first RF signal is pulsing with a repetition rate in a range between 1 Kilohertz (KHz) and 20 KHz.

6. The method of claim 1 further including sending a control signal to a first power source, wherein said first power source is configured for generating said first RF signal, said control signal including at least frequency and duty cycle information, wherein

said pulsing of said first RF signal is at least 10 microseconds pulsing high and at least 10 microseconds pulsing low for each pulse period, and

said duty cycle is between 10 percent and 90 percent.

7. The method of claim 6 further including determining parameters for performing said synchronized RF pulsing, wherein said determining including at least

triggering a first circuit after receiving a first synchronization signal, wherein said first circuit is configured at least for

receiving a first ~~delay~~ control ~~signal~~, wherein said first control signal specifies a first delay time for gathering data about a first set of ~~first~~ sensor signals,

receiving a first V-I probe signal and a first Phase/Mag signal, and

collecting said data about said first set of sensor signals, wherein said first set of sensor signals including at least one of said first control signal, said first V-I probe signal and said first Phase/Mag signal; and

triggering a second circuit after receiving a second synchronization signal, wherein said second circuit is configured at least for

receiving a second ~~delay~~ control signal, wherein said second control signal specifies a second delay time for gathering data about a second set of sensor signals,

receiving a second V-I probe signal and a second Phase/Mag signal, and

collecting said data about said second set of sensor signals, wherein said second set of sensor signals including at least one of said second control signal, said second V-I probe signal and said ~~first~~ second Phase/Mag signal.

8. The method of claim 7 wherein said first time ~~delay~~ starts after 80 percent of said first RF signal pulse has elapsed.

9. The method of claim 7 wherein said second ~~time~~ delay time starts after between 50 to 80 percent of said second RF signal pulse has elapsed.

10. The method of claim 7 wherein said first circuit is a TCP track-and-hold circuit.

11. The method of claim 7 wherein said second circuit is a bias track-and-hold circuit.

12. An arrangement for performing synchronized radio frequency (RF) pulsing during substrate processing of a substrate in a plasma processing chamber of a plasma processing system, comprising:

a power source configured at least for generating a plasma-generating RF signal;

a bias generator configured at least for generating a bias RF signal;

means for creating a set of synchronization signals, said set of synchronization signals configured at least for controlling said power source and said bias generator;

a host control system configured at least for interacting with said means for creating said set of synchronization signals, said interacting including at least

sending a first control signal wherein said first control signal includes at least frequency and duty cycle information for creating said plasma-generating RF signal, and

sending a delay value for controlling time delay for said generating of said bias RF signal so as to ensure that said bias RF signal is present when a plasma is actively generated by said plasma-generating RF signal and sending a second control signal ending said bias RF signal before said plasma transitions into an afterglow phase.

13. The arrangement of claim 12 wherein said means for creating said set of synchronization signals is one of said power source and said bias generator.

14. The arrangement of claim 12 wherein said means for creating said set of synchronization signals is an independent circuit configured for controlling said power source and said bias generator.

15. The arrangement of claim 12 wherein said power source is a TCP generator.

16. The arrangement of claim 12 wherein said power source pulses with a repetition rate in a range between about 1 Kilohertz (KHz) and about 20 KHz.

17. The arrangement of claim 12 wherein said RF pulsing of said ~~first~~ plasma-generating RF signal is at least 10 microseconds pulsing high and at least 10 microseconds pulsing low for each pulse period.

18. The arrangement of claim 12 wherein said duty cycle is between 10 percent and 90 percent.

19. A method for performing synchronized radio frequency (RF) pulsing during substrate processing in a plasma processing system, comprising:

sending a first control signal, wherein said first control signal including at least frequency and duty cycle information for a first power source;

generating a first RF signal configured at least for generating a plasma;

transitioning from low-to-high for said first RF signal;

waiting for a delay period before igniting said plasma;

generating a first synchronization signal to a second power source after a delay value, said delay value is employed for controlling time delay for generating a second RF signal;

generating said second RF signal;

transitioning from low-to-high for said second RF signal;

transitioning from high-to-low for said second RF signal, wherein said second RF signal is transitioned from said high-to-low before said plasma transitions into an afterglow phase; and

transitioning from high-to-low for said first RF signal.

20. The method of claim 19 wherein said first RF signal is a primary plasma-generating RF signal and said second RF signal is an RF bias signal.

21. The method of claim 19 wherein said first RF signal is an RF bias signal and said second RF signal is a primary plasma-generating RF signal.

22. The method of claim 19 wherein said first RF signal is a high frequency signal and said second RF signal is a low frequency RF signal.

23. The method of claim 19 wherein said transitioning from high-to-low for said second RF signal is performed no later than said transitioning from high-to-low for said first RF signal.

24. The method of claim 19 wherein said pulsing of said first RF signal is at least 10 microseconds pulsing high and at least 10 microseconds pulsing low for each pulse period.

25. The method of claim 19 wherein said duty cycle is between 10 percent and 90 percent.

26. The method of claim 19 further including determining parameters for performing said synchronized RF pulsing, wherein said determining including at least

triggering a first circuit after receiving a second synchronization signal, wherein said first circuit is configured at least for

receiving a first ~~delay~~ control signal, wherein said first control signal specifies a first delay time for gathering data about a first set of ~~first~~ sensor signals,

receiving a first V-I probe signal and a first Phase/Mag signal, and

collecting said data about said first set of sensor signals, wherein said first set of sensor signals including at least one of said first control signal, said first V-I probe signal and said first Phase/Mag signal; and

triggering a second circuit after receiving a third synchronization signal, wherein said second circuit is configured at least for

receiving a second ~~delay~~ control signal, wherein said second control signal specifies a second delay time for gathering data about a second set of sensor signals,

receiving a second V-I probe signal and a second Phase/Mag signal, and

collecting said data about said second set of sensor signals, wherein said second set of sensor signals including at least one of said second control signal, said second V-I probe signal and said ~~first~~ second Phase/Mag signal.

27. The method of claim 26 wherein said first ~~time~~ delay time starts after 80 percent of said first RF signal pulse has elapsed.

28. The method of claim 26 wherein said second ~~time~~ delay time starts after 80 percent of said second RF signal pulse has elapsed.

29. The method of claim 26 wherein said first circuit is a TCP track-and-hold circuit.

30. The method of claim 26 wherein said second circuit is a bias track-and-hold circuit.