METHODS AND APPARATUS FOR SYNCHRONIZING RF PULSES IN A PLASMA PROCESSING SYSTEM

PRIORITY CLAIM

[0001] This application claims priority under 35 USC. 119(e) to a commonly-owned provisional patent application entitled "METHODS AND APPARATUS FOR SYNCHRONIZING RF PULSES IN A PLASMA PROCESSING SYSTEM", US Application Number 61/602,041, filed on February 22, 2012 by John C. Valcore, Jr. all of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] Plasma processing has long been employed to process substrates (e.g., wafer or flat panels or other substrates) to create electronic devices (e.g., integrated circuits or flat panel displays). In plasma processing, a substrate is disposed in a plasma processing chamber, which employs one or more electrodes to excite a source gas (which may be an etchant source gas or a deposition source gas) into a plasma for processing the substrate. The electrodes may be excited by an RF signal, which is furnished by a RF generator, for example.

[0003] In some plasma processing systems, multiple RF signals, some of which may have the same or different RF frequencies, may be provided to one or more electrodes to generate plasma. In a capacitively-coupled plasma processing system, for example, one or more RF signals may be provided to the top electrode, the bottom electrode, or both in order to generate the desired plasma.

[0004] In some applications, the RF signals may be pulsed. For any given RF signal, RF pulsing involves turning the RF signal on and off, typically within the same RF signal period but may span multiple RF signal periods. Furthermore, the RF pulsing may be synchronized among signals. For example, if two signals RF1 and RF2 are synchronized,

there is an active pulse of signal RF1 for every active pulse of signal RF2. The pulses of the two RF signals may be in phase, or the leading edge of one RF pulse may lag behind the leading edge of the other RF pulse, or the trailing edge of one RF pulse may lag behind the trailing edge of the other RF pulse, or the RF pulses may be out of phase.

[0005] In the prior art, pulsing synchronization of multiple RF signals typically involves a communication network to facilitate control communication among the various RF generators. To facilitate discussion, Fig. 1 is a high level drawing of a generic prior art implementation of a typical pulsed RF plasma processing system 102. Pulsed RF plasma processing system 102 includes two RF generators 104 and 106. In the example of Fig. 1, RF generator 104 represents a 2 MHz generator while RF generator 106 represents a 60 MHz generator.

[0006] A host computer 110 implements tool control and receives a feedback signal 112 from an impedance matching network 114 to provide (via a digital or analog communications interface 116) power set point data to RF generator 104 and RF generator 106 via paths 118 and 120 respectively. The feedback signal 112 pertains to the impedance mismatch between the source and the load, and is employed to control either the delivered power or the forward power levels of RF generators 104 and 106 to maximize power delivery and minimize the reflected power.

[0007] Host computer 110 also provides Pulse_Enable signal 160 to a pulse synchronizer and controller 130. Responsive to the Pulse_Enable signal 160, the pulse synchronizer and controller 130 provides the synchronized control signals 170 and 172 to RF generator 104 and RF generator 106 (via External Synchronization Interfaces 140 and 142) to instruct RF generators 104 and 106 to pulse its RF signals using power controllers 150 and 152 respectively to produce pulsed RF signals 162 and 164. The pulsed RF signals 162 and 164 are then delivered to the load in plasma chamber 160 via impedance matching network 114.

[0008] Although the pulsed RF synchronization scheme of Fig. 1 can provide the synchronized pulsing function for the RF generators, there are drawbacks. For example, synchronizing the pulsing function of the various RF generators in Fig. 1 requires the use

of a network to communicate among host computer 110, pulse synchronizer/controller 130, and external synchronization interfaces 140 and 142 in RF generators 104 and 106. Further, synchronizing the pulsing function of the various RF generators in Fig. 1 requires the implementation of the external synchronization interfaces (such as 140 and 142) in the various generators. Implementing these external synchronization interfaces adds an extra layer of complexity to RF generator designs, and render existing RF generators incapable of being used for RF synchronized pulsing.

[0009] In view of the foregoing, there are desired improved techniques and systems for implementing synchronized RF pulsing in a plasma processing system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0011] Fig. 1 is a high level drawing of a generic prior art implementation of a typical pulsed RF plasma processing system.

[0012] Fig. 2 shows a timing diagram of the pulsing of a 2 MHz RF signal to illustrate the change in gamma value for one RF generator when another RF generator pulses its RF signal.

[0013] Fig. 3 shows a simplified circuit block diagram of an implementation of the synchronized pulsing RF, in accordance with an embodiment of the invention.

[0014] Fig. 4 is an example implementation of a DP RF generator for providing the synchronized RF pulsing capability, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0015] The present invention will now be described in detail with reference to a few embodiments thereof as illustrated in the accompanying drawings. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without some or all of these specific details. In other instances, well known process steps and/or structures have not been described in detail in order to not unnecessarily obscure the present invention.

[0016] Various embodiments are described herein below, including methods and techniques. It should be kept in mind that the invention might also cover articles of manufacture that includes a computer readable medium on which computer-readable instructions for carrying out embodiments of the inventive technique are stored. The computer readable medium may include, for example, semiconductor, magnetic, opto-magnetic, optical, or other forms of computer readable medium for storing computer readable code. Further, the invention may also cover apparatuses for practicing embodiments of the invention. Such apparatus may include circuits, dedicated and/or programmable, to carry out tasks pertaining to embodiments of the invention. Examples of such apparatus include a general-purpose computer and/or a dedicated computing device when appropriately programmed and may include a combination of a computer/computing device and dedicated/programmable circuits adapted for the various tasks pertaining to embodiments of the invention.

[0017] Embodiments of the invention relate to methods and apparatus for implementing synchronized pulsing of RF signals in a plasma processing system having a plurality of RF generators. In one or more embodiments, one of the RF generators is designated the independent pulsing (IP) RF generator, and other RF generators are designated dependent pulsing (DP) generators.

[0018] The IP RF generator represents the RF generator that pulses independently from the DP RF generators. The IP RF generator (independent pulsing generator) generates its

RF pulses responsive to a signal from the tool host or another controller. The DP RF generators (dependent pulsing generators) monitor the change in plasma impedance that is characteristic of pulsing by the IP RF generator and trigger their individual RF pulses responsive to the detected change in plasma impedance. In one or more embodiments, the change in the plasma impedance is detected by the power sensor in each of the DP RF generators, which may measure, for example, the forward and reflected RF powers.

[0019] The inventors herein recognize that existing RF generators are already provided with sensors (such as power sensors) which can monitor parameters related to the plasma impedance. When the values of these parameters change in a certain manner, a change in the plasma impedance may be detected.

[0020] To further elaborate, the efficiency with which an RF generator delivers RF power to a load depends on how well the load impedance matches with the source impedance. The more closely the load impedance matches the source impedance, the more efficient the RF power is delivered by an RF generator. Since this matching issue is well-known, many or most prior art RF generators have been provided with the ability to sense the mismatch between the source impedance and the load impedance, and to adjust the delivered or forward power in order to reduce the mismatch. The parameter gamma is typically employed to measure the load-source impedance mismatch. A gamma value of zero indicates perfect matching while a gamma value of 1 indicates a high degree of mismatch. In some RF generators, this gamma value is calculated from values provided by the power sensor, which detects the source and reflected RF powers.

[0021] The inventors herein further realize that the plasma impedance is a function of power delivered to the plasma. When a given RF generator (referred to herein as the independent pulsing or IP RF generator) pulses, the delivered RF power changes, and the plasma impedance changes accordingly. Other RF generators (referred to herein as dependent pulsing or DP RF generators) react to this change in the plasma impedance by varying their power output to match their source impedance with the plasma (or load) impedance.

[0022] The detection of changes in the plasma impedance typically relies on the measurement of one or more parameters whose values can be analyzed to directly or indirectly ascertain changes in the plasma impedance. If the plasma impedance change caused by RF pulsing of the IP RF generator can be detected by other RF generators, and more importantly, if this detection can be used to trigger RF pulsing by these other RF generators, synchronized pulsing can be achieved without the need to explicitly link the RF generators via a control network as is done in the prior art.

[0023] To illustrate the change in gamma value for one RF generator when another RF generator pulses its RF signal, Fig. 2 shows a timing diagram of the pulsing of a 2 MHz RF signal 202, which is pulsed at 159 Hz, with a 50% duty cycle. In the example of Fig. 2, two RF generators are involved: a 2 MHz RF generator outputting 6000 Watts RF signal and a 60 MHz RF generator outputting a 900 Watts RF signal. The 2 MHz RF signal is pulsed between 6000 Watts and 0 Watts, as discussed, while the 60 MHz RF signal (204) is not pulsed.

[0024] When the 2 MHz RF signal 202 is active (from reference number 210 to 212), the RF power sensor of the 60 MHz RF generator reacts to the plasma impedance value caused by the high 2 MHz RF signal 202. In this case, the real value of the impedance at the match input (generator output) of the 60 MHz RF generator is 52.9 ohms. The gamma value, which describes the source-load impedance mismatch, is 0.039.

[0025] When the 2 MHz RF signal 202 is inactive (from reference number 212 to 214), the RF power sensor of the 60 MHz RF generator reacts to the plasma impedance caused by the low 2 MHz RF signal 202. In this case, the real value of the impedance at the match input (generator output) of the 60 MHz RF generator is only 27.44 ohms. The gamma value, which describes the source-load impedance mismatch, is 0.856.

[0026] As can be seen in the example of Fig. 2, either the impedance at the match input or the gamma value may be monitored and if a change occurs from the value reflective of the "on" state of the 2 MHz RF signal 202 to the value reflective of the "off" state of the 2 MHz RF signal 202 (or vice versa), the detection of such change may be employed as a trigger signal to a circuit to generate an RF pulse for the 60 MHz signal of the 60 MHz

DP RF generator. If there are other DP RF generators, each DP RF generator may monitor the plasma impedance (e.g., a parameter that is directly or indirectly reflective of this plasma impedance) and use the detection of plasma impedance change to trigger pulse generation. In this manner, no explicit control network between a master control circuit/device (such as from host computer 110 or pulse synchronization controller circuit 130) and the various RF generators is needed. Further, the RF generators do not require any additional circuitry to interface with the control network (such as external synchronization interface circuits 140 and 142 of Fig. 1).

[0027] Instead, only one RF generator (the IP RF generator such as the 2 MHz IP RF generator in the example) needs to be explicitly controlled for RF pulsing. Other RF generators (the DP RF generators) leverage on existing detection circuitry (which is traditionally used to monitor the forward and reflected RF power for adjusting the power set point for RF delivery to match the source impedance to the load impedance) in order to indirectly detect when the IP generator RF signal has pulsed. This detection provides a triggering signal to the DP RF generators to allow the DP RF generators to generate their own RF pulses in response to the detection of RF pulsing by the IP RF generator. In this manner, vastly more simplified synchronized pulsing is accomplished.

[0028] The features and advantages of embodiments of the invention may be better understood with reference to the figures and discussions that follow. Fig. 3 shows a simplified circuit block diagram of an implementation of the synchronized pulsing RF 300, in accordance with an embodiment of the invention. In Fig. 3, RF generator 302 represents the IP RF generator and receives its pulsing control signal from tool host computer 304 (via digital/analog communications interface 306). IP RF generator 304 then generates, using power controller 308, an RF pulse using a power setpoint provided by tool host computer 304. The pulse is furnished to impedance matching network 314 to energize the RF-driven plasma chamber 316. The plasma impedance in RF-driven plasma chamber 316 changes as a result of the on-state of the 2 MHz pulse from IP RF generator 304.

[0029] This plasma impedance change is then detected by RF sensor 320 of DP RF generator 322. By way of example, the forward and reflected power of the DP 60 MHZ RF generator 322 may be monitored. Generally an IP_RF_Pulse_High threshold value may be employed to determine when the 2 MHz pulse from the IP RF generator 302 is deemed to be high. In an embodiment, the gamma value obtained from measurements taken by RF sensor 320 is employed and compared against the aforementioned IP_RF_Pulse_High value. Once the 2 MHz pulse from the IP RF generator 302 is deemed to be on, pulse generation circuit associated with DP RF generator 322 may be employed to generate a pulse for the 60 MHz signal from DP RF generator 322.

[0030] The pulse from DP RF generator 322 may be set to stay on for a predefined duration (e.g., in accordance with some duty cycle specification) or may be synchronized to turn off when the 2 MHz pulse from IP RF generator 302 transitions from a high state to a low state (by monitoring the plasma impedance state in the manner discussed earlier).

[0031] Fig. 4 is an example implementation of a DP RF generator 400 for providing the synchronized RF pulsing capability. In Fig. 4, a signal 402 is provided from the tool host, which signal may include two additional values: a trigger threshold and a gain value. The trigger threshold represents the predefined value for triggering the RF pulse for the DP generator (which keys off the plasma impedance change caused by the independent pulsing generator). By way of example, if the gamma value is monitored by the DP RF generator for detecting the plasma impedance change due to the pulsing of the in RF generator, the threshold value may represent the gamma value which, when traversed, represents the triggering signal for triggering the RF pulse by the DP RF generator. The gain value represents a value for scaling the signal to provide the high level and the low level of the RF pulse by the DP RF generator (since it is possible that different power levels may be desired for high and low instead of full-on or full-off).

[0032] Returning now to Fig. 4, if the IDPC input is zero (block 404, signifying that the chamber is not operating in the RF pulsing mode), the RF pulsing functionality is bypassed in the example of Fig. 4. In this case, the default power set point (normally furnished by the tool host computer to govern the power output by the RF generator) is

sent to the power amplifier (block 406) and amplified via the RF power amplifier 408, which is then output to the plasma chamber 450 via path 410.

[0033] The RF sensors 412 monitors the forward and reflected powers in the example of Fig. 4, and provides these values to logic circuit 414 in order to permit default scaling circuit 416 to scale the power set point to optimize power delivery. For example, if the gamma value is too high (indicating a large mismatch between the forward and reflected power), the power set point provided by the tool host may be increased or decreased as necessary to optimize power delivery to the plasma load.

[0034] However, if the IDPC input is not equal to zero (block 404, signifying that the chamber is operating in the RF pulsing mode), the RF pulsing functionality is enabled in the example of Fig. 4 (via pulse power scaling circuit 420). In this case, the power set point (furnished by the tool host computer to govern the power output by the RF generator and is part of the IDPC input in this case) is sent to the pulse power scaling circuit 420. The scaling may toggle between two values, high and low, depending on the detection of the plasma impedance by RF sensor 412 and logic circuit 414.

[0035] Suppose RF sensor 412 and logic circuit 414 detect that the gamma value has traversed the trigger threshold value provided with signal 402, this information is provided to pulse power scaling circuit 420, which then scales the default power set point scaling to reflect the high RF pulse state. Once pulse scaling is complete (block 420), the newly scaled power setpoint is then sent to block 408 for RF amplification (via block 406) and the high RF pulse level is sent to the plasma chamber. To implement a low pulse, another scaling value may be employed by block 420 (e.g., upon detection of the low pulse of the IP RF generator or after a predefined duration of time has past since the DP RF pulse went high) to generate a low RF pulse level to be sent to the plasma chamber.

[0036] In an embodiment, a generalized method for synchronizing RF pulsing may involve independent pulsing at least one RF power supply (the IP RF power supply). Each of the other RF supplies may then monitor for indicia of plasma impedance change (such as gamma value, forward power, reflected power, VI probe measurement, real

and/or complex values of the generator output impedance, etc.). In other words, detection that the plasma impedance has changed in a manner that is characteristic of pulsing by the independent pulsing RF generator is not limited to gamma monitoring.

[0037] In an advantageous example, the DP RF generators may analyze VI probe measurements and/or phase information received from the chamber in order to detect plasma impedance change that is characteristic of pulsing by the independent pulsing RF generator. Upon detection that the plasma impedance has changed in a manner that is characteristic of pulsing by the independent pulsing RF generator (e.g., from low to high or high to low), the dependent RF power supply may use that detection as a trigger to generate its pulse. The high RF pulse of the dependent RF generator may persist for a predefined period of time, or the RF pulse of the dependent RF generator may transition to a low value upon detecting that the independent pulsing RF signal has transitioned to a low state.

[0038] As can be appreciated from the foregoing, embodiments of the invention detects plasma impedance change that is characteristic of pulsing events by the independent pulsing RF generator and employs the detection as a trigger signal to pulse the dependent pulsing RF generator. In this manner, complicated networks and interfaces are no longer necessary to synchronize pulsing among a plurality of RF generators.

[0039] While this invention has been described in terms of several preferred embodiments, there are alterations, permutations, and equivalents, which fall within the scope of this invention. Although various examples are provided herein, it is intended that these examples be illustrative and not limiting with respect to the invention.

[0040] Also, the title and summary are provided herein for convenience and should not be used to construe the scope of the claims herein. Further, the abstract is written in a highly abbreviated form and is provided herein for convenience and thus should not be employed to construe or limit the overall invention, which is expressed in the claims. If the term "set" is employed herein, such term is intended to have its commonly understood mathematical meaning to cover zero, one, or more than one member. It should also be noted that there are many alternative ways of implementing the methods

and apparatuses of the present invention. It is therefore intended that the following appended claims be interpreted as including all such alterations, permutations, and equivalents as fall within the true spirit and scope of the present invention.

CLAIMS

What is claimed is:

1. A synchronized pulsing arrangement for providing at least two synchronized pulsing RF signals to a plasma processing chamber of a plasma processing system, comprising:

a first RF generator for providing a first RF signal, said first RF signal provided to said plasma processing chamber to energize a plasma therein, said first RF signal representing a pulsing RF signal; and

a second RF generator for providing a second RF signal to said plasma processing chamber, said second RF generator having a sensor subsystem for detecting values of at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low and a pulse controlling subsystem for pulsing said second RF signal responsive to said detecting said values of said at least one parameter.

2. The synchronized pulsing arrangement of claim 1 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents at least one of forward RF power and reflected RF power.

3. The synchronized pulsing arrangement of claim 1 wherein said at least one parameter that reflect whether said first RF signal is pulsed high or pulsed low represents gamma, said gamma representing a numerical index indicating a degree of mismatch between reflected power and forward power of said second RF generator.

4. The synchronized pulsing arrangement of claim 1 further comprising a tool host computer, said tool host computer providing at least a trigger threshold value to enable circuitry in said sensor subsystem of said second RF generator to ascertain whether said first RF signal is pulsed high or pulsed low.

5. The synchronized pulsing arrangement of claim 4 wherein said pulse controlling subsystem is configured to generate at least a high level and a low level for said second RF signal, said high level and said low level governed by at least one value provided said tool host computer.

6. The synchronized pulsing arrangement of claim 1 wherein said second RF signal, when pulsed, comprises at least a high pulse value and a low pulse value, wherein said low pulse value is non-zero.

7. The synchronized pulsing arrangement of claim 1 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents values obtained from a VI probe.

8. The synchronized pulsing arrangement of claim 1 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents an output impedance of said second RF generator.

9. The synchronized pulsing arrangement of claim 1 further comprising a match subsystem coupled to outputs of said first RF generator and said second RF generator, wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents an impedance of an input of said match subsystem.

10. The synchronized pulsing arrangement of claim 1 wherein said second RF signal, when pulsed, comprises at least a predefined high pulse value and a predefined low pulse value.

11. The synchronized pulsing arrangement of claim 1 wherein said second RF signal, when pulsed, comprises at least a predefined high pulse value and a predefined low pulse value and wherein second RF signal transitions, after a predefined duration expires after being pulsed from said predefined low pulse value to said predefined high pulse value, to said predefined pulse low value.

12. The synchronized pulsing arrangement of claim 1 wherein said second RF signal, when pulsed, comprises at least a predefined high pulse value and a predefined low pulse value and wherein second RF signal transitions, after a predefined duration expires after being pulsed from said predefined high pulse value to said predefined low pulse value, to said predefined pulse high value.

13. The synchronized pulsing arrangement of claim 10 further comprising control circuitry for generating a pulse control signal to control pulsing by said first RF generator and wherein said second RF generator does not pulse responsive to a signal from said control circuitry, said second RF generator pulses at least one of high-to-low and low-to-high responsive to said detecting said values of said at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low.

14. A synchronized pulsing arrangement for providing a plurality of synchronized pulsing RF signals to a plasma processing chamber of a plasma processing system, comprising:

a first RF generator for providing a first RF signal, said first RF signal provided to said plasma processing chamber to energize a plasma therein, said first RF signal representing a pulsing RF signal;

control circuitry for generating a pulse control signal to control pulsing by said first RF generator;

a second RF generator for providing a second RF signal to said plasma processing chamber, said second RF generator having a second RF generator sensor subsystem for detecting values of at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low and a second RF generator pulse controlling subsystem for pulsing said second RF signal responsive to said detecting said values of said at least one parameter; and

a third RF generator for providing a third RF signal to said plasma processing chamber, said third RF generator having a third RF generator sensor subsystem for

detecting said values of at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low and a third RF generator pulse controlling subsystem for pulsing said third RF signal responsive to said detecting said values of said at least one parameter,

wherein said second RF generator does not pulse responsive to a signal from said control circuitry, said second RF generator pulses at least one of high-to-low for said second RF signal and low-to-high for said second RF signal responsive to said detecting said values of said at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low, and

wherein said third RF generator does not pulse responsive to a signal from said control circuitry, said third RF generator pulses at least one of high-to-low for said third RF signal and low-to-high for said third RF signal responsive to said detecting said values of said at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low.

15. The synchronized pulsing arrangement of claim 14 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents at least one of forward RF power and reflected RF power.

16. The synchronized pulsing arrangement of claim 14 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents gamma, said gamma representing a numerical index indicating a degree of mismatch between reflected power and forward power of said second RF generator.

17. The synchronized pulsing arrangement of claim 14 wherein said second RF generator sensor subsystem compares said values of at least said one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low with a threshold value to ascertain when to pulse said second RF signal.

18. The synchronized pulsing arrangement of claim 14 wherein said second RF signal, when pulsed, comprises at least a high pulse value and a low pulse value, wherein said low pulse value is non-zero.

19. The synchronized pulsing arrangement of claim 14 wherein said second RF signal, when pulsed, comprises at least a predefined high pulse value and a predefined low pulse value.

20. The synchronized pulsing arrangement of claim 14 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents values obtained from a VI probe.

21. The synchronized pulsing arrangement of claim 14 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents an output impedance of said second RF generator.

22. The synchronized pulsing arrangement of claim 14 further comprising a match subsystem coupled to outputs of said first RF generator and said second RF generator, wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents an impedance of an input of said match subsystem.

23. The synchronized pulsing arrangement of claim 14 wherein said second RF signal, when pulsed, comprises at least a predefined high pulse value and a predefined low pulse value and wherein said second RF signal transitions, after a predefined duration expires after being pulsed from said predefined low pulse value to said predefined high pulse value, to said predefined pulse low value.

24. A method for providing a plurality of synchronized pulsing RF signals to a plasma processing chamber of a plasma processing system, comprising:

pulsing a first RF signal, using a first RF generator, said first RF signal provided to said plasma processing chamber to energize a plasma therein;

detecting values of at least one parameter associated with said plasma processing chamber that reflects whether said first RF signal is pulsed high or pulsed low; and

pulsing a second RF signal, using a second RF generator, responsive to said detecting said values of said at least one parameter.

25. The method of claim 24 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents at least one of forward RF power and reflected RF power.

26. The method of claim 24 wherein said at least one parameter that reflect whether said first RF signal is pulsed high or pulsed low represents gamma, said gamma representing a numerical index indicating a degree of mismatch between reflected power and forward power of said second RF generator.

27. The method of claim 24 further comprising receiving a trigger threshold value from a tool host computer, said trigger threshold value to enable circuitry in said sensor subsystem of said second generator to ascertain whether said first RF signal is pulsed high or pulsed low.

28. The method of claim 24 wherein said second RF signal comprises at least a high level and a low level when pulsed, said high level and said low level governed by at least one value provided said tool host computer.

29. The method of claim 24 wherein said second RF signal, when pulsed, comprises at least a high pulse value and a low pulse value, wherein said low pulse value is non-zero.

30. The method of claim 24 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents values obtained from a VI probe.

31. The method of claim 24 wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents an output impedance of said second RF generator.

32. The method of claim 24 further comprising a match subsystem coupled to outputs of said first RF generator and said second RF generator, wherein said at least one parameter that reflects whether said first RF signal is pulsed high or pulsed low represents an impedance of an input of said match subsystem.

33. The method of claim 24 wherein said second RF signal, when pulsed, pulses between a predefined high pulse value and a predefined low pulse value.