

What is claimed is:

1. A method of controlling a plasma processing chamber, the method comprising:
measuring a first voltage, a first current and a phase difference between
the first voltage and the first current with a first RF voltage-current (V/I) sensor
positioned within the plasma processing chamber;
controlling an RF generator connected to the plasma processing chamber
based on the measurements provided by the first RF voltage-current sensor to
maintain a predetermined plasma power,
wherein controlling the RF generator to maintain the predetermined
plasma power comprises determining the product of the first RF voltage and the
first RF current to determine the coupled plasma power at the first RF voltage-
current sensor; and controlling the RF power to maintain the predetermined
plasma power.
2. The method of claim 1, further comprising measuring a second RF voltage, a
second RF current and a phase difference between the second RF voltage and
the second RF current with a second RF voltage-current sensor positioned within
the plasma processing chamber.
3. The method of claim 2, wherein the first RF voltage-current sensor is positioned
above a substrate during processing and the second RF voltage-current sensor
is positioned below the substrate.
4. The method of claim 2, wherein the plasma processing chamber operates at
multiple frequencies.
5. The method of claim 1, wherein the root mean square of the first RF voltage and
the first RF current are used to determine an average plasma power.

6. The method of claim 1, wherein measuring with the first RF voltage-current sensor is performed at an interval in a range of 1 μ s to 1 second.
7. The method of claim 6, wherein the interval is in a range of 1 μ s to 1 ms.
- 5 8. A plasma processing chamber comprising:
 - a susceptor positioned within a processing volume and configured to support one or more substrate during processing;
 - an RF plasma generator configured to output a variable voltage, variable current and variable phase between the voltage and the current;
 - 10 at least one RF voltage-current (V/I) sensor positioned within the processing volume and configured to measure a first voltage, a first current and a phase difference between the first RF voltage and the first RF current; and
 - a controller connected to the RF plasma generator and the at least one RF voltage-current sensor, the controller configured to control the RF generator based on inputs from the at least one RF voltage-current sensor,
 - 15 wherein controlling the RF generator based on inputs from the at least one RF voltage-current sensor comprises:
 - determining the coupled power at the at least one RF voltage-current sensor by multiplying the root mean squares of the first RF voltage and the first RF current; and
 - 20 comparing the coupled power to a predetermined plasma power; and
 - if outside of a predetermined range of predetermined plasma power, modifying the RF generator output to modify the coupled power at the at least one RF voltage-current sensor.
 - 25
9. The plasma processing chamber of claim 8, wherein at least two RF voltage-current sensors are positioned within the processing volume.
- 30 10. The plasma processing chamber of claim 9, wherein a first RF voltage-current sensor is positioned above the substrate support apparatus and a second RF voltage-current sensor is positioned below the substrate support apparatus.

11. The plasma processing chamber of claim 9, further comprising a second RF plasma generator operating at a different frequency than the RF plasma generator.
- 5 12. The plasma processing chamber of claim 8, further comprising a substrate heater powered at 50/60 Hz.
13. The plasma processing chamber of claim 12, wherein the at least one RF voltage-current (V/I) sensor is configured to measure voltage current and phase for both conductive leads between the substrate heater and an external power
10 source.
14. The plasma processing chamber of claim 8, wherein the at least one RF voltage-current sensor is configured to stream a waveform of each of the first RF voltage, the first RF current and the phase difference to the controller.
- 15 15. The plasma processing chamber of claim 14, wherein each waveform has a resolution in a range of 1 μ s to 1 ms.
16. The plasma processing chamber of claim 14, wherein each waveform is
20 streamed in real-time.
17. A non-transitory computer readable medium including instructions, that, when executed by a controller of a plasma processing system, cause the plasma
25 processing system to perform the operations of:
 - activating an RF generator;
 - measuring an RF voltage, an RF current and a phase difference between the RF voltage and the RF current with an RF voltage-current sensor;
 - determining a measurement of the coupled plasma power at the voltage
30 current sensor by multiplying the root mean squares of the first RF voltage and the first RF current;
 - comparing the coupled power to a predetermined plasma power; and

if outside of a predetermined range of predetermined plasma power, modifying an output of the RF generator to modify the coupled power at the at least one RF voltage-current sensor.