

CLAIMS

What is claimed is:

1. A substrate processing system comprising:
 - a matching network configured to receive a first radio frequency signal having a
5 first frequency from a radio frequency generator and impedance match an input of the matching network to an output of the radio frequency generator;
 - a first tuning circuit distinct from the matching network and comprising a first circuit component having a first impedance, the first tuning circuit is configured to receive an output of the matching network and output a second radio frequency signal
10 to a first electrode in a substrate support; and
 - a controller configured to determine a target impedance for the first circuit component, and based on the target impedance, signal the radio frequency generator to adjust the first frequency of the first radio frequency signal received at the matching network to a second frequency to alter the first impedance of the first circuit component
15 to match the target impedance.
2. The substrate processing system of claim 1, further comprising the radio frequency generator having a center frequency and configured to, based on a control signal, generate the first radio frequency signal having the first frequency, wherein:
 - the controller is configured to generate the control signal; and
20 the first frequency is within a predetermined range of the center frequency.
3. The substrate processing system of claim 1, wherein the matching network does not change the first frequency of the first radio frequency signal and provides the first radio frequency signal to the first tuning circuit.
4. The substrate processing system of claim 1, wherein the controller is configured
25 to adjust the first frequency to the second frequency independent of impedance matching the input of the matching network to the output of the radio frequency generator.

5. The substrate processing system of claim 1, wherein the controller is configured to adjust the first frequency to the second frequency without affecting impedance matching between the matching network and the radio frequency generator.
6. The substrate processing system of claim 1, wherein the matching network is
5 configured to maintain impedance matching between an input of the matching network and an output of the radio frequency generator while the controller adjusts the first frequency to the second frequency.
7. The substrate processing system of claim 1, wherein:
the first tuning circuit comprises the first circuit component and a second circuit
10 component;
the first circuit component is connected to the first electrode;
the second circuit component is connected to a second electrode in the
substrate support; and
the controller is configured to adjust the first frequency to the second frequency
15 to adjust the first impedance of the first circuit component and a second impedance of
the second circuit component to alter power distribution from the first tuning circuit to
the first electrode and the second electrode.
8. The substrate processing system of claim 1, wherein a frequency of the second
20 radio frequency signal is a same frequency as a frequency of the first radio frequency
signal.
9. The substrate processing system of claim 1, wherein the controller is configured
to, when altering the first impedance to match the target impedance, adjust a
capacitance or an inductance of the first circuit component in addition to adjusting the
first frequency to the second frequency.
- 25 10. The substrate processing system of claim 1, wherein the controller is configured
to maintain at least one of capacitance or inductance of the first circuit component at a
fixed value while adjusting the first impedance.

11. The substrate processing system of claim 1, wherein:
the first tuning circuit comprises distributes a total amount of power received from the matching network to the first circuit component and a second circuit component; and
- 5 the controller is configured to adjust the first frequency to the second frequency to adjust a first portion of the total amount of power provided to the first circuit component and a second portion of the total amount of power provided to the second circuit component.
12. The substrate processing system of claim 1, further comprising:
10 a source terminal; and
the substrate support comprising the first electrode and a second electrode, wherein the first electrode and the second electrode receive power from the matching network via the source terminal,
the first tuning circuit comprises at least one of
- 15 a first impedance set serially connected between the first electrode and the matching network, wherein the first impedance set receives the second radio frequency signal from the matching network via the source terminal, or
a second impedance set connected between an output of the matching network and a reference terminal, wherein the second impedance set receives the
- 20 second radio frequency signal from the matching network via the source terminal.
13. The substrate processing system of claim 12, further comprising a second tuning circuit, a third tuning circuit and a third electrode, wherein:
the first tuning circuit is connected to the first electrode to modify the output of the matching network to generate the second radio frequency signal;
- 25 the second tuning circuit is connected to the second electrode and is configured to modify the output of the matching network to generate a third radio frequency signal provided to the second electrode; and
the third tuning circuit is connected to the third electrode and is configured to modify the output of the matching network to generate a fourth radio frequency signal
- 30 provided to the third electrode.

14. The substrate processing system of claim 1, wherein the first circuit component is connected to the first electrode and a second electrode in the substrate support and affects power distribution to the first electrode and the second electrode.

15. A substrate processing system comprising:

5 a matching network configured to receive a first radio frequency signal having a first frequency from a radio frequency generator and impedance match an input of the matching network to an output of the radio frequency generator;

a tuning circuit distinct from the matching network, the tuning circuit is configured to, based on an output of the matching network, output a second radio frequency signal
10 to a first electrode in a substrate support and a third radio frequency signal to a second electrode in the substrate support; and

a controller configured to adjust power distribution to the first electrode and the second electrode within the substrate support by signaling the radio frequency generator to adjust the first frequency of the first radio frequency signal received at the
15 matching network to a second frequency.

16. The substrate processing system of claim 15, wherein the matching network does not change the first frequency of the first radio frequency signal and provides the first radio frequency signal to the tuning circuit.

17. The substrate processing system of claim 15, wherein the controller is
20 configured to adjust the first frequency to the second frequency independent of impedance matching the input of the matching network to the output of the radio frequency generator.

18. The substrate processing system of claim 15, wherein the controller is
25 configured to adjust the first frequency to the second frequency without affecting impedance matching between the matching network and the radio frequency generator.

19. The substrate processing system of claim 15, wherein the matching network is configured to maintain impedance matching between an input of the matching network and an output of the radio frequency generator while the controller adjusts the first frequency to the second frequency.

20. The substrate processing system of claim 15, wherein:
- the tuning circuit includes a first circuit component and a second circuit component;
 - the first circuit component is connected to the first electrode;
 - 5 the second circuit component is connected to the second electrode; and
 - adjusting the first frequency to the second frequency changes a first impedance of the first circuit component and a second impedance of the second circuit component.