CLAIMS

What is claimed is:

1. A plasma etch chamber, comprising:

a chuck to support a workpiece during an etching process;

a first showerhead disposed above the chuck to distribute a first feed gas into the first chamber region, wherein the chuck and the first showerhead form a first RF coupled electrode pair to capacitively energize a first plasma of the first feed gas within a first chamber region between the first showerhead and the chuck;

a secondary electrode disposed above the first showerhead, opposite the chuck, wherein the secondary electrode and the first showerhead form a second RF coupled electrode pair to capacitively discharge a second plasma of a second feed gas within a second chamber region between the first showerhead and the secondary electrode; and

a controller to alternately energize the first and second plasmas during the etching process by alternately powering the first and second RF coupled electrode pairs automatically.

2. The plasma etch chamber of claim 1, wherein the secondary electrode is a second showerhead to distribute the first and second feed gases into the second chamber region, and wherein the first showerhead is further to conduct the first feed gas or a reactive species from the second plasma to the first chamber region.

3. The plasma etch chamber of claim 1, wherein the chuck and the secondary electrode are both coupled to a same RF power source through a relay switchable by the controller.

4. The plasma etch chamber of claim 1, wherein the chuck is coupled to a first RF power source comprising one or more RF generators, and wherein the first showerhead is selectably coupled through a relay to both a ground plane and to a second RF power source comprising

one or more RF generators operable at a frequency other than that of the first RF power source, the relay controllable by the controller.

5. The plasma etch chamber of claim 1, wherein the chuck is movable in a direction normal to the first showerhead or the chuck includes a lifter to elevate the workpiece off the chuck to control heating of the workpiece by the first showerhead during the etch process.

6. The plasma etch chamber of claim 1, wherein the first showerhead is a dual zone showerhead having a first plurality of aperture which fluidly couple the first and second chamber regions, and a second plurality of apertures which fluidly couple the first chamber region to a fluid source isolated from the second chamber region.

7. A plasma etch chamber, comprising:

a chuck to support a workpiece during an etching process;

a first showerhead disposed above the chuck to distribute a first feed gas into the first chamber region, wherein the chuck and the first showerhead form a first RF coupled electrode pair to capacitively discharge a first plasma of the first feed gas within a first chamber region between the first showerhead and the chuck and to provide an RF bias potential on the chuck;

a remote RF plasma source disposed above the first showerhead, opposite the chuck, wherein the remote RF plasma source is to discharge a second plasma of a second feed gas within the remote plasma source without providing an RF bias potential on the chuck; and

a controller to alternately energize the first and second plasmas during the etching process by alternately powering the first RF coupled electrode pair and the remote RF plasma source automatically.

8. The plasma etch chamber of claim 7, wherein the chuck is coupled to a first RF power source comprising one or more RF generators, and wherein the first showerhead is coupled to a

second RF power source comprising one or more RF generators operable at a frequency other than that of the first RF power source, the first showerhead isolated from a grounded chamber wall by a dielectric spacer to be electrically floating relative to the chamber wall.

9. The plasma etch chamber of claim 7, further comprising a second showerhead disposed between the remote RF plasma source and the first showerhead, the second showerhead to distribute etching species generated by the RF plasma source.

10. The plasma etch chamber of claim 7, wherein the first showerhead is a dual zone showerhead having a first plurality of apertures which fluidly couple the first chamber region and the remote plasma source, and a second plurality of apertures which fluidly couple the first chamber region to a fluid source isolated from the remote plasma source.

11. A plasma etch chamber, comprising:

a chuck to support a workpiece during an etching process;

a first showerhead disposed above the chuck to distribute a first feed gas into the first chamber region, wherein the chuck and the first showerhead form a first RF coupled electrode pair to capacitively discharge an RF plasma of the first feed gas within a first chamber region between the first showerhead and the chuck and to provide an RF bias potential on the chuck;

a high voltage DC supply coupled to a pair of electrodes disposed above the first showerhead to generate a DC plasma discharge, the pair of electrodes electrically insulated from the first showerhead by a dielectric spacer, wherein the first showerhead is biased negatively to an anodic potential relative a cathode of the DC supply coupled electrodes; and

a controller to alternately energize the RF and DC plasmas during the etching process by alternately powering the first RF coupled electrode pair and the DC supply coupled electrode pair automatically.

12. The plasma etch chamber of claim 11, wherein an anode of the DC supply coupled electrodes is a second showerhead having apertures to pass electrons from the DC plasma discharge, and wherein the first showerhead is further to conduct the first feed gas or to pass the electrons to the first chamber region.

13. The plasma etch chamber of claim 11, wherein the chuck is has a controllable DC potential between ground potential and a positive bias to control electron flux from the DC plasma to the workpiece.

14. The plasma etch chamber of claim 13, further comprising a thief electrode disposed between the first showerhead and the chuck, wherein the thief electrode is grounded through a variable capacitor to control electron flux from the DC plasma to the workpiece.

15. A plasma etch chamber, comprising:

a chuck to support a workpiece during an etching process;

a first showerhead disposed above the chuck to distribute a first feed gas into the first chamber region, wherein the chuck and the first showerhead form a first RF coupled electrode pair to capacitively discharge an RF plasma of the first feed gas within a first chamber region between the first showerhead and the chuck and to provide an RF bias potential on the chuck;

a conductive coil disposed above a dielectric chamber lid of the etch chamber and coupled to an RF source to generate an inductively coupled plasma discharge in a second chamber region disposed between the dielectric chamber lid and the first showerhead; and

a controller to alternately energize the capacitively coupled and inductively coupled plasmas during the etching process by alternately powering the first RF coupled electrode pair and the conductive coil automatically.

CLAIMS

What is claimed is:

1. A plasma etch chamber, comprising:

a chuck to support a workpiece during an etching process;

a first showerhead disposed above the chuck to distribute a first feed gas into the first chamber region, wherein the chuck and the first showerhead form a first RF coupled electrode pair to capacitively energize a first plasma of the first feed gas within a first chamber region between the first showerhead and the chuck;

a secondary electrode disposed above the first showerhead, opposite the chuck, wherein the secondary electrode and the first showerhead form a second RF coupled electrode pair to capacitively discharge a second plasma of a second feed gas within a second chamber region between the first showerhead and the secondary electrode; and

a controller to alternately energize the first and second plasmas during the etching process by alternately powering the first and second RF coupled electrode pairs automatically;

wherein the chuck and the secondary electrode are both coupled to a same RF power source through a relay switchable by the controller.