

CLAIMS

1. A plasma processing apparatus, the plasma processing apparatus comprising:
 - a processing chamber;
 - a pedestal disposed in the processing chamber, the pedestal operable to support a workpiece;
 - a plasma chamber disposed above the processing chamber in a vertical direction, the plasma chamber comprising a dielectric sidewall;
 - a separation grid separating the processing chamber from the plasma chamber;
 - a first plasma source proximate the dielectric sidewall of the plasma chamber, the first plasma source operable to generate a remote plasma in the plasma chamber above the separation grid;
 - a second plasma source, the second plasma source operable to generate a direct plasma in the processing chamber below the separation grid; and
 - a pump assembly comprising:
 - a pressure control valve;
 - a pumping selection control valve;
 - a turbopump coupled to the pumping selection control valve; and
 - a foreline pump coupled to the pumping selection control valve,wherein the pumping selection control valve is operable to select the turbopump to provide a first defined pressure within the processing chamber and further operable to select the foreline pump to provide a second defined pressure within the processing chamber.
2. The plasma processing apparatus of claim 1, wherein the plasma processing apparatus comprises a dielectric window extending from a portion of a processing chamber wall, the dielectric window defining at least a part of the processing chamber.
3. The plasma processing apparatus of claim 2, wherein the second plasma source comprises an induction coil located proximate the dielectric window.

4. The plasma processing apparatus of claim 1, wherein the separation grid is operable to filter one or more ions generated in the remote plasma, the separation grid operable to pass one or more neutral radicals to the processing chamber.
5. The plasma processing apparatus of claim 1, wherein the plasma processing apparatus comprises a gas source configured to feed a process gas into the plasma chamber, and wherein the first defined pressure is in a first range of about 5 millitorr to about 100 millitorr and the second defined pressure is in a second range of about 100 millitorr to about 10 Torr.
6. The plasma processing apparatus of claim 5, wherein the separation grid is operable to act as a showerhead for passage of the process gas into the processing chamber.
7. The plasma processing apparatus of claim 1, wherein the pedestal is movable in a vertical direction between at least a first vertical position for performing a first process and a second vertical position for performing a second process, the first vertical position being closer to the separation grid relative to the second vertical position.
8. The plasma processing apparatus of claim 1, wherein the pedestal comprises one or more lift pins movable in a vertical direction between at least a first vertical position for performing a first process and a second vertical position for performing a second process, the first vertical position being closer to the separation grid relative to the second vertical position.
9. The plasma processing apparatus of claim 7, wherein the first process is a dry strip process and the second process is a dry etch process.
10. The plasma processing apparatus of claim 1, wherein the first plasma source comprises an induction coil disposed about the dielectric sidewall.
11. The plasma processing apparatus of claim 1, wherein the second plasma source comprises an RF bias electrode associated with the pedestal, the RF bias electrode operable to

generate the direct plasma in the processing chamber when the RF bias electrode is energized with RF energy from an RF bias source.

12. A plasma processing apparatus, the plasma processing apparatus comprising:
- a processing chamber;
 - a pedestal disposed in the processing chamber, the pedestal operable to support a workpiece;
 - a plasma chamber disposed above the processing chamber in a vertical direction, the plasma chamber comprising a dielectric sidewall, the dielectric sidewall having a cylindrical shape;
 - a separation grid separating the processing chamber from the plasma chamber;
 - a dielectric window forming a portion of a ceiling of the processing chamber, the dielectric window flaring outward in a horizontal direction from the plasma chamber;
 - a first plasma source proximate the dielectric sidewall, the first plasma source operable to generate a remote plasma in the plasma chamber;
 - a second plasma source proximate the dielectric window, the second plasma source operable to generate a direct plasma in the processing chamber; and
 - a pump assembly comprising:
 - a pressure control valve;
 - a pumping selection control valve;
 - a turbopump coupled to the pumping selection control valve; and
 - a foreline pump coupled to the pumping selection control valve,wherein the pumping selection control valve is operable to select the turbopump to provide a first defined pressure within the processing chamber and further operable to select the foreline pump to provide a second defined pressure within the processing chamber.

13. The plasma processing apparatus of claim 12, wherein the first plasma source comprises an induction coil disposed about the dielectric sidewall, and wherein the first defined pressure is in a first range of about 5 millitorr to about 100 millitorr and the second defined pressure is in a second range of about 100 millitorr to about 10 Torr.

14. The plasma processing apparatus of claim 12, wherein the second plasma source comprises an induction coil disposed proximate the dielectric window.
15. The plasma processing apparatus of claim 12, further comprising an RF bias electrode associated with the pedestal, the RF bias electrode operable to generate a direct plasma in the processing chamber when the RF bias electrode is energized with RF energy from an RF bias source.
16. The plasma processing apparatus of claim 12, wherein the pedestal is movable in a vertical direction between at least a first vertical position for performing a first process and a second vertical position for performing a second process, the first vertical position being closer to the separation grid relative to the second vertical position.
17. The plasma processing apparatus of claim 12, wherein the pedestal comprises one or more lift pins movable in a vertical direction between at least a first vertical position for performing a first process and a second vertical position for performing a second process, the first vertical position being closer to the separation grid relative to the second vertical position.
18. A plasma processing apparatus, comprising:
a processing chamber;
a pedestal disposed in the processing chamber, the pedestal operable to support a workpiece;
a plasma chamber disposed above the processing chamber in a vertical direction, the plasma chamber comprising a dielectric sidewall, the dielectric sidewall having a cylindrical shape;
a separation grid separating the processing chamber from the plasma chamber;
a first plasma source proximate the dielectric sidewall, the first plasma source operable to generate a remote plasma in the plasma chamber;
a second plasma source, the second plasma source operable to generate a direct plasma in the processing chamber, the second plasma source comprising an RF bias electrode associated

with the pedestal, the RF bias electrode operable to generate the direct plasma in the processing chamber when the RF bias electrode is energized with RF energy from an RF bias source; and

a pump assembly comprising:

a pressure control valve;

a pumping selection control valve;

a turbopump coupled to the pumping selection control valve; and

a foreline pump coupled to the pumping selection control valve,

wherein the pumping selection control valve is operable to select the turbopump to provide a first defined pressure within the processing chamber and further operable to select the foreline pump to provide a second defined pressure within the processing chamber.

19. The plasma processing apparatus of claim 18, wherein the pedestal is movable in a vertical direction between at least a first vertical position for performing a first process and a second vertical position for performing a second process, the first vertical position being closer to the separation grid relative to the second vertical position, and wherein the first defined pressure is in a first range of about 5 millitorr to about 100 millitorr and the second defined pressure is in a second range of about 100 millitorr to about 10 Torr.

20. The plasma processing apparatus of claim 19, wherein the pedestal comprises one or more lift pins movable in a vertical direction between at least a first vertical position for performing a first process and a second vertical position for performing a second process, the first vertical position being closer to the separation grid relative to the second vertical position.