~~What is Claimed is:~~Claims

1. A substrate processing chamber, comprising:

a chamber body;

a chamber lid assembly having a housing enclosing a central channel that extends along a central axis and has an upper portion and a lower portion;

a lid plate coupled to the housing and having a contoured bottom surface that extends downwardly and outwardly from a central opening coupled to the lower portion of the central channel to a peripheral portion of the lid plate, the lid plate having one or more channels formed through the lid plate from a top surface of the lid plate to the contoured bottom surface; ~~and~~

a gas distribution plate disposed below the lid plate and having a plurality of apertures disposed through the gas distribution plate; and

an isolation collar coupled to the housing and having an inner channel extending through the isolation collar, wherein the inner channel of the isolation collar is fluidly coupled to the central channel of the lid plate through a plurality of holes;

wherein the contoured bottom surface of the lid plate extends to and contacts the gas distribution plate.

2. The substrate processing chamber of claim 1, further comprising:

a remote plasma source fluidly coupled to the central channel; and

~~an isolation collar coupled between the remote plasma source and the housing,~~ wherein the ~~isolation collar has an~~ inner channel extending through the isolation collar ~~to~~ fluidly couples the remote plasma source and the central channel.

3. The substrate processing chamber of claim 2, further comprising:

an exhaust conduit coupled to the isolation collar at a first end and to a main pumping channel at a second end; and

a valve coupled to the exhaust conduit to selectively open or close the exhaust conduit.

4. The substrate processing chamber of claim 1, wherein the housing includes an inner region; and further comprising:

an insert disposed in the inner region and having a central passageway that at least partially defines the central channel.

5. The substrate processing chamber of claim 4, further comprising:

a differential pumping line coupled to the insert at a first end and to the one or more channels formed through the lid plate at a second end,

wherein the one or more channels formed through the lid plate ~~includes one or more channels~~ are disposed in an area of the lid plate between two or more o-rings to exhaust gases trapped between the o-rings.

6. The substrate processing chamber of ~~any of claims 1 to 5~~ claim 1, further comprising:

a heater plate coupled to an upper surface of the lid plate to heat the lid plate to a predetermined temperature.

7. The substrate processing chamber of ~~any of claims 1 to 5~~ claim 1, wherein a density of the plurality of apertures varies across the gas distribution plate.

8. The substrate processing chamber of ~~any of claims 1 to 5~~ claim 1, wherein the plurality of apertures have an equivalent fluid conductance.

9. The substrate processing chamber of ~~any of claims 1 to 5~~ claim 1, wherein the gas distribution plate is formed of a non-corrosive ceramic material.

10. The substrate processing chamber of ~~any of claims 1 to 5~~ claim 1, wherein a lower surface of the chamber lid assembly is downwardly sloping.

11. The substrate processing chamber of claim 1, wherein the contoured bottom surface of the lid plate and the gas distribution plate form the lower portion of the central channel.

~~11~~12. The substrate processing chamber of ~~any of claims 1 to 5~~ claim 1, wherein each aperture of the plurality of apertures of the gas distribution plate ~~provide the only gas pathway from the central channel to a volume of the substrate processing chamber disposed on a side of the gas distribution plate opposite the central channel~~ comprises a through hole having an upper portion having a countersunk hole, a cylindrical center portion extending perpendicularly to an upper surface of the gas distribution plate, and a lower portion that tapers outwardly from a center of each aperture.

13. A substrate processing chamber, comprising:

a chamber body;

a chamber lid assembly having a housing enclosing a central channel that extends along a central axis and has an upper portion and a lower portion;

a lid plate coupled to the housing and having a contoured bottom surface that extends downwardly and outwardly from a central opening coupled to the lower portion of the central channel to a peripheral portion of the lid plate, the lid plate having one or more channels formed through the lid plate from a top surface of the lid plate to the contoured bottom surface;

a gas distribution plate disposed below the lid plate and having a plurality of apertures disposed through the gas distribution plate, wherein the contoured bottom surface of the lid plate completely encloses top openings of the plurality of apertures disposed through the gas distribution plate;

a remote plasma source fluidly coupled to the central channel;

an isolation collar coupled between the remote plasma source and the housing, wherein the isolation collar has an inner channel extending through the isolation collar to fluidly couple the remote plasma source and the central channel;

an exhaust conduit coupled to the isolation collar at a first end and to a main pumping channel at a second end; and

a valve coupled to the exhaust conduit to selectively open or close the exhaust conduit.

14. The substrate processing chamber of claim 13, wherein the housing includes an inner region; and further comprising:

an insert disposed in the inner region and having a central passageway that at least partially defines the central channel.

15. The substrate processing chamber of claim 14, further comprising:

a differential pumping line coupled to the insert at a first end and to the one or more channels formed through the lid plate at a second end,

wherein the one or more channels formed through the lid plate are disposed in an area of the lid plate between two or more o-rings to exhaust gases trapped between the o-rings.

16. The substrate processing chamber of claim 13, further comprising:

a heater plate coupled to an upper surface of the lid plate to heat the lid plate to a predetermined temperature.

17. The substrate processing chamber of claim 13, wherein a density of the plurality of apertures varies across the gas distribution plate.

18. The substrate processing chamber of claim 13, wherein the plurality of apertures have an equivalent fluid conductance.

19. The substrate processing chamber of claim 13, wherein the gas distribution plate is formed of a non-corrosive ceramic material.

20. The substrate processing chamber of claim 13, wherein the contoured bottom surface of the lid plate and the gas distribution plate form the lower portion of the central channel.

~~12. The substrate processing chamber of any of claims 1 to 5, further comprising:~~

~~a heater plate coupled to an upper surface of the lid plate to heat the lid plate to a predetermined temperature, wherein the gas distribution plate is formed of a~~

non-corrosive ceramic material, and wherein a lower surface of the chamber lid assembly is downwardly sloping.

13. A method of processing a substrate, comprising:

flowing a first process gas into a gas dispersion channel of a chamber lid assembly and a reaction zone of a process chamber;

flowing the first process gas through a plurality of apertures in a gas distribution plate disposed in the reaction zone and onto the substrate;

flowing a cleaning gas into the gas dispersion channel and the reaction zone;

exhausting the cleaning gas via an exhaust system;

flowing a second process gas into the gas dispersion channel and the reaction zone;

flowing the second process gas through the plurality of apertures in the gas distribution plate and onto the substrate;

flowing the cleaning gas into the gas dispersion channel and the reaction zone; and

exhausting the cleaning gas via the exhaust system.

14. The method of claim 13, further comprising:

heating the chamber lid assembly to a predetermined temperature.

15. The method of claim 14, wherein the predetermined temperature is greater than or equal to 150 °C.