

CLAIMS

1. A semiconductor processing system, comprising:
 - a processing chamber including-
 - a lower electrode plate,
 - an upper electrode assembly disposed above and substantially parallel to the lower electrode plate, the upper electrode assembly having a gas supply channel formed to extend through a bottom surface of the upper electrode assembly, and
 - a dielectric edge ring having an upper surface defined to contact and support a peripheral region of a bottom surface of a substrate, the dielectric edge ring formed to circumscribe the lower electrode plate and extend in a controllable manner above the lower electrode plate into a region between the lower electrode plate and the upper electrode assembly, such that a lower processing region is formed inside the dielectric edge ring between a top surface of the lower electrode plate and a plane corresponding to the upper surface of the dielectric edge ring,
 - an inner base plate configured to support the lower electrode plate, the inner base plate formed of a dielectric material, and
 - an outer base plate configured to support and circumscribe the inner base plate;
 - a conduit configured to extend into the chamber to the lower processing region; and
 - a remote plasma source configured to generate reactive constituents of a plasma external to the chamber and flow the reactive constituents of the plasma through the conduit to the lower processing region,
 - wherein the outer base plate is connected to receive radiofrequency power from a radiofrequency power supply to generate more reactive constituents of the plasma at a region near a peripheral edge of the substrate.

2. The semiconductor processing system as recited in claim 1, wherein the remote plasma source is configured to generate reactive constituents of the plasma using radiofrequency power.

3. The semiconductor processing system as recited in claim 2, wherein the radiofrequency power is within a range extending from about 1 kiloWatt to about 10 kiloWatts.

4. The semiconductor processing system as recited in claim 2, wherein the radiofrequency power is within a range extending from about 5 kiloWatts to about 8 kiloWatts.

5. The semiconductor processing system as recited in claim 2, wherein the radiofrequency power is generated using one or more radiofrequency signals within a range extending from about 2 megaHertz to about 60 megaHertz.

6. The semiconductor processing system as recited in claim 1, wherein the remote plasma source is configured to generate reactive constituents of the plasma using microwave power.

7. The semiconductor processing system as recited in claim 1, wherein the remote plasma source is configured to generate reactive constituents of the plasma using a combination of radiofrequency power and microwave power.

8. The semiconductor processing system as recited in claim 1, wherein the remote plasma source is configured as a capacitively coupled plasma source.

9. The semiconductor processing system as recited in claim 1, wherein the remote plasma source is configured as an inductively coupled plasma source.

10. The semiconductor processing system as recited in claim 1, wherein the remote plasma source is configured to generate reactive constituents of the plasma using a process gas supplied at a flow rate within a range extending from about 0.1 standard liters per minute to about 5 standard liters per minute, and at a pressure within a range extending from about 0.1 Torr to about 10 Torr.

11. The semiconductor processing system as recited in claim 1, wherein the dielectric edge ring is configured as a stack of annular shaped ring structures separated from each other by spaces that form vents for fluid communication from the lower processing region to an exhaust region.

12. The semiconductor processing system as recited in claim 11, wherein the dielectric edge ring includes a plurality of structural members connected to the stack of annular shaped ring structures, the plurality of structural members located at spaced apart locations about a circumference of the dielectric edge ring.

13. The semiconductor processing system as recited in claim 12, wherein the plurality of structural members are defined to hold the stack of annular shaped ring structures in a fixed spatial configuration.

14. The semiconductor processing system as recited in claim 12, wherein the plurality of structural members are defined to provide for controlled variation of a spatial configuration of the stack of annular shaped ring structures, such that spaces between the annular shaped rings that form the vents are adjustable in size by adjustment of the plurality of structural members.

15. The semiconductor processing system as recited in claim 11, wherein each annular shaped ring structure has a substantially same size and shape.

16. The semiconductor processing system as recited in claim 1, further comprising:

a radiofrequency power supply connected to supply radiofrequency signals to the lower electrode plate.

17. The semiconductor processing system as recited in claim 1, wherein the upper electrode assembly includes a dielectric upper plate positioned in exposure to the lower electrode plate.

18. The semiconductor processing system as recited in claim 17, wherein the upper electrode assembly includes an upper electrode plate, wherein the dielectric upper plate is positioned between the upper electrode plate and the lower electrode plate.

19. A method for plasma cleaning of a substrate, comprising:
positioning a substrate on a dielectric edge ring within a processing chamber, the dielectric edge ring having an upper surface defined to contact and support a peripheral region of a bottom surface of the substrate, the dielectric edge ring formed to circumscribe a lower electrode plate and extend in a controllable manner above the lower electrode plate into a region between the lower electrode plate and an upper electrode assembly, such that a lower processing region is formed inside the dielectric edge ring between a top surface of the lower electrode plate and the bottom surface of the substrate;

generating reactive constituents of a plasma within a remote plasma source external to the chamber; and

flowing the reactive constituents of the plasma through a conduit to the lower processing region; and

supplying radiofrequency power to an outer base plate that is configured to support and circumscribe an inner base plate, wherein the inner base plate is formed of a dielectric material and is configured to support the lower electrode plate, wherein the radiofrequency power supplied to the outer base plate generates more reactive constituents of the plasma at a region near a peripheral edge of the substrate.

20. The method for plasma cleaning of the substrate as recited in claim 19, further comprising:

flowing a process gas to a peripheral region of the substrate;

flowing a purge gas through a central location of the upper plate to central location of a top surface of the substrate, the purge gas preventing flow of the process gas toward the central location of the top surface of the substrate; and

supplying radiofrequency power to the lower electrode plate, the radiofrequency power transforming the process gas into a second plasma in exposure to the peripheral region of the substrate.