Claims

1. A plasma etch processing tool, comprising:

a substrate support for supporting a substrate having a substrate surface area;

a processing head including a plasma microchamber having an internal plasma volume bounded by a chamber insert in the processing head on all sides except for a single entire open side of the plasma microchamber, the open side of the plasma microchamber being defined by a portion of the substrate surface to be processed, the open side of the plasma microchamber being oriented over the surface to be processed, the open side of the plasma microchamber having an area that is less than the substrate surface area, and the plasma microchamber being movable relative to the substrate;

a sealing structure defined between the substrate support and the processing head; and

a power supply connected to the plasma microchamber and the substrate support, wherein the processing head includes a first plasma electrode and the substrate support includes a second plasma electrode, wherein the plasma microchamber is capable of generating a plasma in the internal plasma volume between the first plasma electrode and the surface to be processed, wherein only a portion of the substrate support is biased and the biased portion of the substrate support is substantially aligned with the plasma microchamber, and wherein the biased portion of the substrate support is movable for maintaining substantial alignment with the movable plasma microchamber.

2. The plasma etch processing tool of claim 1, wherein the power supply has a setting that is proportional to the internal plasma volume in the plasma microchamber.

3. The plasma etch processing tool of claim 1, wherein the power supply includes a first power supply coupled to the plasma microchamber and a second power supply coupled to the substrate support.

4. The plasma etch processing tool of claim 1, wherein the substrate support is a chuck.

5. The plasma etch processing tool of claim 4, wherein the chuck has a chucking area that is less than or equal an area of the substrate.

6. The plasma etch processing tool of claim 1, further comprising:
a process material source coupled to the plasma microchamber; and
a vacuum source coupled to the plasma microchamber.

7. The plasma etch processing tool of claim 6, wherein the vacuum source is an adjustable vacuum source.

8. The plasma etch processing tool of claim 1, wherein the sealing structure includes a sealing ring.

9. The plasma etch processing tool of claim 1, wherein the sealing structure defined between the substrate support and the processing head contacts the substrate support and the processing head.

10. The plasma etch processing tool of claim 1, wherein the plasma microchamber is movable relative to the surface to be processed and further comprises an actuator connected to the substrate support, the actuator configured to move the substrate support so as to expose a selected region of surface to be processed, when placed over the substrate support.

11. The plasma etch processing tool of claim 10, wherein the actuator is configured to move in one or more of a rotational direction, an angular direction, a linear direction, a non-linear direction, or a pivoting direction.

12. The plasma etch processing tool of claim 1, wherein the plasma microchamber is movable relative to the surface to be processed and further comprises an actuator connected to the plasma microchamber, the actuator configured to move the plasma microchamber so as to expose a selected region of surface to be processed, when placed over the substrate support.

13. The plasma etch processing tool of claim 12, wherein the actuator is configured to move in one or more of a rotational direction, an angular direction, a linear direction, a non-linear direction, or a pivoting direction.

14. The plasma etch processing tool of claim 1, wherein the substrate support includes an edge ring.

15. The plasma etch processing tool of claim 14, wherein at least a portion of the edge ring is biased.

16. The plasma etch processing tool of claim 14, wherein at least a portion of the edge ring is replaceable.

17. The plasma etch processing tool of claim 14, wherein at least a portion of the edge ring is reactive with a plasma in the plasma microchamber.

18. The plasma etch processing tool of claim 14, wherein the edge ring is adjacent to at least a portion of an edge of a substrate when present on the substrate support.

19. The plasma etch processing tool of claim 14, wherein the edge ring is adjacent to a curved portion of an edge of a substrate when present on the substrate support.

20. The plasma etch processing tool of claim 1, wherein the plasma microchamber includes a plurality of inlet ports and a plurality of outlet ports.

21. The plasma etch processing tool of claim 20, wherein at least one of the plurality of inlet ports is coupled to one of a plurality of process material sources.

22. The plasma etch processing tool of claim 20, wherein at least one of the plurality of inlet ports are coupled to a purge material source.

23. The plasma etch processing tool of claim 20, wherein at least one of the plurality of outlet ports are coupled to a vacuum source.

24. The plasma etch processing tool of claim 23, wherein the at least one of the plurality of outlet ports is formed in the plasma microchamber proximate to an upper portion of the plasma microchamber and capable of drawing plasma byproducts out of the plasma microchamber.

25. The plasma etch processing tool of claim 23, wherein the at least one of the plurality of outlet ports is formed in the plasma microchamber proximate to a lower portion of the plasma microchamber and capable of drawing plasma byproducts out of the plasma microchamber.

26. The plasma etch processing tool of claim 20, wherein at least one of the plurality of outlet ports are included in a top portion of the plasma microchamber.

27. The plasma etch processing tool of claim 1, further comprising at least one monitoring instrument.

28. The plasma etch processing tool of claim 27, wherein the monitoring instrument monitors a byproduct output from the plasma microchamber.

29. The plasma etch processing tool of claim 27, wherein the monitoring instrument monitors a spectrum of light emitted from the plasma microchamber.

30. The plasma etch processing tool of claim 27, wherein the monitoring instrument is coupled to a controller.

31. The plasma etch processing tool of claim 27, wherein the monitoring instrument is oriented toward the surface of the substrate.

32. The plasma etch processing tool of claim 1, wherein the internal plasma volume of the plasma microchamber has a constant width along a length of the open side of the plasma microchamber.

33. The plasma etch processing tool of claim 1, wherein the internal plasma volume of the plasma microchamber has a width that varies along a length of the open side of the plasma microchamber.

34. The plasma etch processing tool of claim 1, wherein the internal plasma volume of the plasma microchamber has a constant depth along a length of the open side of the plasma microchamber.

35. The plasma etch processing tool of claim 1, wherein the internal plasma volume of the plasma microchamber has a depth that varies along a length of the open side of the plasma microchamber.

36. The plasma etch processing tool of claim 1, wherein the internal plasma volume of the plasma microchamber has a depth that is adjustable along a length of the open side of the plasma microchamber.

37. The plasma etch processing tool of claim 1, wherein the plasma etch processing tool includes a plurality of plasma microchambers.

38. The plasma etch processing tool of claim 37, wherein the plurality of plasma microchambers have a linear arrangement.

39. The plasma etch processing tool of claim 37, wherein the plurality of plasma microchambers have a rotary arrangement.

40. The plasma etch processing tool of claim 1, wherein the internal plasma volume has a substantially centrally located cross-sectional area parallel to the surface to be processed and the area of the open side of the plasma microchamber is equal to or greater than the substantially centrally located cross-sectional area of the internal plasma volume.

41. The plasma etch processing tool of claim 1, wherein the sealing structure defined between the substrate support and the processing head does not contact the substrate surface.

42. A plasma etch processing tool comprising:

a substrate support for supporting a substrate having a substrate surface area;

a processing head including a plasma microchamber having an open side that is oriented over the substrate support, the open side of the plasma microchamber having a process area that is less than the substrate surface area;

a sealing structure defined between the substrate support and the processing head; and

a power supply connected to the plasma microchamber and the substrate support, wherein the processing head includes a first plasma electrode and the substrate support includes a second plasma electrode, wherein the plasma microchamber is capable of generating a plasma between the first plasma electrode and the second plasma electrode, wherein only a portion of the substrate support is biased, and wherein the biased portion of the substrate support is movable.

43. The plasma etch processing tool of claim 42, wherein the plasma microchamber is movable relative to the substrate and the biased portion of the substrate support is substantially aligned with the plasma microchamber.

44. The plasma etch processing tool of claim 42, wherein the plasma microchamber has an internal plasma volume bounded by a chamber insert in the processing head on all sides except for an open side, the open side being an entire open side of the plasma microchamber, the open side of the plasma microchamber being defined by a portion of a surface to be processed, the open side of the plasma microchamber being oriented over the surface to be processed, and wherein the plasma microchamber is capable of generating a plasma in the internal plasma volume between the first plasma electrode and the surface being processed.