

What is claimed is CLAIMS:

1. ~~An apparatus for treating a workpiece with plasma, the apparatus comprising:~~
 - ~~a chamber partially defining a processing space;~~
 - ~~a base assembly having an upper surface and an inner perimeter, wherein the upper surface of the base assembly defines, at least in part, a lower end of the chamber, and wherein the inner perimeter of the base assembly defines an opening in the base assembly; and~~
 - ~~a workpiece holder assembly positioned within the opening in the base assembly,~~~~wherein the workpiece holder assembly comprises:~~
 - ~~a workpiece holder body having an outer perimeter and an upper surface, wherein the upper surface is configured to receive the workpiece, and~~
 - ~~one or more heating elements in contact with, at least in part, the workpiece holder body of the workpiece holder assembly,~~~~— wherein the inner perimeter of the base assembly and the outer perimeter of the workpiece holder body define a gap circumscribing, at least in part, the workpiece holder body, wherein the gap thermally isolates the base assembly from the workpiece holder body.~~
2. ~~The apparatus of claim 1, wherein a bottom portion of the workpiece holder body comprises a flange by which the workpiece holder assembly is exclusively coupled to the base assembly.~~
3. ~~The apparatus of claim 2, wherein a top surface of the flange is coupled to an undercut of the base assembly by, exclusively, one or more connectors.~~
4. ~~The apparatus of claim 3, wherein a substantially horizontal portion of the gap is defined by the undercut of the base assembly and the top surface of the flange, and a majority of the substantially horizontal portion of the gap is unbroken by the one or more connectors.~~
5. ~~The apparatus of claim 4, wherein a circumference of the top surface of the flange is configured with a sealing element, the sealing element providing contact with the undercut of the base assembly.~~

6. — The apparatus of claim 5, wherein direct conductive heat transfer between the workpiece holder body and the base assembly is limited exclusively to the one or more connectors and the sealing element.

7. — The apparatus of the claim 6, wherein an electrode of the base assembly comprises the undercut of the base assembly.

8. — The apparatus of claim 7, further comprising a chamber base supporting, at least in part, the electrode, wherein a sealing element is situated between the chamber base and the electrode to provide a thermal break between the chamber base and the electrode.

9. — The apparatus of claim 1, wherein a substantially vertical portion of the gap is defined by an outer sidewall of the workpiece holder body and the inner perimeter of the base assembly.

10. — The apparatus of claim 9, wherein the substantially vertical portion of the gap fully circumscribes the outer sidewall of the workpiece holder body.

11. — The apparatus of claim 10, wherein a bottom portion of the workpiece holder body comprises a flange by which the workpiece holder assembly is coupled to the base assembly, wherein the substantially vertical portion of the gap vertically spans from the upper surface of the workpiece holder body to the flange.

12. — The apparatus of claim 11, wherein there is no direct contact, via the substantially vertical portion of the gap, between the base assembly and the workpiece holder body.

13. — The apparatus of claim 1, wherein the one or more heating elements are configured as two or more concentric rings.

14. — The apparatus of claim 1, wherein the one or more heating elements are at least partially embedded in a bottom surface of the workpiece holder body.

15. — ~~The apparatus of claim 14, wherein the bottom surface of the workpiece holder body is flush with respective one or more bottom surfaces of the one or more heating elements.~~

16. — ~~The apparatus of claim 15, wherein an insulator piece is coupled to the bottom surface of the workpiece holder body and the insulator piece covers the one or more bottom surfaces of the one or more heating elements.~~

17. — ~~The apparatus of claim 1, wherein the workpiece holder body is configured with a temperature sensor.~~

18. — ~~A method for processing a workpiece, the method comprising:~~
— ~~positioning the workpiece at an apparatus configured to perform plasma treatment;~~
— ~~positioning, following completion of the plasma treatment, the workpiece at an unheated cooling station comprising a temperature sensor;~~
— ~~determining, via the temperature sensor, that a temperature of the workpiece is below a threshold value; and~~
— ~~moving, based on the determining that the temperature of the workpiece is below the threshold value, the workpiece away from the cooling station.~~

19. — ~~The method of claim 18, where the moving the workpiece away from the cooling station comprises moving the workpiece to a second apparatus associated with the apparatus configured to perform plasma treatment.~~

20. — ~~The method of claim 18, where the moving the workpiece away from the cooling station comprises moving the workpiece to a container configured to receive the workpiece.~~

21. — ~~The method of claim 20, wherein the container comprises at least one of a Front Opening Universal Pod (FOUP) and an Equipment Front End Module (EFEM).~~

22. — ~~A system for processing a workpiece, the system comprising:~~

~~— a transport apparatus configured to receive the workpiece;~~
~~— a plasma treatment apparatus configured to perform a plasma treatment; and~~
~~— an unheated cooling station comprising a temperature sensor,~~
~~— wherein the transport apparatus is further configured to:~~
~~— position the workpiece at the plasma treatment apparatus,~~
~~— position, following completion of the plasma treatment, the workpiece at the~~
~~unheated cooling station,~~
~~— determine, via the temperature sensor, that a temperature of the workpiece is~~
~~below a threshold value, and~~
~~— receive, based on the determination that the temperature of the workpiece is~~
~~below the threshold value, the workpiece by the transport apparatus for further~~
~~positioning.~~

~~23. — The system of claim 22, wherein the unheated cooling station comprises a second~~
~~apparatus associated with the plasma treatment apparatus.~~

~~24. — The system of claim 22, wherein the unheated cooling station comprises a container~~
~~configured to receive the workpiece.~~

~~25. — The system of claim 24, wherein the container comprises at least one of a Front Opening~~
~~Universal Pod (FOUP) and an Equipment Front End Module (EFEM).~~

~~26. — An apparatus for treating a workpiece with plasma, the apparatus comprising:~~
~~— a chamber partially defining a processing space;~~
~~— a chamber base having an upper surface, wherein the upper surface of the chamber base~~
~~defines, at least in part, a lower end of the chamber, and wherein the upper surface of the~~
~~chamber base defines an opening in the chamber base;~~
~~— a heated workpiece holder positioned within the opening in the chamber base and~~
~~configured to receive the workpiece;~~
~~— a plasma excitation source operable to provide a plasma in the processing space for~~
~~treating the workpiece; and~~

~~— a liquid conduit proximate the plasma excitation source, the liquid conduit configured to receive a liquid to cool the plasma excitation source.~~

~~27. The apparatus of claim 26, wherein the plasma excitation source comprises an electrode.~~

~~28. The apparatus of claim 27, wherein the liquid conduit is in contact, at least in part, with the electrode.~~

~~29. The apparatus of claim 27, wherein the liquid conduit is embedded, at least in part, within the electrode.~~

~~30. The apparatus of claim 27, wherein the liquid conduit extends, substantially, around a periphery of the electrode.~~

~~31. An apparatus for treating a workpiece with plasma, the apparatus comprising:~~

~~a chamber partially defining a processing space for receiving process gas, wherein the chamber is under vacuum during treatment of the workpiece with plasma;~~

~~a base assembly defining a lower end of the processing space, wherein the base assembly comprises a workpiece holder having a perimeter and configured to receive the workpiece, a baffle assembly having a perimeter and surrounding the perimeter of the workpiece holder, and a chamber base surrounding the perimeter of the baffle assembly, and wherein the workpiece holder has an upper surface that defines at least a first portion of the lower end of the processing space and the baffle assembly has an upper surface that defines at least a second portion of the lower end of the processing space;~~

~~a process gas supply port in the chamber for introducing the process gas to the processing space;~~

~~a plasma excitation source operable to provide a plasma in the processing space from the process gas for treating the workpiece; and~~

~~an exhaust opening extending continuously around a majority of the perimeter of the baffle assembly for evacuating said processing space during treatment of the workpiece with plasma.~~

32. — ~~The apparatus of claim 31, wherein the base assembly defines a flow path via which said processing space is evacuated from the base assembly.~~

33. — ~~The apparatus of claim 32, wherein the flow path comprises a first vertical portion vertically offset from a second vertical portion.~~

34. — ~~The apparatus of claim 33, wherein the first vertical portion is defined by a first vertical passage and the second vertical portion is defined by a second vertical passage, the second vertical passage being vertically offset from the first vertical passage.~~

35. — ~~The apparatus of claim 34, wherein the plasma excitation source comprises an electrode and the electrode is positioned vertically between the chamber base and the baffle assembly in the base assembly, and wherein the first vertical passage is defined by the electrode and the second vertical passage is defined by the chamber base.~~

36. — ~~The apparatus of claim 35, wherein the baffle assembly and the electrode are coupled and define an interior space between the baffle assembly and the electrode, and wherein the interior space between the baffle assembly and the electrode defines a portion of the flow path immediately subsequent to evacuation of said processing space via the exhaust opening.~~

37. — ~~The apparatus of claim 36, wherein the portion of the flow path defined by the interior space between the baffle assembly and the electrode comprises a first lateral portion prior to the first vertical passage defined by the electrode.~~

38. — ~~The apparatus of claim 37, wherein the electrode is coupled to the chamber base and the first vertical passage passes to the chamber base.~~

39. — ~~The apparatus of claim 38, wherein the chamber base defines a circular channel configured to define a second lateral portion of the flow path subsequent to the first vertical passage.~~

40. — ~~The apparatus of claim 39, wherein a lateral direction of the first lateral portion of the flow path and a lateral direction of the second lateral portion of the flow path are substantially opposite one another.~~

41. — ~~The apparatus of claim 39, wherein the second vertical passage is defined by a floor of the circular channel of the chamber base.~~

42. — ~~The apparatus of claim 41, wherein a vacuum plate is coupled to a bottom end of the chamber base, the coupled chamber base and the vacuum plate defining a vacuum space configured with a vacuum port connected to a vacuum source.~~

43. — ~~The apparatus of claim 42, wherein vacuum space defines a third lateral portion of the flow path, wherein the third lateral portion of the flow path extends laterally from a periphery of the vacuum space and the vacuum port.~~

44. — ~~The apparatus of claim 35, wherein the electrode defines two or more vertical passages and the chamber base defines two or more vertical passages, the two or more vertical passages defined by the electrode being vertically offset from each of the two or more vertical passages defined by the chamber base.~~

45. — ~~The apparatus of claim 44, wherein the two or more vertical passages defined by the electrode comprises four vertical passages and the two or more vertical passages defined by the chamber base comprises four vertical passages, the four vertical passages defined by the electrode being vertically offset from each of the four vertical passages defined by the chamber base by at least 30 degrees relative to a center of at least one of the electrode and the chamber base.~~

46. — ~~The apparatus of claim 45, wherein the four vertical passages defined by the electrode are vertically offset from each of the four vertical passages defined by the chamber base by 45 degrees relative to the center of the at least one of the electrode and the chamber base.~~

1. An apparatus for treating a workpiece with plasma, the apparatus comprising:
a chamber partially defining a processing space for receiving process gas, wherein the chamber is under vacuum during treatment of the workpiece with plasma;
a base assembly defining a lower end of the processing space, wherein the base assembly comprises a workpiece holder having a perimeter and configured to receive the workpiece, a baffle plate having an outer perimeter, an electrode coupled to the baffle plate and having a sidewall, and a chamber base surrounding an outer surface of the sidewall of the electrode, and wherein a majority of the outer perimeter of the baffle plate is proximate to, but not in direct contact with, an inner surface of the sidewall of the electrode;
a process gas supply port in the chamber for introducing the process gas to the processing space; and
a plasma excitation source operable to provide a plasma in the processing space from the process gas for treating the workpiece,
the majority of the outer perimeter of the baffle plate and the inner surface of the sidewall of the electrode being arranged to define a gap for evacuating said processing space during treatment of the workpiece with plasma.
2. The apparatus of claim 1, wherein the base assembly defines a flow path via which said processing space is evacuated from the base assembly.
3. The apparatus of claim 2, wherein the flow path comprises a first vertical portion vertically offset from a second vertical portion.
4. The apparatus of claim 3, wherein the first vertical portion is defined by a first vertical passage and the second vertical portion is defined by a second vertical passage, the second vertical passage being vertically offset from the first vertical passage.
5. The apparatus of claim 4, wherein the plasma excitation source comprises the electrode and the electrode is positioned vertically between the chamber base and the baffle plate in the base assembly, and wherein the first vertical passage is defined by the electrode and the second vertical passage is defined by the chamber base.

6. The apparatus of claim 5, wherein the baffle plate and the electrode are coupled and define an interior space between the baffle plate and the electrode, and wherein the interior space between the baffle plate and the electrode defines a portion of the flow path immediately subsequent to evacuation of said processing space.

7. The apparatus of claim 6, wherein the portion of the flow path defined by the interior space between the baffle plate and the electrode comprises a first lateral portion prior to the first vertical passage defined by the electrode.

8. The apparatus of claim 7, wherein the electrode is coupled to the chamber base and the first vertical passage passes to the chamber base.

9. The apparatus of claim 8, wherein the chamber base defines a circular channel configured to define a second lateral portion of the flow path subsequent to the first vertical passage.

10. The apparatus of claim 9, wherein a lateral direction of the first lateral portion of the flow path and a lateral direction of the second lateral portion of the flow path are substantially opposite one another.

11. The apparatus of claim 9, wherein the second vertical passage is defined by a floor of the circular channel of the chamber base.

12. The apparatus of claim 11, wherein a vacuum plate is coupled to a bottom end of the chamber base, the coupled chamber base and the vacuum plate defining a vacuum space configured with a vacuum port connected to a vacuum source.

13. The apparatus of claim 12, wherein the vacuum space defines a third lateral portion of the flow path, wherein the third lateral portion of the flow path extends laterally from a periphery of the vacuum space and the vacuum port.

14. The apparatus of claim 5, wherein the electrode defines two or more vertical passages and the chamber base defines two or more vertical passages, the two or more vertical passages defined by the electrode being vertically offset from each of the two or more vertical passages defined by the chamber base.

15. The apparatus of claim 14, wherein the two or more vertical passages defined by the electrode comprises four vertical passages and the two or more vertical passages defined by the chamber base comprises four vertical passages, the four vertical passages defined by the electrode being vertically offset from each of the four vertical passages defined by the chamber base by at least 30 degrees relative to a center of at least one of the electrode and the chamber base.

16. The apparatus of claim 15, wherein the four vertical passages defined by the electrode are vertically offset from each of the four vertical passages defined by the chamber base by 45 degrees relative to the center of the at least one of the electrode and the chamber base.

17. The apparatus of claim 2, wherein a first portion of the flow path is defined by the gap and a second portion of the flow path comprises a horizontal portion immediately subsequent to the first portion of the flow path.

18. The apparatus of claim 17, wherein the horizontal portion of the flow path is defined between at least a portion of the baffle plate and at least a portion of the electrode.

19. The apparatus of claim 17, wherein a third, vertical portion of the flow path is defined by a vacuum conduit leading from a vacuum space in the base assembly.

20. The apparatus of claim 1, wherein an entirety of the outer perimeter of the baffle plate is proximate to, but not in direct contact with, the inner surface of the sidewall of the electrode.