

CLAIMS

1. A plasma processing apparatus, comprising:
 - a chamber having walls and a substrate support defined in a processing volume;
 - a Faraday shield having a disk shape with a process side and a back side, the disk shape extending between a center region to a periphery region, the Faraday shield defined within the processing volume, such that the process side faces the substrate support;
 - a dielectric window disposed over the Faraday shield, the dielectric window having a center opening;
 - coils for supplying radio frequency (RF) power disposed over the dielectric window;
 - a hub having an internal plenum for passing a flow of fluid received from an input conduit and removing the flow of fluid from an output conduit, the hub having sidewalls and a center cavity inside of the sidewalls for an optical probe, the internal plenum is disposed in the sidewalls, the hub having an interface surface that is in physical contact with the back side of the Faraday shield, the physical contact provides for a thermal coupled to said Faraday shield at the center region, and wherein an outer surface of the sidewalls of the hub are disposed within the center opening of the dielectric window and the coils are oriented around the sidewalls of the hub above the dielectric window, said sidewalls of the hub further providing thermal couple to a region of the dielectric window proximate to the center opening;
 - a fluid delivery control coupled to the input conduit of the hub, the fluid delivery control is configured with a flow rate regulator for setting a flow rate of the flow of fluid through the plenum of the hub; and
 - a fluid removal control coupled to the output conduit for removing the flow of fluid from the plenum of the hub.
2. The plasma processing apparatus of claim 1,
wherein the coils are transformer coupled plasma (TCP) coils.
3. The plasma processing apparatus of claim 1, wherein the plenum of the hub defines a loop into and out of the hub, such that the flow of fluid is maintained outside of the processing volume.

4. The plasma processing apparatus of claim 1, wherein the flow of fluid provides for a reduced temperature at the center region of the Faraday shield, the reduced temperature in the center region induces a conductive flow of heat through the Faraday shield toward the center region.

5. The plasma processing apparatus of claim 4, wherein the plenum of the hub defines a loop into and out of the hub, such that the flow of fluid is maintained outside of the processing volume.

6. The plasma processing apparatus of claim 1, wherein the center region in the back side of the Faraday shield includes a plenum that mates with the plenum of the hub, such that the interface surface of the hub surrounds the plenum of the Faraday shield, wherein the thermal couple to the back side of the Faraday shield is defined at the interface surface and via the flow of fluid passing through the hub.

7. The plasma processing apparatus of claim 6, wherein the plenum of the hub and the plenum of the Faraday shield define a loop into and out of the hub, and the fluid flow is maintained outside of the processing volume.

8. The plasma processing apparatus of claim 1, further comprising, a gas injector defined in a center cavity of the hub, the gas injector defined for providing process gas into the processing volume.

9. The plasma processing apparatus of claim 1, wherein the optical probe is defined for monitoring process conditions in the processing volume during use.

10. The plasma processing apparatus of claim 1, wherein the fluid delivery control delivers fluids selected from air, gases, liquids, or mixtures thereof.

11. The plasma processing apparatus of claim 1, wherein the fluids are coupled to a chiller for reducing a temperature of the fluids before delivery by the fluid delivery control.

12. The plasma processing apparatus of claim 1, further comprising, a compressed dry air (CDA) source coupled to the fluid delivery control.

13. The plasma processing apparatus of claim 1, further comprising, an air supply and air amplifier coupled to the fluid delivery control.
14. The plasma processing apparatus of claim 1, further comprising, a controller for managing the flow rate regulator of the fluid delivery control.
15. The plasma processing apparatus of claim 14, wherein the controller correlates the flow rate of the fluid delivery control to process operations to be executed by the plasma processing apparatus.
16. The plasma processing apparatus of claim 14, wherein the controller increases flow rate to increase temperature reductions in the center region of the Faraday shield, or reduces flow rate to reduce temperature reductions in the center region of the Faraday shield, wherein temperature reductions increase conductive heat flow within the Faraday shield in a direction toward the center region.
17. A plasma processing apparatus, comprising,
a disk structure defining a Faraday shield, the disk structure having a process side and a back side, the disk structure extending between a center region to a periphery region, the disk structure configured to reside within the processing volume of the plasma processing apparatus, such that the process side faces a substrate support within the processing volume;
a dielectric window disposed over the Faraday shield, the dielectric window having a center opening;
coils for supplying radio frequency (RF) power disposed over the dielectric window;
a hub having an internal plenum for passing a flow of air received from an input conduit and removing the flow of air from an output conduit, the hub having an interface surface that is in physical contact to the back side of the disk structure at the center region, the hub having sidewalls, the internal plenum is disposed in the sidewalls and the sidewalls of the hub are configured to fit within the center opening of the dielectric window and extend to the center region of the disk structure of the Faraday shield, the coils are oriented around the sidewalls of the hub above the dielectric window, wherein an outer surface of said sidewalls of the hub further provide a thermal couple to a region of the dielectric window proximate to the center opening of the dielectric window;

a fluid delivery control coupled to the input conduit of the hub, the fluid delivery control configured with a flow rate regulator for setting a flow rate of the flow of air through the plenum of the hub; and

a fluid removal control coupled to the output conduit for removing the flow of air from the plenum of the hub, wherein the plenum of the hub defines a loop into and out of the hub, and that the flow of air is isolated from the processing volume; and

a controller for managing the flow rate regulator that sets the flow rate of the flow of air.

18. The plasma processing apparatus of claim 17, further comprising,
a compressed dry air (CDA) source coupled to the fluid delivery control.
19. The plasma processing apparatus of claim 17, further comprising,
an air supply and air amplifier coupled to the fluid delivery control.
20. The plasma processing apparatus of claim 17, further comprising,
a chiller for adjusting a temperature of the air before delivery by the fluid delivery control.
21. The plasma processing apparatus of claim 17, wherein the interface surface of the hub defines the loop of the plenum.