CLAIMS

1. A pedestal assembly, comprising:

an electrostatic chuck having a substrate supporting surface;

a base plate attached to the electrostatic chuck and having cooling channels formed therein, wherein the cooling channels have an inlet passage and an outlet passage; and

a cooling assembly connected to the cooling channels via the inlet passage and the outlet passage, wherein the cooling assembly comprises:

an inlet coupled to a gas source;

an outlet open to an immediate environment outside a processing chamber wherein the base plate is disposed;

a flow controller coupled between the inlet and the inlet passage; and

a heat exchanger coupled to the outlet, wherein the heat exchanger is not coupled between the inlet and the inlet passage.

2. The pedestal assembly of claim 1, wherein the gas source comprises a pump to extract air from the immediate environment.

3. The pedestal assembly of claim 2, wherein the heat exchanger comprises gas passages connected between the outlet passage and the outlet.

4. The pedestal assembly of claim 3, wherein the cooling assembly further comprises a cooling liquid source coupled to the heat exchanger, and the heat exchanger performs liquid and gas heat exchanges.

5. The pedestal assembly of claim 1, further comprising a controller coupled to the flow controller.

6. The pedestal assembly of claim 5, wherein the controller sends control signal to the flow controller to adjust a flow rate and a pressure of the flow of cooling gas.

7. An apparatus for processing a semiconductor substrate, comprising:

a chamber body defining a processing volume;

a pedestal assembly for supporting one or more substrate during processing, wherein the pedestal assembly comprises:

an electrostatic chuck having a substrate supporting surface and disposed in the processing volume; and

a base plate attached to the electrostatic chuck, wherein the base plate has cooling channels formed therein, wherein the cooling channels have an inlet passage and an outlet passage; and

a cooling assembly connected to the cooling channels of the pedestal assembly via the inlet passage and the outlet passage, wherein the cooling assembly is disposed outside the processing volume, and the cooling assembly comprises:

an inlet coupled to a gas source;

an outlet open to an immediate environment outside the chamber body;

a flow controller coupled between the inlet and the inlet passage; and

a heat exchanger coupled to the outlet, wherein the heat exchanger is not coupled between the inlet and the inlet passage.

8. The apparatus of claim 7, wherein the cooling assembly is disposed adjacent to the chamber body.

9. The apparatus of claim 8, wherein the gas source comprises one of a pump to extract air from the immediate environment outside the chamber body, a compressed gas source and an existing system gas source.

10. The apparatus of claim 9, wherein the heat exchanger comprises gas passages connected between the outlet passage and the outlet.

11. The apparatus of claim 10, wherein the cooling assembly further comprises a cooling liquid source coupled to the heat exchanger, and the heat exchanger performs liquid and gas heat exchanges.

12. The apparatus of claim 7, further comprising a controller coupled to the cooling assembly.

13. The apparatus of claim 12, wherein the controller sends control signal to the cooling assembly to adjust a flow rate and/or a pressure of the flow of cooling gas.

14. The apparatus of claim 13, further comprising one or more temperature sensors coupled to the controller, and the controller adjusts the flow rate and/or

the pressure of the flow of cooling gas according to measurements of the one or more temperature sensors.

15. A method for controlling temperature of a substrate being processed, comprising:

processing a substrate on a substrate support in a processing chamber;

supplying a flow of cooling gas to an inlet passage of cooling channels formed in the substrate support to control temperature of the substrate;

flowing the flow of cooling gas exiting the cooling channels through a heat exchanger, wherein the heat exchanger is not connected with the inlet passage; and

releasing the flow of cooling gas from the heat exchanger to an environment surrounding the processing chamber.

16. The method of claim 15, wherein supplying a flow of cooling gas comprising extracting a flow of air from the environment surrounding the processing chamber.

17. The method of claim 16, wherein processing the substrate comprises maintaining the temperature of the substrate between about 400 degrees Celsius to about 450 degrees Celsius.

18. The method of claim 16, wherein processing the substrate comprises forming physical vapor deposition over the substrate for a time period of longer than about 1000 seconds.

19. The method of claim 15, wherein supplying the flow of cooling gas comprises adjusting a flow rate and/or pressure of the flow of cooling gas to adjust the temperature of the substrate.

20. The method of claim 19, further comprising measuring a temperature of the substrate via one or more temperature sensors, and adjusting the flow rate and/or pressure of the flow of cooling gas.