Claims

1. An apparatus for processing a substrate, comprising:

a process chamber having a temperature-controlled reaction volume including interior surfaces comprising quartz and having a substrate support disposed within the temperature-controlled reaction volume to support a processing surface of a substrate;

a heating system disposed below the substrate support to provide heat energy to the substrate support;

an injector disposed to a first side of the substrate support and having a first flow path to provide a first process gas and a second flow path to provide a second process gas independent of the first process gas, wherein the injector is positioned to provide the first and second process gases across the processing surface of the substrate;

a heated exhaust manifold disposed to a second side of the substrate support, opposite the injector, to exhaust the first and second process gases from the process chamber,

wherein the temperature-controlled reaction volume is at least partially formed by a plurality of chamber components including a chamber lid disposed above the substrate support, an upper chamber liner disposed adjacent to the substrate support and above the injector and the heated exhaust manifold and below the chamber lid, and a lower chamber liner disposed adjacent to the substrate support and below the injector and the heated exhaust manifold,

wherein the first process gas is more susceptible to decomposition under temperature condition than the second process gas,

wherein the injector further comprises:

a plurality of first injector ports to inject the first process gas; and

a plurality of second injector ports to inject the second process gas, and

wherein the plurality of first injector ports are disposed at a first distance from an edge of the substrate when positioned on the substrate support, the plurality of second injector ports are disposed at a second distance from the edge of the substrate when positioned on the substrate support, and the first distance is smaller than the second distance.

2. The apparatus of claim 1, wherein the substrate support further comprises:

a rotation mechanism to rotate the substrate support; and

a lift mechanism to position the substrate support within the temperature-controlled reaction volume and relative to the injector.

3. The apparatus of claim 1, wherein the heating system further comprises:

a plurality of heating zones, wherein each one of the plurality of heating zones includes a plurality of lamps.

4. The apparatus of claim 1, wherein the temperature-controlled reaction volume may be at least partially formed by a plurality of chamber components including:

a chamber lid disposed above the substrate support;

an upper chamber liner disposed adjacent to the substrate support and above

the injector and the exhaust manifold and below the chamber lid; and

a lower chamber liner disposed adjacent to the substrate support and below the injector and the exhaust manifold

5. The apparatus of claim 4, wherein the upper chamber liner, the lower chamber liner, the chamber lid, and the injector comprise quartz.

6. The apparatus of any one of claims 1 to 5, wherein each of the plurality of second injector ports has a larger diameter than each of the plurality of first injector ports.

7. The apparatus of any one of claims 1 to 6, wherein the pluralities of first and second injector ports are disposed in separate planes, wherein each plane is parallel to the processing surface of the substrate.

8. The apparatus of any one of claims 1 to 7, wherein one of the plurality of first injector ports has a different diameter than another of the plurality of first injector ports and wherein one of the plurality of second injector ports has a different diameter than another of the plurality of second injector ports.

9. The apparatus of claim 1, wherein the heated exhaust manifold further comprises:

an adhesion reducing liner.

10. An apparatus for processing a substrate, comprising:

a process chamber having a temperature-controlled reaction volume including interior surfaces comprising quartz and having a substrate support disposed within the temperature-controlled reaction volume to support a processing surface of a substrate;

a heating system disposed below the substrate support to provide heat energy to the substrate support;

an active cooling system to control thermal uniformity on a backside of the substrate support and the processing surface of the substrate during processing, wherein the active cooling system is configured to flow a gas coolant about the process chamber;

an injector disposed to a first side of the substrate support and having a first flow path to provide a first process gas and a second flow path to provide a second process gas independent of the first process gas, wherein the injector is positioned to provide the first and second process gases across the processing surface of the substrate; and

a heated exhaust manifold disposed to a second side of the substrate support, opposite the injector, to exhaust the first and second process gases from the process chamber,

wherein the first process gas is more susceptible to decomposition under temperature condition than the second process gas,

wherein the injector further comprises:

a plurality of first injector ports to inject the first process gas; and

a plurality of second injector ports to inject the second process gas, and

wherein the plurality of first injector ports are disposed at a first distance from an edge of the substrate when positioned on the substrate support and the plurality of second injector ports are disposed at a second distance from the edge of the substrate when positioned on the substrate support, where the first distance is smaller than the second distance.

11. The apparatus of claim 10, further comprising:

one or more passive cooling components.