

What is claimed is

1. A self-centering wafer carrier system for a chemical vapor deposition (CVD) reactor, the wafer carrier system comprising:
 - a) a wafer carrier comprising an edge, the wafer carrier at least partially supporting a wafer for CVD processing; and
 - b) a rotating tube comprising an edge, an edge geometry of the wafer carrier and an edge geometry of the rotating tube being chosen to provide a coincident alignment of a central axis of the wafer carrier and a rotation axis of the rotating tube during process at a desired process temperature.
2. The self-centering wafer carrier system of claim 1 wherein the wafer carrier supports an entire bottom surface of the wafer.
3. The self-centering wafer carrier system of claim 1 wherein the wafer carrier supports the wafer at a perimeter of the wafer, leaving a portion of both a top and a bottom surface of the wafer exposed.
4. The self-centering wafer carrier system of claim 3 further comprising a separator that provides radiant heating to the wafer.
5. The self-centering wafer carrier system of claim 4 wherein the separator comprises a geometry chosen to provide centering of the separator with respect to the center of the rotating tube.
6. The self-centering wafer carrier system of claim 4 wherein the separator

comprises a geometry chosen to cause the separator to remain static with respect to the rotating tube during rotation.

7. The self-centering wafer carrier system of claim 4 wherein the separator comprises a material selected from the group consisting of silicon carbide and quartz.
8. The self-centering wafer carrier system of claim 4 further comprising a tube that supplies positive pressure purge gas to a cavity.
9. The self-centering wafer carrier system of claim 1 wherein a rotation eccentricity of the wafer is substantially zero at the desired process temperature.
10. The self-centering wafer carrier system of claim 1 wherein the wafer carrier edge and the rotating tube edge are dimensioned to define a gap.
11. The self-centering wafer carrier system of claim 10 wherein a width of the gap approaches zero at the desired process temperature.
12. The self-centering wafer carrier system of claim 10 wherein a width of the gap changes during heating due to a difference between a coefficient of thermal expansion of the material forming the wafer carrier and a coefficient of thermal expansion of the material forming the rotating tube.
13. The self-centering wafer carrier system of claim 10 wherein a width of the gap at room temperature is chosen so that there is space for expansion of the wafer carrier relative to the rotating tube at processing temperatures.

14. The self-centering wafer carrier system of claim 1 wherein the coincident alignment of the central axis of the wafer carrier and the rotation axis of the rotating tube during processing at the desired process temperature establishes an axial-symmetrical temperature profile across the wafer.
15. The self-centering wafer carrier system of claim 1 wherein a material forming at least one of the wafer carrier and the rotating tube is chosen to have a coefficient of thermal expansion that maintains space for expansion of the wafer carrier relative to the rotating tube at processing temperatures.
16. The self-centering wafer carrier system of claim 1 wherein the edge geometry of the wafer carrier and the edge geometry of the rotating tube both defined matching bevel surfaces.
17. The self-centering wafer carrier system of claim 16 wherein the matching bevel surfaces are parallel.
18. The self-centering wafer carrier system of claim 17 wherein the matching bevel surfaces are at an angle α such that $\tan(\alpha) > f$, where f is a coefficient of friction between the wafer carrier and rotation tube.
19. The self-centering wafer carrier system of claim 1 wherein the edge geometry of the wafer carrier is beveled on an inner surface and the edge geometry of the rotating tube is beveled on an outer surface.
20. The self-centering wafer carrier system of claim 1 wherein the rotating tube comprises a flat rim.

21. The self-centering wafer carrier system of claim 1 wherein the edge geometry of the wafer carrier is beveled on an outer surface and the edge geometry of the rotating tube is beveled on an inner surface.
22. The self-centering wafer carrier system of claim 1 wherein the wafer carrier further comprises a pocket adapted to hold a wafer.
23. The self-centering wafer carrier system of claim 22 further comprising one or more bumpers which are symmetrically placed within the pocket.
24. The self-centering wafer carrier system of claim 1 wherein the wafer carrier comprises a pocketless wafer carrier having two or more posts which are symmetrically placed on the upper surface of the wafer carrier.
25. A self-centering wafer carrier system for a chemical vapor deposition (CVD) reactor, the wafer carrier system comprising:
 - a) a wafer carrier comprising an edge geometry comprising a spacer, the wafer carrier at least partially supporting a wafer for CVD processing; and
 - b) a rotating tube that supports the wafer carrier, the spacer in the wafer carrier edge geometry forcing both a center axis of the wafer carrier and an axis of rotation of the rotating tube to align at a desired process temperature.
26. The self-centering wafer carrier system of claim 25 wherein the wafer carrier further comprises a relief structure positioned opposite to the spacer, the relief

structure shifting a center of mass of the wafer carrier.

27. The self-centering wafer carrier system of claim 26 wherein the relief structure comprises a relatively flat section.
28. The self-centering wafer carrier system of claim 25 wherein the spacer is dimensioned so that the rotation of the wafer has a desired eccentricity.
29. The self-centering wafer carrier system of claim 25 wherein the spacer is machined into an edge of the wafer carrier.
30. The self-centering wafer carrier system of claim 25 wherein the wafer carrier is formed from a ceramic material chosen from the group consisting of silicon carbide (SiC), boron nitride (BN), boron carbide (BC), aluminum nitride (AlN), alumina (Al₂O₃), sapphire, silicon, gallium nitride, gallium arsenide, quartz, graphite, graphite coated with silicon carbide (SiC), and combinations thereof.
31. The self-centering wafer carrier system of claim 30 wherein the ceramic material includes a refractory coating.
32. The self-centering wafer carrier system of claim 25 wherein the wafer carrier is formed from a refractory metal.
33. The self-centering wafer carrier system of claim 30 wherein the wafer carrier edge geometry comprises at least two spacers that form a contact with an edge of the rotating tube.
34. A single wafer substrate carrier for chemical vapor deposition comprising a wafer

carrier adapted to receive a wafer, the wafer carrier having an edge geometry for positioning on top of a rotating tube, the rotating tube also having an edge geometry, wherein the edge geometries of the single wafer substrate carrier and the rotating tube being chosen to provide a coincident alignment of a central axis of the wafer carrier and a rotation axis of the rotating tube during process at a desired process temperature.

35. The single wafer substrate carrier of claim 34 wherein the wafer carrier is configured to receive the wafer by using a pocket adapted to hold the wafer.
36. The single wafer substrate carrier of claim 35 wherein the wafer carrier further comprises one or more bumpers symmetrically placed within the pocket.
37. The single wafer substrate carrier of claim 34 wherein the wafer carrier comprises a pocketless wafer carrier, the pocketless wafer carrier comprising two or more posts symmetrically placed on the upper surface of the wafer carrier.
38. A method of self-centering a wafer carrier system for a chemical vapor deposition (CVD) reactor, the method comprising:
 - a) at least partially supporting a wafer for CVD processing with a wafer carrier;
 - b) selecting an edge geometry of a rotating tube and an edge geometry of the wafer carrier so that a central axis of the wafer carrier is coincident with a rotation axis of the rotating tube during process at a desired process temperature; and

- c) rotating the wafer carrier with the rotating tube.
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- 39. The method of claim 38 further comprising adjusting at least one zone of a multi-zone heater to compensate for wafer film non-uniformity due to an axially-symmetric temperature profile.
 - 40. The method of claim 38 wherein a centrifugal force generated by rotating the wafer carrier with the rotating tube moves the wafer carrier in a direction such that one or more spacers in the wafer carrier remain in contact with the edge of the rotating tube.
 - 41. The method of claim 38 further comprising forcing both a center axis of the wafer carrier and an axis of rotation of the rotating tube to align at a desired process temperature using a spacer.