What is claimed is:

1. A plasma chamber of a plasma processing system, the plasma chamber defining a plasma channel having a first side and a second side oppositely disposed along a length of the plasma channel, the plasma chamber comprising:

a first section constructed from a dielectric material, the first section having (i) a first flange positioned along the first side of the plasma channel and extending beyond the first side by a first width, and (ii) a second flange positioned along the second side of the plasma channel and extending beyond the second side by a second width;

a second section constructed from the dielectric material, the second section having (i) a third flange positioned along the first side of the plasma channel and extending beyond the first side by the first width, and (ii) a fourth flange positioned along the second side of the plasma channel and extending beyond the second side by the second width; and

an interface that bonds together the first and second dielectric sections at between the first and third flanges and between the second and fourth flanges to create a hermetic seal between the first and third flanges and between the second and fourth flanges.

2. The plasma chamber of claim 1, wherein the dielectric material is alumina (Al_2O_3) ceramic.

3. The plasma chamber of claim 2, wherein the dielectric material is an oxide or a nitride of one of a group II element, a group III element, a lanthanide, or a mixture thereof.

4. The plasma chamber of claim 3, wherein the dielectric material is one of Y_2O_3, Sc_2O_3 La_2O_3, Ce_2O_3, or MgO.

5. The plasma chamber of claim 3, wherein the dielectric material is one of AlN , BN, or YN.

6. The plasma chamber of claim 1, further comprising a coating on an inner surface of the plasma chamber that forms at least a portion of the plasma channel exposed to a plasma therein.

7. The plasma chamber of claim 6, wherein the coating comprises one of Al_2O_3, Y_2O_3, Sc_2O_3, La_2O_3, Ce_2O_3, MgO, SiO_2, B_4C or an alloy including YAG.

8. The plasma chamber of claim 1, wherein the bonding interface comprises a bonding agent that is one of a glass frit, an eutectic mixture or an epoxy.

9. The plasma chamber of claim 1, wherein the first and second sections are substantially identical.

10. The plasma chamber of claim 1, wherein a thickness of a wall of the first or second section is between about 0.04 inches and about 0.12 inches.

11. The plasma chamber of claim 1, further comprising:

a first bonded flange formed by the bonding of the first and third flanges, wherein the first bonded flange has the first width; and

a second bonded flange formed by the bonding of the second and fourth flanges, wherein the second bonded flange has the second width.

12. The plasma chamber of claim 11, wherein the first width of the first bonded flange or the second width of the second bonded flange is between about 0.06 inches and about 1 inch.

13. The plasma chamber of claim 12, wherein the first or second width is about 0.25 inches.

14. The plasma chamber of claim 1, wherein the plasma channel forms a toroidal loop.

15. The plasma chamber of claim 14, wherein the toroidal plasma channel is circular, oval, elliptical or polygon in shape.

16. The plasma chamber of claim 1, wherein the plasma channel is linear.

17. The plasma chamber of claim 1, wherein a cross section of the plasma channel is circular, rectangular or oval in shape.

18. The plasma chamber of claim 17, wherein an area of the cross section of the plasma channel is between about 0.2 cm^2 and about 50 cm^2.

19. A method of manufacturing, the plasma chamber of claim 1, the method comprising:
constructing the first section from the dielectric material;
constructing the second section from the dielectric material; and
bonding the first and second sections together to form the plasma chamber having the plasma channel for containing a plasma therein, bonding the first and second sections comprising forming bonding between the first and third flanges to generate a first bonded flange having the first width and between the second and fourth flanges to generate a second bonded flange having the second width.

20. The method of claim 19, wherein constructing the first or second section comprises machining the dielectric material in a green state.

21. The method of claim 19, wherein bonding the first and second sections together comprises sintering the first and second sections together to create the hermetic seal at the first and second bonded flanges.

22. The method of claim 21, further comprising:
disposing a layer of alloying agent on an inner surface of at least one of the first section or the second section prior to the sintering, the inner surface adapted to form at least a portion of the plasma channel exposed to the plasma therein; and
creating an alloyed coating on at least a portion of the inner surface having the layer of alloying agent disposed thereon by the sintering process that bonds the first and second sections.

23. The method of claim 19, wherein the dielectric material is alumina (Al_2O_3) ceramic.

24. The method of claim 23, wherein the dielectric material is an oxide or a nitride of one of a group II element, a group III element, a lanthanide, or a mixture thereof.

25. The method of claim 19, wherein a thickness of a wall of the first or second section is between about 0.04 inches and about 0.12 inches.

26. The method of claim 19, wherein the first width of the first bonded flange or the second width of the second bonded flange is between about 0.06 inches and about 1 inch.

27. The method of claim 26, wherein the first or second width is about 0.25 inches.