CLAIMS

1. A lower electrode assembly useful for supporting a semiconductor substrate in a plasma processing chamber comprising:

a temperature controlled lower base plate, an upper plate, and a mounting groove surrounding a bond layer in the lower electrode assembly; and

an edge seal comprising an elastomeric band having an outer concave surface in an uncompressed state, the band mounted in the groove such that upper and lower ends of the band are axially compressed and a maximum outward bulging of the band is no greater than a predetermined distance, wherein the predetermined distance corresponds to a maximum outer diameter of the band in the uncompressed state.

2. The electrode assembly of Claim 1, wherein the concave surface is a single curved surface, a single inclined surface oriented such that the band is widest at an upper end thereof and narrowest at a lower end thereof or a pair of converging inclined surfaces oriented such that the band is widest at upper and lower ends thereof and narrowest at a middle thereof.

3. The electrode assembly of Claim 1, wherein the outer surface of the band includes a cylindrical surface of uniform diameter at an upper end of the band extending less than 1/10 of the height of the band.

4. The electrode assembly of Claim 1, wherein the band has a height of 0.05 to 0.15 inch, a width of 0.025 to 0.040 inch, and inner diameter of 11.3 to 11.4 inches and each edge of the band is rounded with a radius of 0.001 to 0.010 inch.

5. The electrode assembly of Claim 1, wherein the band has an upper annular surface, a lower annular surface smaller in width than the upper annular surface, a cylindrical inner surface of uniform diameter extending between the upper and lower annular surfaces, an outer cylindrical surface of uniform diameter extending about 0.01 inch from the upper annular surface and a curved surface of uniform radius extending between the outer cylindrical surface and the lower annular surface.

6. The electrode assembly of Claim 1, wherein the upper plate comprises a ceramic material having at least one electrostatic clamping electrode embedded therein.

7. The electrode assembly of Claim 1, wherein the lower base plate is an aluminum base plate having fluid channels therein through which coolant is circulated for maintaining the lower base plate at a constant temperature.

8. The electrode assembly of Claim 1, wherein the predetermined distance is no greater than 0.004 inch and/or the band is axially compressed 1 to 20%.

9. The electrode assembly of Claim 1, wherein the lower electrode assembly further comprises a heater plate comprising a metal or ceramic plate having one or more spatially distributed heaters and the bond layer comprises a first bond layer attaching the lower base plate to the heater plate and a second bond layer attaching the heater plate to the upper plate, the mounting groove formed by an outer surface of the heater plate and opposed surfaces of the upper plate and the lower base plate.

10. The electrode assembly of Claim 1, wherein the band includes a cylindrical inner surface of uniform diameter, flat upper and lower surfaces of equal width, an outer curved surface extending between the upper and lower surfaces, and each edge of the band is rounded.

11. A plasma etch chamber wherein the electrode assembly of Claim 1 is mounted in an interior thereof and the upper plate of the electrode assembly includes an electrostatic chuck (ESC).

12. A method of making the electrode assembly of Claim 1, comprising pressing the band into the groove such that the band is axially compressed at least 1%.

13. An edge seal for a lower electrode assembly useful for supporting a semiconductor substrate in a plasma processing chamber wherein the lower electrode

assembly includes a temperature controlled lower base plate, a heater plate, an upper plate, a first bond layer attaching the lower plate to the heater plate, a second bond layer attaching the heater plate to the upper plate and a mounting groove formed by an outer surface of the heater plate and opposed surfaces of the upper and lower plates, the edge seal comprising:

an elastomeric band having an outer concave surface in an uncompressed state, the band dimensioned to fit in the groove such that an inner periphery of the band surrounds the heater plate and the upper and lower bond layers and upper and lower ends of the band are axially compressed between the upper and lower plates such that a maximum outward bulging of the band is no greater than a predetermined distance, wherein the predetermined distance corresponds to a maximum outer diameter of the band in the uncompressed state.

14. The edge seal of Claim 13, wherein the concave surface is a single curved surface, a single inclined surface such that the band is widest at an upper end thereof and narrowest at a lower end thereof or a pair of converging surfaces which form an obtuse angle such that the band is widest at upper and lower ends thereof and narrowest at a middle thereof.

15. The edge seal of Claim 13, wherein the outer surface of the band includes a cylindrical surface of uniform diameter at an upper end of the band extending less than 1/10 of the height of the band.

16. The edge seal of Claim 13, wherein the band has a height of 0.05 to 0.15 inch, a width of 0.025 to 0.050 inch, and inner diameter of 11.3 to 11.4 inches and each edge of the band is rounded with a radius of 0.001 to 0.010 inch.

17. The edge seal of Claim 13, wherein the band has an upper annular surface, a lower annular surface smaller in width than the upper annular surface, a cylindrical inner surface of uniform diameter extending between the upper and lower annular surfaces, an outer cylindrical surface of uniform diameter extending about 0.01 inch

from the upper annular surface and a curved surface of uniform radius extending between the outer cylindrical surface and the lower annular surface.

18. The edge seal of Claim 13, wherein the predetermined distance is no greater than 0.004 inch.

19. The edge seal of Claim 13, wherein the band includes a cylindrical inner surface of uniform diameter, flat upper and lower surfaces of equal width, an outer curved surface extending between the upper and lower surfaces, and each edge of the band is rounded.

20. The edge seal of Claim 13, wherein the edge seal is made of perfluoroelastomer material having a Shore Hardness A of 60 to 75 and a specific gravity of 1.9 to 2.1.

21. The edge seal of Claim 13, wherein the edge seal has a cross-sectional aspect ratio of height:thickness of 2 to 5.

22. The edge seal of Claim 13, wherein the edge seal has a cylindrical inner surface with one or more geometrical features thereon.

23. The edge seal of Claim 22, wherein the one or more geometrical features comprise at least one depression in the inner surface or projection on the inner surface.

24. The edge seal of Claim 16, wherein the band has an upper annular surface, a lower annular surface, a cylindrical inner surface of uniform diameter extending between the upper and lower annular surfaces, an outer upper cylindrical surface of uniform diameter extending about 0.01 inch from the upper annular surface, an outer lower cylindrical surface of uniform diameter extending about 0.01 inch from the lower annular surface, and a curved surface of uniform radius extending between the outer upper cylindrical surface and the outer lower cylindrical surface.

25. The lower electrode assembly of Claim 1, wherein the outer concave surface of the edge seal has a radius of curvature between about 0.02 to 0.8 inch.

26. The edge seal of Claim 13, wherein the outer concave surface of the edge seal has a radius of curvature between about 0.02 to 0.8 inch.

27. The lower electrode assembly of Claim 1, wherein the elastomeric band has a metallic content less than 5000 parts per billion for each and every metal element comprised therein.

28. The edge seal of Claim 13, wherein the elastomeric band has a metallic content less than 5000 parts per billion for each and every metal element comprised therein.