plasma may be used during processing to activate chemical reactions. Components located within the substrate processing system need to be able to withstand the plasma and/or gas chemistry that is used during processing.

[0005] The ESC may include an edge seal that protects adhesive bonding layers that are used to bond a heater plate to a ceramic top plate of the ESC. When left unprotected, the adhesive bonding layers are damaged and particle contamination occurs. If the adhesive bonding layers are heavily eroded, the ESC may be permanently damaged.

SUMMARY

[0006] An edge seal for an electrostatic chuck of a substrate processing system includes an annular body, a radially inner surface, a radially outer surface, a top surface, and a bottom surface. The radially inner surface is convex.

[0007] In other features, corners between the radially inner surface, the radially outer surface, the top surface and the bottom surface are radiused. The radially outer surface of the body is generally planar between a first corner between the top surface and the radially outer surface and a second corner between the bottom surface and the radially outer surface.

[0008] In other features, the top surface of the body is generally planar between a third corner between the top surface and the radially inner surface and ~~a fourth~~ the first corner between the top surface and the radially outer surface. The bottom surface of the body is generally planar between the fourth corner between the bottom surface and the radially inner surface and the second corner between the bottom surface and the

radially outer surface. The radially inner surface of the body is convex between the third corner between the top surface and the radially inner surface and the ~~first~~ fourth corner between the bottom surface and the radially inner surface.

[0009] In other features, a radial thickness of the body at a center of the body is 10% to 30% greater than a radial thickness of the body adjacent to the top surface and the bottom surface. A radial thickness of the body at a center of the body is 15% to 25% greater than a radial thickness of the body adjacent to the top surface and the bottom surface. A radial thickness of the body at a center of the body is 20% to 24% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

[0010] An electrostatic chuck includes an upper layer, an intermediate layer, a lower layer, a first adhesive bonding layer arranged between the upper layer and the intermediate layer, and a second adhesive bonding layer arranged between the intermediate layer and the lower layer. Radially outer edges of the intermediate layer and the first and second adhesive bonding layers form an annular slot relative to the upper layer and the lower layer. The edge seal is arranged in the annular slot.

[0011] In other features, the upper layer includes a ceramic layer, the intermediate layer includes a heater plate and the lower layer includes a lower electrode. The first and second adhesive bonding layers include elastomeric silicone. The first and second adhesive bonding layers include silicone rubber.

[0012] A substrate processing system includes a processing chamber, a gas delivery system to deliver process gas to the processing chamber, a plasma generator to generate plasma in the processing chamber, and the electrostatic chuck.

201 having a generally rectangular-shaped cross-section with parallel top and bottom surfaces 202 and 204 and parallel surfaces 206 and 208.

[0039] In FIG. 3B, the annular edge seal 200' includes an annular body 201' with parallel top and bottom surfaces 202 and 204. The inner surface 206 is generally planar (perpendicular to the top and bottom surfaces 202 and 204). An outer surface 208' is concave.

[0040] In FIG. 3C, the annular edge seals 200 and 200' are shown after use. The annular edge seals 200 and 200' may experience vertical stresses in additional to other environmental stresses. The vertical stresses may cause the annular edge seals 200 and 200' to bow radially outwardly away from the annular slot 153. As a result, the annular edge seals 200 and 200' may not fully protect the adhesive bonding layers 180, 184 and damage to the substrate support 6 or contamination (or both) may occur.

[0041] Referring now to FIGs. 4 and 5, an annular edge seal 300 according to the present disclosure is shown. In FIG. 4, the annular edge seal 300 includes an annular body 301 with a radially outer surface 309, a radially inner surface 310, a top surface 311 and a bottom surface 312. The radially outer surface 309 is generally planar and is perpendicular to the top surface 311 and the bottom surface 312. The radially inner surface 310 faces in a radially inwardly direction and is arranged immediately adjacent to the layers 152 (e.g. the upper layer 158, the intermediate layer 164 and the lower layer 170). The radially outer surface 309 faces in a radially outwardly direction. In some examples, the annular edge seal includes corners 314, 316, 318 and 320 that are radiused.

CLAIMS

~~What is claimed is:~~

1. An electrostatic chuck comprising:

an upper layer;

an intermediate layer;

a lower layer;

a first adhesive bonding layer arranged between the upper layer and the intermediate layer;

a second adhesive bonding layer arranged between the intermediate layer and the lower layer, wherein radially outer edges of the intermediate layer and the first and second adhesive bonding layers form an annular slot relative to the upper layer and the lower layer; and

an edge seal arranged in the annular slot, wherein the edge seal includes an annular body including a radially inner surface, a radially outer surface, a top surface and a bottom surface, and

wherein the radially inner surface is convex.

2. The electrostatic chuck ~~edge seal~~ of claim 1, wherein corners between the radially inner surface, the radially outer surface, the top surface and the bottom surface are radiused.

3. The electrostatic chuck ~~edge seal~~ of claim 1, wherein:

the radially outer surface of the body is generally planar between a first corner between the top surface and the radially outer surface and a second corner between the bottom surface and the radially outer surface;

the top surface of the body is generally planar between a third corner between the top surface and the radially inner surface and ~~a fourth~~ the first corner between the top surface and the radially outer surface;

the bottom surface of the body is generally planar between ~~the~~ a fourth corner between the bottom surface and the radially inner surface and the second corner between the bottom surface and the radially outer surface; and

the radially inner surface of the body is convex between the third corner between the top surface and the radially inner surface and the ~~first~~ fourth corner between the bottom surface and the radially inner surface.

4. The electrostatic chuck ~~edge seal~~ of claim 1, wherein a radial thickness of the body at a center of the body is 10% to 30% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

5. The electrostatic chuck ~~edge seal~~ of claim 1, wherein a radial thickness of the body at a center of the body is 15% to 25% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

6. The electrostatic chuck ~~edge seal~~ of claim 1, wherein a radial thickness of the body at a center of the body is 20% to 24% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

7. The electrostatic chuck of claim 1, wherein the upper layer includes a ceramic layer, the intermediate layer includes a heater plate and the lower layer includes a lower electrode.

8. The electrostatic chuck of claim 7, wherein the first and second adhesive bonding layers include elastomeric silicone.

9. The electrostatic chuck of claim 7, wherein the first and second adhesive bonding layers include silicone rubber.

10. A substrate processing system comprising:

a processing chamber;

a gas delivery system to deliver process gas to the processing chamber;

a plasma generator to generate plasma in the processing chamber; and

the electrostatic chuck of claim 1.

11. An edge seal for an electrostatic chuck of a substrate processing system, the edge seal comprising:

an annular body;

a top surface of the body;

a bottom surface of the body;

a radially inner surface of the body, wherein the radially inner surface is convex; and

a radially outer surface of the body, wherein the radially outer surface of the body is generally planar between a first corner between the top surface and the radially outer surface and a second corner between the bottom surface and the radially outer surface~~;~~

~~a top surface of the body; and~~

~~a bottom surface of the body~~.

12. The edge seal of claim 11 wherein corners between the radially inner surface, the radially outer surface, the top surface and the bottom surface are radiused.

13. The edge seal of claim 11, wherein:

the top surface of the body is generally planar between a third corner between the top surface and the radially inner surface and ~~a fourth~~ the first corner between the top surface and the radially outer surface;

the bottom surface of the body is generally planar between ~~the~~ a fourth corner between the bottom surface and the radially inner surface and the second corner between the bottom surface and the radially outer surface; and

the radially inner surface of the body is convex between the third corner between the top surface and the radially inner surface and the fourth corner between the bottom surface and the radially inner surface.

14. The edge seal of claim 11, wherein a radial thickness of the body at a center of the body is 10% to 30% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

15. The edge seal of claim 11, wherein a radial thickness of the body at a center of the body is 15% to 25% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

16. The edge seal of claim 11, wherein a radial thickness of the body at a center of the body is 20% to 24% greater than a radial thickness of the body adjacent to the top surface and the bottom surface.

17. An electrostatic chuck comprising:

a ceramic layer;

a heater plate;

a lower electrode;

a first adhesive bonding layer arranged between the ceramic layer and the heater plate;

a second adhesive bonding layer arranged between the heater plate and the lower electrode,

wherein radially outer edges of the heater plate and the first and second adhesive bonding layers form an annular slot relative to the ceramic layer and the lower electrode; and

the edge seal of claim 11, wherein the edge seal is arranged in the annular slot.

18. The electrostatic chuck of claim ~~16~~17, wherein the first and second adhesive bonding layers include elastomeric silicone.

19. The electrostatic chuck of claim ~~16~~17, wherein the first and second adhesive bonding layers include silicone rubber.

20. A substrate processing system comprising:

a processing chamber;

a gas delivery system to deliver process gas to the processing chamber;

a plasma generator to generate plasma in the processing chamber; and

the electrostatic chuck of claim ~~16~~17.