[0015] While such designs attempt to create ways to protect the sealing materials from damage and/or from contamination from the seals reaching the environment, a need in the art still exists for sealing assemblies for various sealing configurations between sealing members that provide sufficient space for thermal expansion of the sealing material in the sealing ring and prevent damage to the sealing ring at higher temperatures, while retaining a cohesive assembly upon installation and in use within industrial applications such as internal vacuum, internal pressure, and sanitary liquid sealing assemblies.

SUMMARY

[0016] The present disclosure includes a sealing assembly for a high temperature applications, comprising: an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area; an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area; a center sealing ring configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application, the elastomeric center sealing ring is enclosed within the outer and the inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring.

[016a] In one aspect, the present disclosure refers to a sealing assembly for a high temperature applications, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100ºC to about 300ºC, the center sealing ring is enclosed within the outer and the inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring.

[016b] In another aspect, the present disclosure refers to a sealing assembly for a high temperature application, comprising

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100° to about 300 °C, the center sealing ring is enclosed within the outer and inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V and,

wherein each inwardly extending projection of the outer ring is angled away from a transverse central axis through the outer ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the outer ring.

[016c] In a further aspect, the present disclosure refers to a sealing assembly for high temperature application, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100° to about 300 °C, the center sealing ring is enclosed within the outer and inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring, wherein the seal receiving area of the inner ring has a longitudinal cross-sectional profile of an outwardly facing truncated V and,

wherein each outwardly extending projection of the inner ring is angled away from a transverse central axis through the inner ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the inner ring.

[016d] In another aspect, the present disclosure refers to a sealing assembly for a high temperature application, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100° to about 300 °C, the center sealing ring is enclosed within the outer and inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V and the seal receiving area of the inner ring has a longitudinal profile of an outwardly facing truncated V and,

wherein each inwardly extending projection of the outer ring is angled away from a transverse central axis through the outer ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the outer ring, and wherein each outwardly extending projection of the inner ring is angled away from a transverse central axis through the inner ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the inner ring.

[0017] The high temperature application may be a vacuum sealing assembly for use in semiconductor manufacturing. High temperature applications in examples herein may be service temperatures of about 100°C to about 300°C, and in another example, service temperatures of about 180°C to about 300°C.

[0018] The center sealing ring may comprise an elastomer, preferably a fluoroelastomer or a perfluoroelastomer.

[0019] In a preferred example, the seal receiving area of the outer ring of the above-described assembly has a longitudinal cross-sectional profile of an inwardly facing truncated V. The inwardly facing projections of the outer ring may be each spaced from each other and each spaced from a longitudinal center of the interior surface of the outer ring by a distance of about 50% to about 60% of a height of the interior surface of the outer ring. Each inwardly facing projection of the outer ring may be angled away from a transverse central axis through the outer ring and from each other, and each may form an angle of about 5° to about 25° with the transverse central axis of the outer ring, and preferably forms an angle of about 10° to about 20° with the transverse central axis of the outer ring.

[0020] In a preferred example, the seal receiving area of the inner ring may have a longitudinal cross-sectional profile of an outwardly facing truncated V. The outwardly facing projections of the inner ring may be each spaced from each other and each spaced from a longitudinal center of the exterior surface of the inner ring by a distance of about 43% to about 53% of a height of the exterior surface of the inner ring. Each outwardly facing projection of the inner ring may be angled away from a transverse central axis through the inner ring and from each other, and may each form an angle of about 5° to about 25° with the transverse central axis of the inner ring, and preferably angle of about 10° to about 20° with the transverse central axis of the inner ring.

[0021] In a further preferred example, the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V and the seal receiving area of the inner ring has a longitudinal cross-sectional profile of an outwardly facing truncated V. In such an example, the inwardly facing projections of the outer ring may each spaced from each other and may each be spaced from a longitudinal center of the interior surface of the outer ring by a distance of about 50% to about 60% of a height of the interior surface of the outer ring. The outwardly facing projections of the inner ring may each be spaced from each other and each be spaced from a longitudinal center of the exterior surface of the inner ring by a distance of about 43% to about 53% of a height of the exterior surface of the inner ring. Further, each inwardly extending projection of the outer ring may be angled away from a transverse central axis through the outer ring and from each other, and each may form an angle of about 5° to about 25° with the transverse central axis of the outer ring, preferably about 10° to about 20°, and each outwardly extending projection of the inner ring may also be angled away from a transverse central axis through the inner ring and from each other, and each may also form an angle of about 5° to about 25°, preferably about 10° to about 20°, with the transverse central axis of the inner ring.

[0022] Also in such an example, the center sealing ring may have varying shapes including a longitudinal cross-section that has a side-ways barrel shape; a truncated side-ways tear drop shape with an inner facing side that is flat and an outer facing side that is curved, wherein the inner facing side is smaller than the outer facing side; and a truncated side-ways tear drop shape with an inner facing side that is curved and an outer facing side that is curved, and wherein the inner facing side is smaller than the outer facing side. The center sealing ring may also have a truncated side-ways tear drop shape with an inner facing side that is flat and an

outer facing side that is flat, and wherein the inner facing side is smaller than the outer facing side.

[0023] The present disclosure also includes a sealing assembly for a high temperature application, comprising: an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area; an inner ring having an exterior surface having an outwardly extending rectangular portion on a central portion of the exterior surface of the inner ring and a further rounded projection extending outwardly from the rectangular portion; a center sealing ring having a longitudinal cross-section that is inwardly facing and generally C-shaped to define an inner ring receiving area, wherein the center sealing ring is configured to be positioned within the seal receiving area of the outer ring and to receive the outwardly extending rounded projection of the inner ring within the inner ring receiving area, and wherein when the sealing assembly is installed in a high temperature application, the elastomeric center sealing ring is enclosed within the outer ring and compressed against the inner ring so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring.

[023a] In another aspect, the present disclosure refers to a sealing assembly for a high temperature application, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having an outwardly extending rectangular portion on a central portion of the exterior surface of the inner ring and a further rounded projection extending outwardly from the rectangular portion;

a center sealing ring comprising an elastomer having a longitudinal cross-section that is inwardly facing and generally C-shaped to define an inner ring receiving area, wherein the center sealing ring is configured to be positioned within the seal receiving area of the outer ring and to receive the outwardly extending rounded projection of the inner ring within the inner ring receiving area, and wherein when the sealing assembly is installed in a high temperature application, the center sealing ring is enclosed within the outer ring and compressed against the inner ring so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring.

[0024] The seal receiving area of the outer ring in this example may have a longitudinal cross-sectional profile of an inwardly facing truncated V. The inwardly facing projections of the outer ring may each be spaced from each other and each spaced from a longitudinal center of the interior surface of the outer ring by a distance of about 50% to

about 60% of a height of the interior surface of the outer ring. Each inwardly facing projection of the outer ring may be angled away from a transverse central axis through the outer ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the outer ring, and preferably about 10° to about 20° with the transverse central axis of the outer ring.

[0025] The outer ring and/or the inner ring in this example may comprise one or more of a metal, a metal alloy or a fluoropolymer. The outer ring and/or the inner ring may comprise a metal or metal alloy such as aluminum 6061, aluminum 7075, stainless steel 316, and/or stainless steel 304. The outer ring and/or the inner ring may also comprise a fluoropolymer such as polytetrafluoroethylene (PTFE), a copolymer of perfluoroalkylvinyl ether (PAVE) and tetrafluoroethylene (TFE) such as Teflon PFA and other similar melt-processible copolymers, and/or a copolymer of hexafluoropropylene (HFP) and PTFE such as Teflon FEP and similar melt-processible copolymers. The center sealing ring may comprise a fluoroelastomer or a perfluoroelastomer.

[0026] The present disclosure also includes a bonded sealing assembly for a high temperature application, comprising: a sealing ring body having a longitudinal cross-section that has an outer ring portion, an inner ring portion and a central transversely extending bridge extending between the outer and the inner ring portions, wherein the outer ring portion has an inwardly extending rectangular portion and the inner ring portion has an inwardly extending rectangular portion, each of the rectangular portions of the inner ring portion and the outer ring portions being positioned so as to be longitudinally centered with respect to a central transverse axis through the sealing ring body, wherein the bridge has an upper surface and a lower surface, and wherein the outer and inner ring portions together with and the bridge define upper and lower seal receiving areas; and an upper seal lobe portion and a lower seal lobe portion, each bonded respectively to the upper surface and the lower surface of the bridge and each respectively located within the seal receiving areas of the sealing ring body, wherein the upper and the lower seal lobe portions have respectively an upwardly extending and a downwardly extending generally parabolic longitudinal cross-section.

[026a] In a further aspect, the present disclosure refers to a bonded sealing assembly for a high temperature application, comprising:

a sealing ring body having a longitudinal cross-section that has an outer ring portion, an inner ring portion and a central transversely extending bridge extending between the outer and the inner ring portions, wherein the outer ring portion has an inwardly extending rectangular portion and the inner ring portion has an inwardly extending rectangular portion, each of the rectangular portions of the inner ring portion and the outer ring portions being positioned so as to be longitudinally centered with respect to a central transverse axis through the sealing ring body, wherein the bridge has an upper surface and a lower surface, and wherein the outer and inner ring portions together with and the bridge define upper and lower seal receiving areas; and

an upper seal lobe portion and a lower seal lobe portion, each bonded respectively to the upper surface and the lower surface of the bridge and each respectively located within the seal receiving areas of the sealing ring body, wherein the upper and the lower seal lobe portions have respectively an upwardly extending and a downwardly extending generally parabolic longitudinal cross-section, and wherein the upper and lower seal lobe portions define troughs in the respective seal receiving areas that allow for expansion of each of the upper seal lobe portion and the lower seal lobe portion.

[0027] In this example, the sealing ring body may comprise a metal, a metal alloy and/or a fluoropolymer. The upper and lower seal lobe portions may comprise an elastomer. The sealing ring body and the seal lobe portions may be chemically or mechanically bonded.
[0028] The sealing ring body may further be a metal or a metal alloy such as aluminum 6061, aluminum 7075, stainless steel 316, and/or stainless steel 304. The sealing ring body may include a fluoropolymer such as PTFE, a copolymer of PAVE and TFE, and a copolymer of HFP and TFE. The elastomer in the seal lobe portions may comprise a perfluoroelastomer or a fluoroelastomer.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0029] The foregoing summary, as well as the following detailed description of preferred embodiments of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings embodiments which are presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:
[0030] Fig. 1 is a longitudinal cross-sectional view of a prior art vacuum sealing assembly with a centering ring only;

CLAIMS

We claim:

1. A sealing assembly for a high temperature applications, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100ºC to about 300ºC, the center sealing ring is enclosed within the outer and the inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring.

2. The sealing assembly according to claim 1, wherein the high temperature application is a vacuum sealing assembly for use in semiconductor manufacturing.

3. The sealing assembly according to claim 1, wherein the high temperature application includes a service temperature of about 180°C to about 300°C.

4. The sealing assembly according to claim 1, wherein the elastomer is a fluoroelastomer or a perfluoroelastomer.

5. The sealing assembly according to claim 1, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V.

6. The sealing assembly according to claim 5, wherein the inwardly extending projections of the outer ring are each spaced from each other and are each spaced from a longitudinal center of the interior surface of the outer ring by a distance of about 50% to about 60% of a height of the interior surface of the outer ring.

7. A sealing assembly for a high temperature application, comprising

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100° to about 300 °C, the center sealing ring is enclosed within the outer and inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V and,

wherein each inwardly extending projection of the outer ring is angled away from a transverse central axis through the outer ring and from

each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the outer ring.

8. The sealing assembly according to claim 7, wherein each inwardly extending projection of the outer ring forms an angle of about 10° to about 20° with the transverse central axis of the outer ring.

9. The sealing assembly according to claim 1, wherein the seal receiving area of the inner ring has a longitudinal cross-sectional profile of an outwardly facing truncated V.

10. The sealing assembly according to claim 9, wherein the outwardly extending projections of the inner ring are each spaced from each other and are each spaced from a longitudinal center of the exterior surface of the inner ring by a distance of about 43% to about 53% of a height of the exterior surface of the inner ring.

11. A sealing assembly for high temperature application, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100° to about 300 °C, the center sealing ring is enclosed within the outer and inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring, wherein the seal receiving area of the inner ring has a longitudinal cross-sectional profile of an outwardly facing truncated V and,

wherein each outwardly extending projection of the inner ring is angled away from a transverse central axis through the inner ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the inner ring.

12. The sealing assembly according to claim 11, wherein each outwardly extending projection of the inner ring forms an angle of about 10° to about 20° with the transverse central axis of the inner ring.

13. The sealing assembly according to claim 1, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V and the seal

receiving area of the inner ring has a longitudinal cross-sectional profile of an outwardly facing truncated V.

14. The sealing assembly according to claim 13, wherein the inwardly extending projections of the outer ring are each spaced from each other and are each spaced from a longitudinal center of the interior surface of the outer ring by a distance of about 50% to about 60% of a height of the interior surface of the outer ring, and wherein the outwardly extending projections of the inner ring are each spaced from each other and are each spaced from a longitudinal center of the exterior surface of the inner ring by a distance of about 43% to about 53% of a height of the exterior surface of the inner ring.

15. A sealing assembly for a high temperature application, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having two outwardly extending projections defining a seal receiving area;

a center sealing ring comprising an elastomer and configured to be positioned within the seal receiving areas of the outer ring and the inner ring, wherein when the sealing assembly is installed in a high temperature application including a service temperature of about 100° to about 300 °C, the center sealing ring is enclosed within the outer and inner rings so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V and the seal receiving area of the inner ring has a longitudinal profile of an outwardly facing truncated V and,

wherein each inwardly extending projection of the outer ring is angled away from a transverse central axis through the outer ring and from each other, and each forms an angle of about 5° to about 25° with the transverse

central axis of the outer ring, and wherein each outwardly extending projection of the inner ring is angled away from a transverse central axis through the inner ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the inner ring.

16. The sealing assembly according to claim 1, wherein the center sealing ring has a longitudinal cross-section that has a side-ways barrel shape.

17. The sealing assembly according to claim 1, wherein the center sealing ring has a longitudinal cross-section that has a truncated side-ways tear drop shape with an inner facing side that is flat and an outer facing side that is curved, wherein the inner facing side is smaller than the outer facing side.

18. The sealing assembly according to claim 1, wherein the center sealing ring has a longitudinal cross-section that has a truncated side-ways tear drop shape with an inner facing side that is curved and an outer facing side that is curved, and wherein the inner facing side is smaller than the outer facing side.

19. The sealing assembly according to claim 1, wherein the center sealing ring has a longitudinal cross-section that has a truncated side-ways tear drop shape with an inner facing side that is flat and an outer facing side that is flat, and wherein the inner facing side is smaller than the outer facing side.

20. A sealing assembly for a high temperature application, comprising:

an outer ring having an interior surface having two inwardly extending projections defining a seal receiving area;

an inner ring having an exterior surface having an outwardly extending rectangular portion on a central portion of the exterior surface of the inner ring and a further rounded projection extending outwardly from the rectangular portion;

a center sealing ring comprising an elastomer having a longitudinal cross-section that is inwardly facing and generally C-shaped to define an inner ring receiving area, wherein the center sealing ring is configured to be positioned within the seal receiving area of the outer ring and to receive the outwardly extending rounded projection of the inner ring within the inner ring receiving area, and wherein when the sealing assembly is installed in a high temperature application, the center sealing ring is enclosed within the outer ring and compressed against the inner ring so as to protect the center sealing ring while allowing for thermal expansion of the center sealing ring.

21. The sealing assembly according to claim 20, wherein the seal receiving area of the outer ring has a longitudinal cross-sectional profile of an inwardly facing truncated V.

22. The sealing assembly according to claim 21, wherein the inwardly facing projections of the outer ring are each spaced from each other and are each spaced from a longitudinal center of the interior surface of the outer ring by a distance of about 50% to about 60% of a height of the interior surface of the outer ring.

23. The sealing assembly according to claim 21, wherein each inwardly facing projection of the outer ring is angled away from a transverse central axis through the outer ring and from each other, and each forms an angle of about 5° to about 25° with the transverse central axis of the outer ring.

24. The sealing assembly according to claim 23, wherein the inwardly facing projections of the outer ring each form an angle of about 10° to about 20° with the transverse central axis of the outer ring.

25. The sealing assembly of claim 20, wherein the outer ring and the inner ring comprise a metal, a metal alloy or a fluoropolymer.

26. The sealing assembly of claim 25, wherein the outer ring and/or the inner ring comprises a metal or metal alloy selected from the group consisting of aluminum 6061, aluminum 7075, stainless steel 316, and stainless steel 304.

27. The sealing assembly according to claim 25, wherein the outer ring and/or the inner ring comprises a fluoropolymer that is selected from polytetrafluoroethylene, a copolymer of perfluoroalkylvinyl ether and tetrafluoroethylene, and a copolymer of hexafluoropropylene and tetrafluoroethylene.

28. The sealing assembly of claim 20, wherein the center sealing ring comprises a fluoroelastomer or a perfluoroelastomer.

29. A bonded sealing assembly for a high temperature application, comprising:

a sealing ring body having a longitudinal cross-section that has an outer ring portion, an inner ring portion and a central transversely extending bridge extending between the outer and the inner ring portions, wherein the outer ring portion has an inwardly extending rectangular portion and the inner ring portion has an inwardly extending rectangular portion, each of the rectangular portions of the inner ring portion and the outer ring portions being positioned so as to be longitudinally centered with respect to a central transverse axis through the sealing ring body, wherein the bridge has an upper surface and a lower surface, and wherein

the outer and inner ring portions together with and the bridge define upper and lower seal receiving areas; and

an upper seal lobe portion and a lower seal lobe portion, each bonded respectively to the upper surface and the lower surface of the bridge and each respectively located within the seal receiving areas of the sealing ring body, wherein the upper and the lower seal lobe portions have respectively an upwardly extending and a downwardly extending generally parabolic longitudinal cross-section, and wherein the upper and lower seal lobe portions define troughs in the respective seal receiving areas that allow for expansion of each of the upper seal lobe portion and the lower seal lobe portion.

30. The bonded sealing assembly according to claim 29, wherein the sealing ring body comprises a metal, a metal alloy and/or a fluoropolymer; the upper and lower seal lobe portions comprise an elastomer; and the sealing ring body and the seal lobe portions are chemically bonded.

31. The bonded sealing assembly according to claim 30, wherein the sealing ring body is a metal or metal alloy selected from the group consisting of aluminum 6061, aluminum 7075, stainless steel 316, and stainless steel 304.

32. The bonded sealing assembly according to claim 30, wherein the sealing ring body is a fluoropolymer selected from polytetrafluoroethylene, a copolymer of perfluoroalkylvinyl ether and tetrafluoroethylene, and a copolymer of hexafluoropropylene and tetrafluoroethylene.

33. The bonded sealing assembly according to claim 30, wherein the elastomer is a perfluoroelastomer or a fluoroelastomer.

34. The bonded sealing assembly according to claim 29, wherein the sealing ring body and the seal lobe portions are mechanically bonded.

35. The bonded sealing assembly for high temperature application according to claim 29, wherein the troughs in the respective seal receiving areas allow for expansion of each of the upper seal lobe portion and the lower seal lobe portion when the sealing assembly is installed in a high temperature application including a service temperature of about 100°C to about 300°C.