

## CLAIMS

What is claimed is:

1. A process chamber component comprising:  
a ceramic body of the process chamber component, the ceramic body having at least an exterior facing surface comprising a crystalline yttrium aluminum garnet (YAG),  
wherein the crystalline YAG comprises yttrium oxide at a molar concentration ranging from 35 mole% to 40 mole% and aluminum oxide at a molar concentration ranging from 60 mole% to 65 mole%, and  
wherein the crystalline YAG has a density of about 98% or greater and a hardness greater than about 10 GPa.
2. The process chamber component of claim 1, wherein the crystalline YAG has less than 0.1% porosity.
3. The process chamber component of claim 1, wherein the crystalline YAG has a hardness greater than about 12 GPa.
4. The process chamber component of claim 1, wherein the ceramic body consists of the crystalline YAG, and wherein the crystalline YAG is a single phase bulk crystalline YAG.
5. The process chamber component of claim 1, wherein an average total number of yttrium based particles released from the crystalline YAG upon exposure to a corrosive chemistry is less than 3 per 500 radiofrequency hours.
6. The process chamber component of claim 5, wherein the corrosive chemistry comprises hydrogen based chemistry, halogen based chemistry, or a mixture thereof.
7. The process chamber component of claim 6, wherein the corrosive chemistry comprises one or more of HF, HBr, HCl, Cl<sub>2</sub>, or H<sub>2</sub>.
8. The process chamber component of claim 1, wherein the process chamber component comprises at least one of a lid, a nozzle, or a liner.

9. The process chamber component of claim 1, wherein the crystalline YAG is a result of a two-step sintering process comprising hot isotactic pressing (HIP).
10. A method of coating a process chamber component, comprising:
  - performing electron beam ion assisted deposition (e-beam IAD) to deposit a plasma resistant protective coating on at least a portion of a process chamber component,
  - wherein the plasma resistant protective coating comprises a single phase amorphous blend of yttrium oxide at a molar concentration ranging from about 35 mole% to about 95 mole% and aluminum oxide at a molar concentration ranging from about 5 mole% to about 65 mole%, and
  - wherein the plasma resistant protective coating has a porosity of 0% and an adhesion strength greater than about 25 MPa.
11. The method of claim 10, wherein the plasma resistant protective coating comprises a single phase amorphous blend of yttrium oxide at a molar concentration ranging from 35 mole% to 40 mole% and aluminum oxide at a molar concentration ranging from 60 mole% to 65 mole%.
12. The method of claim 11, wherein the plasma resistant protective coating comprises a single phase amorphous blend of yttrium oxide at a molar concentration ranging from 37 mole% to 38 mole% and aluminum oxide at a molar concentration ranging from 62 mole% to 63 mole%.
13. The method of claim 10, wherein the plasma resistant protective coating, at a thickness of 5  $\mu\text{m}$ , has one or more of: a roughness of less than about 6  $\mu\text{in}$ , a breakdown voltage of greater than about 2,500 V/mil, a hermeticity of less than about  $3\text{E-}9$ , a hardness of about 8 GPa, a flexural strength of greater than about 400 MPa, or stability at temperatures ranging from about 80  $^{\circ}\text{C}$  to about 120  $^{\circ}\text{C}$ .
14. The method of claim 10, wherein an average total number of yttrium based particles released from the plasma resistant protective coating upon exposure to a corrosive chemistry is less than 3 per 500 radiofrequency hours.

15. The method of claim 14, wherein the corrosive chemistry comprises a hydrogen-based chemistry, a halogen-based chemistry, or a mixture thereof.
16. The method of claim 15, wherein the corrosive chemistry comprises one or more of HF, HBr, HCl, Cl<sub>2</sub>, or H<sub>2</sub>.
17. A method of coating a process chamber component, comprising:
  - performing plasma spray or physical vapor deposition (PVD) to deposit a plasma resistant protective coating on a process chamber component,
  - wherein the plasma resistant protective coating comprises a blend of yttrium oxide at a molar concentration ranging from about 35 mole% to about 95 mole% and aluminum oxide at a molar concentration ranging from about 5 mole% to about 65 mole%,
  - wherein the plasma resistant protective coating is at least about 90% amorphous, and
  - wherein an average total number of yttrium based particles released from the plasma resistant protective coating upon exposure to a corrosive chemistry is less than 3 per 500 radiofrequency hours.
18. The method of claim 17, wherein the plasma resistant protective coating comprises a blend of yttrium oxide at a molar concentration ranging from 35 mole% to 40 mole% and aluminum oxide at a molar concentration ranging from 60 mole% to 65 mole%.
19. The method of claim 18, wherein the plasma resistant protective coating comprises a blend of yttrium oxide at a molar concentration ranging from 37 mole% to 38 mole% and aluminum oxide at a molar concentration ranging from 62 mole% to 63 mole%.
20. The method of claim 19, wherein the corrosive chemistry comprises hydrogen based chemistry, halogen based chemistry, or a mixture thereof.