CLAIMS

1. An ozone generator cell comprising:

a high voltage electrode layer;

two dielectric layers, the first dielectric layer disposed on a first side of the high voltage electrode layer and the second dielectric layer disposed on the second, opposite side of the high voltage electrode layer;

two low voltage electrode layers, one low voltage electrode layer disposed over each of the two dielectric layers;

two discharge regions, the first discharge region defined, in part, by the high voltage electrode layer, the dielectric layer disposed on the first side of the high voltage electrode layer, and the low voltage electrode layer disposed on the first side of the high voltage electrode layer, the second discharge region defined, in part, by the high voltage electrode layer, the dielectric layer disposed on the second side of the high voltage electrode layer, and the low voltage electrode layer disposed on the second side of the high voltage electrode layer; and

two thermally conductive plates, the first thermally conductive plate in contact with the low voltage electrode layer on the first side of the high voltage electrode layer, and the second thermally conductive plate in contact with the low voltage electrode layer on the second side of the high voltage electrode layer, wherein the two thermally conductive plates maintain contact between the layers located therebetween in the absence of a bonding agent.

2. The ozone generator cell of claim 1, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

3. The ozone generator cell of claim 2, wherein the reduced thickness produces an increased capacitance between the low voltage electrode layers and the high voltage electrode layer.

4. The ozone generator cell of claim 1, wherein the dielectric layers, the low voltage electrode layers, and the high voltage electrode layer are fabricated using non-aluminum containing materials.

5. The ozone generator cell of claim 1, comprising spacer shims protruding from a surface of each low voltage electrode layer towards a surface of a dielectric layer.

6. The ozone generator cell of claim 5, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage electrode layers and the second side of the high voltage electrode layer.

7. The ozone generator cell claim 5, wherein the spacer shims are integral portions of the low voltage electrode layers or separate components sandwiched between the dielectric layers and the low voltage electrode layers.

8. A method for fabricating an ozone generator cell, the method comprising:

locating a first dielectric layer on a first side of a high voltage electrode layer;

locating a second dielectric layer on a second, opposite side of the high voltage electrode layer;

locating a first low voltage electrode layer over the first dielectric layer to define a first discharge region by combination of the high voltage electrode layer, the first dielectric layer and the first low voltage electrode layer;

locating a second low voltage electrode layer over the second dielectric layer to define a second discharge region by combination of the high voltage electrode layer, the second dielectric layer and the second low voltage electrode layer; and

locating a first thermally conductive plate over the first low voltage electrode layer;

locating a second thermally conductive plate over the second low voltage electrode layer;

applying pressure to all the layers located between the first and second thermally conductive plates to maintain contact between the layers located therebetween in the absence of a bonding agent.

9. The method of claim 8, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces an increased electrical capacitance between the low voltage electrode layers and the high voltage electrode layer.

10. The method of claim 8, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent reduces thermal variation effects in the ozone generation cell.

11. The method of claim 10, wherein the ozone generation cell may be operated over a wider range of temperatures because of the absence of a bonding agent.

12. The method of claim 8, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

13. The method of claim 8, comprising fabricating the dielectric layers, the low voltage electrode layers, and the high voltage electrode layer using non-aluminum containing materials.

14. The method of claim 8, comprising using an assembly jig to locate the first dielectric layer, the high voltage electrode layer, the second dielectric layer, the first low voltage electrode layer, the second low voltage electrode layer, the first thermally conductive plate, and the second thermally conductive plate relative to each other.

15. The method of claim 8, wherein spacer shims protrude from a surface of each low voltage electrode layer towards a surface of a dielectric layer.

16. The method of claim 15, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage electrode layers and the second side of the high voltage electrode layer.

17. An ozone generator cell comprising:

a high voltage electrode layer;

two dielectric layers, the first dielectric layer disposed on a first side of the high voltage electrode layer and the second dielectric layer disposed on the second, opposite side of the high voltage electrode layer;

two low voltage electrode layers comprising tungsten, one low voltage electrode layer disposed over each of the two dielectric layers;

two discharge regions, the first discharge region defined, in part, by the high voltage electrode layer, the dielectric layer disposed on the first side of the high voltage electrode layer, and the low voltage electrode layer disposed on the first side of the high voltage electrode layer, the second discharge region defined, in part, by the high voltage electrode layer, the dielectric layer disposed on the second side of the high voltage electrode layer, and the low voltage electrode layer disposed on the second side of the high voltage electrode layer; and

two thermally conductive plates, the first thermally conductive plate in contact with the low voltage electrode layer on the first side of the high voltage electrode layer, and the second thermally conductive plate in contact with the low voltage electrode layer on the second side of the high voltage electrode layer, wherein the two thermally conductive plates maintain contact between the layers located therebetween in the absence of a bonding agent.

18. The ozone generator cell of claim 17, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

19. The ozone generator cell of claim 17, comprising spacer shims protruding from a surface of each low voltage electrode layer towards a surface of a dielectric layer.

20. The ozone generator cell of claim 19, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage electrode layers and the second side of the high voltage electrode layer.

21. The ozone generator cell claim 19, wherein the spacer shims are integral portions of the low voltage electrode layers or separate components sandwiched between the dielectric layers and the low voltage electrode layers.

22. A high concentration ozone generator cell comprising:

a high voltage electrode layer fabricated using non-aluminum containing materials;

two dielectric layers, the first dielectric layer disposed on a first side of the high voltage electrode layer and the second dielectric layer disposed on the second, opposite side of the high voltage electrode layer;

two low voltage electrode layers, one low voltage electrode layer disposed over each of the two dielectric layers fabricated using non-aluminum containing materials;

two discharge regions lacking aluminum containing materials, the first discharge region defined, in part, by the high voltage electrode layer, the dielectric layer disposed on the first side of the high voltage electrode layer, and the low voltage electrode layer disposed on the first side of the high voltage electrode layer, the second discharge region defined, in part, by the high voltage electrode layer, the dielectric layer disposed on the second side of the high voltage electrode layer, and the low voltage electrode layer disposed on the second side of the high voltage electrode layer; and

two thermally conductive plates, the first thermally conductive plate in contact with the low voltage electrode layer on the first side of the high voltage electrode layer, and the second thermally conductive plate in contact with the low voltage electrode layer on the second side of the high voltage electrode layer, wherein the two thermally conductive plates maintain contact between the layers located therebetween in the absence of a bonding agent to reduce the shear stresses in the ozone generator cell.

CLAIMS

1. An ozone generator, comprising:

an ozone generator cell comprising:

a high voltage electrode layer having a first side and a second side opposing the first side;

a first dielectric layer having a first side and a second side opposing the first side,and a second dielectric layer having a first side and a second side opposing the first side, the second side of the first dielectric layer disposed on the first side of the high voltage electrode layer and the first side of the second dielectric layer disposed on the second side of the high voltage electrode layer;

a first low voltage electrode layer having a first side and a second side opposing the first side, and a second low voltage electrode layer having a first side and a second side opposing the first side, the second side of the first low voltage electrode layer disposed over the first side of the first dielectric layer and the first side of the second low voltage electrode layer disposed over the second side of the second dielectric layer;

two discharge regions, a first discharge region, of the two discharge regions, defined, in part, by the high voltage electrode layer, the first dielectric layer disposed on the first side of the high voltage electrode layer, and the second side of the first low voltage electrode layer disposed on the first side of the first dielectric layer, a second discharge region, of the two discharge regions, defined, in part, by the high voltage electrode layer, the second dielectric layer disposed on the second side of the high voltage electrode layer, and the first side of the second low voltage electrode layer disposed on the second side of the second dielectric layer; and

a first thermally conductive plate having a first side and a second side opposing the first side, and a second thermally conductive plate having a first side and a second side opposing the first side, the second side of the first thermally conductive plate disposed over the first side of the first low voltage electrode layer and the first side of the second thermally conductive plate disposed over the second side of the second low voltage electrode layer, wherein the two thermally conductive plates maintain contact between the first low voltage electrode layer, the first dielectric layer, the high voltage

electrode layer, the second dielectric layer, and the second low voltage electrode layer located therebetween in the absence of a bonding agent,

wherein the two dielectric layers, the two low voltage electrode layers, and the high voltage electrode layer are all fabricated using non-aluminum containing materials.

2. The ozone generator of claim 1, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

3. The ozone generator of claim 2, wherein the reduced thickness produces an increased capacitance between the low voltage electrode layers and the high voltage electrode layer.

4. The ozone generator of claim 1, comprising spacer shims protruding from a surface of each low voltage electrode layer towards a surface of each of the two dielectric layers.

5. The ozone generator of claim 4, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage electrode layers and the second side of the high voltage electrode layer.

6. The ozone generator claim 4, wherein the spacer shims are integral portions of the low voltage electrode layers or separate components sandwiched between the dielectric layers and the low voltage electrode layers.

7. The ozone generator of claim 1, further comprising:

a base plate over which the ozone generator cell is positioned; and

a spring-loaded clamp plate coupled to the base plate such that the ozone generator cell is disposed between the base plate and the spring-loaded clamp plate, such that the coupled base plate and spring-loaded clamp plate apply pressure to the ozone generator cell to hold the layers of the ozone generator cell together.

8. A method for fabricating an ozone generator cell, the method comprising:

locating a second side of a first dielectric layer on a first side of a high voltage electrode layer;

locating a first side of a second dielectric layer on a second, opposite side of the high voltage electrode layer;

locating a second side of a first low voltage electrode layer over a first side of the first dielectric layer to define a first discharge region by combination of the high voltage electrode layer, the first dielectric layer and the first low voltage electrode layer;

locating a first side of a second low voltage electrode layer over a second side of the second dielectric layer to define a second discharge region by combination of the high voltage electrode layer, the second dielectric layer and the second low voltage electrode layer;

locating a first thermally conductive plate over a first side of the first low voltage electrode layer;

locating a second thermally conductive plate over the second side of the second low voltage electrode layer; and

applying pressure to the first low voltage electrode layer, the first dielectric layer, the high voltage electrode layer, the second dielectric layer, and the second low voltage electrode layer located between the first and second thermally conductive plates to maintain contact between the layers located therebetween in the absence of a bonding agent.

9. The method of claim 8, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces an increased electrical capacitance between the low voltage electrode layers and

the high voltage electrode layer.

10. The method of claim 8, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent reduces thermal variation effects in the ozone generator cell.

11. The method of claim 10, wherein the ozone generator cell may be operated over a wider range of temperatures because of the absence of a bonding agent.

12. The method of claim 8, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

13. The method of claim 8, comprising fabricating all of the dielectric layers, the low voltage electrode layers, and the high voltage electrode layer using non-aluminum-containing materials.

14. The method of claim 8, comprising using an assembly jig to locate the first dielectric layer, the high voltage electrode layer, the second dielectric layer, the first low voltage electrode layer, the second low voltage electrode layer, the first thermally conductive plate, and the second thermally conductive plate relative to each other.

15. The method of claim 8, wherein spacer shims protrude from a surface of each low voltage electrode layer towards a surface of a dielectric layer.

16. The method of claim 15, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage

electrode layers and the second side of the high voltage electrode layer.

17. The method of claim 8, further comprising:

locating a base plate over the second thermally conductive plate;

locating a spring-loaded clamp plate over the first thermally conductive plate; and

coupling the spring-loaded clamp plate to the base plate, the coupled spring-loaded clamp plate and base plate applying the pressure to the first low voltage electrode layer, the first dielectric layer, the high voltage electrode layer, the second dielectric layer, and the second low voltage electrode layer located between the first and second thermally conductive plates to maintain contact between the layers located therebetween.

18. An ozone generator, comprising:

an ozone generator cell comprising:

a high voltage electrode layer having a first side and a second side opposing the first side;

a first dielectric layer having a first side and a second side opposing the first side, and a second dielectric layer having a first side and a second side opposing the first side, the second side of the first dielectric layer disposed on the first side of the high voltage electrode layer and the first side of the second dielectric layer disposed on the second side of the high voltage electrode layer;

a first low voltage electrode layer comprising tungsten and having a first side and a second side opposing the first side, and a second low voltage electrode layer comprising tungsten and having a first side and a second side opposing the first side, the second side of the first low voltage electrode layer disposed over the first side of the first dielectric layer and the first side of the second low voltage electrode layer disposed over the second side of the second dielectric layer;

two discharge regions, a first discharge region, of the two discharge regions, defined, in part, by the high voltage electrode layer, the first dielectric layer disposed on the first side of the high voltage electrode layer, and the second side of the first low voltage electrode layer disposed on the first side of the first dielectric layer, a second discharge region, of the two discharge regions, defined, in part, by the high voltage

electrode layer, the second dielectric layer disposed on the second side of the high voltage electrode layer, and the first side of the second low voltage electrode layer disposed on the second side of the second dielectric layer; and

a first thermally conductive plate having a first side and a second side opposing the first side, and a second thermally conductive plate having a first side and a second side opposing the first side, the second side of the first thermally conductive plate disposed over the first side of the first low voltage electrode layer and the first side of the second thermally conductive plate disposed over the second side of the second low voltage electrode layer, wherein the two thermally conductive plates maintain contact between the first low voltage electrode layer, the first dielectric layer, the high voltage electrode layer, the second dielectric layer, and the second low voltage electrode layer layers located therebetween in the absence of a bonding agent.

19. The ozone generator of claim 18, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

20. The ozone generator of claim 18, comprising spacer shims protruding from a surface of each low voltage electrode layer towards a surface of a dielectric layer.

21. The ozone generator of claim 20, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage electrode layers and the second side of the high voltage electrode layer.

22. The ozone generator claim 20, wherein the spacer shims are integral portions of the low voltage electrode layers or separate components sandwiched between the dielectric layers and the low voltage electrode layers.

23. The ozone generator of claim 18, further comprising:

a base plate over which the ozone generator cell is positioned; and

a spring-loaded clamp plate coupled to the base plate such that the ozone generator cell is disposed between the base plate and the spring-loaded clamp plate, such that the coupled base plate and spring-loaded clamp plate apply pressure to the ozone generator cell to maintain the contact between the first low voltage electrode layer, the first dielectric layer, the high voltage electrode layer, the second dielectric layer, and the second low voltage electrode layer layers located therebetween in the absence of a bonding agent.

24. A high concentration ozone generator, comprising:

an ozone generator cell comprising:

a high voltage electrode layer fabricated using non-aluminum containing materials having a first side and a second side opposing the first side;

a first dielectric layer having a first side and a second side opposing the first side, and a second dielectric layer having a first side and a second side opposing the first side, the second side of the first dielectric layer disposed on the first side of the high voltage electrode layer and the first side of the second dielectric layer disposed on the second side of the high voltage electrode layer;

a first low voltage electrode layer having a first side and a second side opposing the first side, and a second low voltage electrode layer having a first side and a second side opposing the first side, the second side of the first low voltage electrode layer disposed over the first side of the first dielectric layer and the first side of the second low voltage electrode layer disposed over the second side of the second dielectric layer;

two discharge regions lacking aluminum-containing materials, a first discharge region, of the two discharge regions, defined, in part, by the high voltage electrode layer, the first dielectric layer disposed on the first side of the high voltage electrode layer, and the second side of the first low voltage electrode layer disposed on the first side of the first dielectric layer, a second discharge region, of the two discharge regions, defined, in part, by the high voltage electrode layer, the second dielectric layer disposed on the second side of the high voltage electrode layer, and the first side of the second low voltage electrode layer disposed on the second side of the second dielectric layer; and

a first thermally conductive plate having a first side and a second side opposing the first side, and a second thermally conductive plate having a first side and a second side opposing the first side, the second side of the first thermally conductive plate disposed over the first side of the first low voltage electrode layer and the first side of the second thermally conductive plate disposed over the second side of the second low voltage electrode layer, wherein the two thermally conductive plates maintain contact between the first low voltage electrode layer, the first dielectric layer, the high voltage electrode layer, the second dielectric layer, and the second low voltage electrode layer located therebetween in the absence of a bonding agent to reduce the shear stresses in the ozone generator cell.

25. The high concentration ozone generator cell of claim 24, wherein maintaining contact between the layers located between the first and second thermally conductive plates in the absence of a bonding agent produces a reduced thickness of a combination of the dielectric layers and the high voltage electrode layer.

26. The high concentration ozone generator cell of claim 24, comprising spacer shims protruding from a surface of each low voltage electrode layer towards a surface of a dielectric layer.

27. The high concentration ozone generator cell of claim 26, wherein the first dielectric layer is sandwiched between the spacer shims protruding from the surface of one of the low voltage electrode layers and the first side of the high voltage electrode layer, and the second dielectric layer is sandwiched between the spacer shims protruding from the surface of the other of the low voltage electrode layers and the second side of the high voltage electrode layer.

28. The high concentration ozone generator cell of claim 26, wherein the spacer shims are integral portions of the low voltage electrode layers or separate components sandwiched between the dielectric layers and the low voltage electrode layers.

29. The high concentration ozone generator cell of claim 24, further comprising:

a base plate over which the ozone generator cell is positioned; and

a spring-loaded clamp plate coupled to the base plate such that the ozone generator cell is disposed between the base plate and the spring-loaded clamp plate, such that the coupled base plate and spring-loaded clamp plate apply pressure to the ozone generator cell to maintain the contact between the first low voltage electrode layer, the first dielectric layer, the high voltage electrode layer, the second dielectric layer, and the second low voltage electrode layer layers located therebetween in the absence of a bonding agent to reduce the shear stresses in the ozone generator cell.