CLAIMS

1. An electrochemical cell comprising:

a housing having an inlet, an outlet, and a central axis;

at least one anode-cathode pair disposed substantially concentrically within the housing about the central axis and defining an active area between an anode and a cathode of the anode-cathode pair, an active surface area of at least one of the anode and the cathode having a surface area greater than a surface area of an internal surface of the housing, the at least one anode-cathode pair configured and arranged to direct all fluid passing through the electrochemical cell axially through the active area, a non-conductive central core element disposed within an innermost anode-cathode pair in the electrochemical cell and configured to block fluid flow through the central axis, the central core element unconnected from at least one electrode of the anode-cathode pair.

2. The electrochemical cell of claim 1, having an overall electrode packing density of at least about 2 mm^{-1}.

3. The electrochemical cell of claim 1, wherein the anode-cathode pair is spiral-wound about the central axis.

4. The electrochemical cell of claim 3, further comprising one or more spiral-wound bipolar electrodes.

5. The electrochemical cell of claim 4, wherein the anode is laterally displaced from the cathode along a length of the electrochemical cell.

6. The electrochemical cell of claim 3, wherein at least one of the anode and the cathode is a rigid electrode.

7. The electrochemical cell of claim 6, wherein the anode and the cathode each comprise one or more of titanium, nickel and aluminum.

8. The electrochemical cell of claim 6, wherein surfaces of the anode are coated with an oxidation resistant coating selected from the group consisting of platinum, a mixed metal oxide, magnetite, ferrite, cobalt spinel, tantalum, palladium, iridium, gold, and silver.

9. The electrochemical cell of claim 3, further comprising a separator configured to maintain a gap distance between the anode and the cathode, the separator being open to flow of an electrolyte solution through the active area.

10. The electrochemical cell of claim 9, wherein the separator includes a hub having spokes with slots that engage edges of at least one of the anode and the cathode.

11. The electrochemical cell of claim 10, wherein the hub further includes an electrical connector configured to electrically connect the one of the anode and the cathode to a source of current.

12. The electrochemical cell of claim 3, further comprising a hub including spokes in electrical contact with one of the anode and the cathode.

13. The electrochemical cell of claim 12, wherein the spokes include slots that engage edges of the one of the anode and the cathode and maintain a gap between turns of the spiral wound anode-cathode pair.

14. The electrochemical cell of claim 3, wherein the central core element comprises a non-conductive core disposed within an innermost winding of the anode-cathode pair.

15. The electrochemical cell of claim 1, wherein the anode-cathode pair includes a plurality of concentric electrode tubes and gaps defined between adjacent electrode tubes.

16. The electrochemical cell of claim 15, wherein the plurality of concentric electrode tubes includes one of a plurality of anode electrode tubes and a plurality of cathode electrode tubes.

17. The electrochemical cell of claim 16, wherein one of the plurality of anode electrode tubes and the plurality of cathode electrode tubes are rigid electrodes.

18. The electrochemical cell of claim 16, wherein the plurality of concentric tube electrodes includes a plurality of anode electrode tubes and a plurality of cathode electrode tubes.

19. The electrochemical cell of claim 16, configured to enable current to flow through an electrolyte solution from an anode electrode tube to a cathode electrode tube in a single pass.

20. The electrochemical cell of claim 16, further comprising a bipolar electrode tube disposed between an anode electrode tube and a cathode electrode tube.

21. The electrochemical cell of claim 20, further comprising an electrode tube including an anodic half and a cathodic half.

22. The electrochemical cell of claim 20, further comprising a plurality of bipolar electrode tubes disposed between respective concentrically arranged adjacent pairs of electrode tubes having anodic halves and cathodic halves.

23. The electrochemical cell of claim 20, wherein at least one of the plurality of anode electrode tubes and the plurality of cathode electrode tubes is fluid permeable.

24. The electrochemical cell of claim 15, further comprising at least one separator positioned between adjacent electrode tubes, the at least one separator configured to define and maintain a gap between the adjacent electrode tubes.

25. The electrochemical cell of claim 24, wherein the separator is open to flow of an electrolyte solution through the gap defined between the adjacent electrode tubes.

26. The electrochemical cell of claim 15, further comprising a metallic hub including spokes electrically coupled to edges of a plurality of the concentric electrode tubes.

27. The electrochemical cell of claim 26, wherein each spoke include slots that engage the edges of the plurality of the concentric electrode tubes maintain gaps between adjacent electrode tubes in the plurality of the concentric electrode tubes.

28. The electrochemical cell of claim 15, wherein the central core element includes an end cap disposed within an end of an innermost concentric tube electrode of the electrochemical cell.

29. The electrochemical cell of claim 1, further comprising an electrical connector including first portion disposed to contact process fluid passing through the electrochemical cell and electrically connected to a second portion disposed to contact air external to the housing but not the process fluid, the first portion formed of a material that is more chemically resistant and less electrically conductive than the second portion.

30. The electrochemical cell of claim 29, wherein the first portion is comprised of titanium.

31. The electrochemical cell of claim 29, wherein the second portion is comprised of copper.

32. The electrochemical cell of claim 1, further comprising non-conductive bumpers having portions passing through apertures defined in the electrodes, the non-conductive bumpers maintaining gaps between adjacent electrodes.

33. The electrochemical cell of claim 32, wherein the bumpers comprise male portions disposed on first surfaces of the electrodes that snap into female portions disposed on second surfaces of the electrodes opposite the first surfaces.