CLAIMS

1. An apparatus for generating an electrolyte containing metal ions, the apparatus comprising:

(a) an anolyte chamber configured to contain an active anode and an anolyte, wherein the apparatus is configured to electrochemically dissolve the active anode into the anolyte, and to thereby form the electrolyte containing metal ions, wherein the anolyte chamber comprises:

(i) an inlet for receiving a fluid; and

(ii) an outlet for removing the anolyte;

(b) a first catholyte chamber separated from the anolyte chamber by a first anion permeable membrane, wherein the first catholyte chamber is configured to contain a first catholyte, and wherein the first catholyte chamber comprises an inlet for receiving a fluid and an outlet for removing the first catholyte from the first catholyte chamber;

(c) a second catholyte chamber configured to contain a cathode and a second catholyte, wherein the second catholyte chamber is separated from the first catholyte chamber by a second anion permeable membrane, wherein the volume of the first catholyte chamber is less than about 20% of the total volume of the first and second catholyte chambers, and wherein the apparatus is configured for flushing the metal ions from the first catholyte chamber using the inlet and the outlet of the first catholyte chamber; and

(d) one or more sensors configured for measuring a concentration of metal ions in the anolyte.

2. The apparatus of claim 1, wherein the first catholyte chamber and the second catholyte chamber are parts of a removable cathode-housing assembly, wherein the removable cathode-housing assembly is configured to be releasably inserted into the anolyte chamber.

3. The apparatus of claim 1, wherein the apparatus is configured to deliver the first catholyte from the first catholyte chamber to the anolyte chamber through a fluidic conduit, and/or wherein the apparatus is configured to remove the first catholyte from the first catholyte chamber to a drain via the outlet of the first catholyte chamber.

4. The apparatus of claim 3, wherein the first catholyte chamber and the second catholyte chamber are fluidically connected through a fluidic conduit, wherein the fluidic conduit allows for transfer of the second catholyte from the second catholyte chamber to the first catholyte chamber via the inlet in the first catholyte chamber.

5. The apparatus of claim 1, wherein the apparatus comprises a single piece metal anode.

6. The apparatus of claim 1, wherein the anolyte chamber comprises an ion - permeable container for containing a plurality of metal pieces that serve as an anode.

7. The apparatus of claim 6, wherein the anolyte chamber further comprises a receiving port for receiving a plurality of metal pieces into the ion-permeable container.

8. The apparatus of claim 7, wherein the receiving port comprises a gravity fed hopper.

9. The apparatus of claim 7, wherein the receiving port comprises a sensor configured to communicate to a system controller when the level of metal pieces in the receiving port is low.

10. The apparatus of claim 1, wherein the apparatus comprises a hydrogen-generating cathode positioned in the second catholyte chamber.

11. The apparatus of claim 10, wherein the apparatus comprises a diluent gas conduit configured to deliver a diluent gas to a space above the second catholyte, and to dilute hydrogen gas accumulating in that space, wherein the space above the second catholyte is covered with a first lid having one or more openings that allow for transfer of diluted hydrogen gas into a space above the first lid.

12. The apparatus of claim 11, further comprising: a second lid over the first lid and spaced apart from the first lid such that there is a space between the first and the second lids; and a second diluent gas conduit configured to deliver a diluent gas to a space between the first and second lids and to move the diluted hydrogen gas from the space between the first and second lids towards an exhaust.

13. The apparatus of claim 1, wherein the anolyte chamber comprises a cooling system.

14. The apparatus of claim 1, wherein the anolyte chamber comprises a cooling system that is located in a cooling portion of the anolyte chamber away from the active anode.

15. The apparatus of claim 14, further comprising a fluidic conduit and an associated pump configured to deliver the anolyte from the anolyte chamber outlet located proximate the active anode to the cooling portion of the anolyte chamber.

16. The apparatus of claim 1, wherein the apparatus is configured to measure the concentration of metal ions in the anolyte with the one or more sensors, and to communicate the measurement to an apparatus controller.

17. The apparatus of claim 16, wherein a single sensor is used for measuring the concentration of metal ions in the anolyte and the sensor is a densitometer.

18. The apparatus of claim 16, wherein at least two sensors are used for measuring the concentration of metal ions in the anolyte, wherein the at least two sensors comprise a densitometer and a conductivity meter.

19. The apparatus of claim 18, wherein the densitometer and the conductivity meter are further configured for measuring the concentration of acid in the anolyte.

20. The apparatus of claim 19, wherein the conductivity meter is an inductive probe.

21. The apparatus of claim 1, further comprising a sensor configured to measure a concentration of acid in the second catholyte.

22. The apparatus of claim 1, wherein the apparatus comprises a controller having program instructions for automatically generating electrolyte having a concentration of metal ions in a target range.

23. The apparatus of claim 1, further comprising a fluidic connection allowing for automated transfer of the anolyte from the anolyte chamber to an electrolyte storage tank, wherein the electrolyte storage tank is fluidically connected to an electroplating tool, and wherein the apparatus is configured to deliver the electrolyte from the electrolyte storage tank to the electroplating tool.

24. The apparatus of claim 1, further comprising an accessible compartment configured for holding a replaceable source of an acid, wherein the replaceable source of an acid is fluidically connected with the inlet of the anolyte chamber, and said fluidic connection comprises an acid buffer tank, wherein the apparatus is configured to deliver the acid from the replaceable source of the acid to the acid buffer tank and from the acid buffer tank to the anolyte chamber.