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;

(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; 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.

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.

25. An apparatus for automatically 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 catholyte chamber configured to contain a cathode and a catholyte, wherein the catholyte chamber is separated from the anolyte chamber by an anion permeable membrane; and

(c) a controller having program instructions for automatically generating an electrolyte having a concentration of metal ions in the anolyte chamber in a target range using data provided by one or more sensors configured for measuring a concentration of metal ions in the anolyte.

26. A system comprising:

(a) an electroplating apparatus that utilizes an electrolyte containing metal ions;

29. The method of claim 27, wherein the active metal anode comprises low alpha tin metal and the anolyte comprises Sn2+ ions.

30. The method of claim 27, wherein the anolyte further comprises acid, and wherein the method further comprises measuring concentration of acid in the anolyte; automatically communicating concentration of acid to the apparatus controller, wherein the apparatus controller comprises program instructions for processing the data on acid concentration and for instructing the electrolyte-generating apparatus to act based on these data.

31. The method of claim 30, further comprising automatically adding acid to the anolyte if the concentration of acid is less than a target concentration range.

32. The method of claim 27, wherein the method further comprises dosing the anolyte with an acidic solution, after a portion of the anolyte has been transferred to the electrolyte storage container, and repeating operations (a)-(c).

33. The method of claim 32, wherein no more than 10% of the total volume of anolyte is transferred from the anolyte chamber per one (a)-(c) cycle.

34. The method of claim 33, comprising performing at least three (a)-(c) cycles with addition of acid to anolyte after each cycle.

35. The method of claim 33, comprising performing at least three (a)-(c) cycles with addition of acid to anolyte and catholyte after each cycle.

36. The method of claim 27, wherein the anolyte and catholyte comprise an acid selected from the group consisting of methansulfonic acid (MSA), sulfuric acid, and mixtures thereof.

37. The method of claim 27, further comprising flowing a diluent gas to the catholyte chamber to dilute a hydrogen gas generated by the cathode.

38. A method of generating electrolyte, the method comprising electrochemically dissolving a metal in the apparatus of claim 1.