CLAIMS

1. An apparatus for monitoring leveler concentrations in a test solution, the apparatus comprising:

an electrode having a metal surface;

one or more electrochemical cells configured to measure an electrochemical response of the electrode in the test solution as cathodic current is supplied to the electrode; and

a controller configured to determine a concentration of leveler in the test solution based on a measured electrochemical response of the electrode by:

(a) exposing the electrode to a pre-acceleration solution comprising at least one accelerator compound and allowing the surface of the electrode to become substantially saturated with the at least one accelerator compound before removing the electrode from the pre-acceleration solution;

(b) exposing the substantially saturated electrode to the test solution and measuring the electrochemical response while plating the substantially saturated electrode in the test solution, the test solution having an unknown concentration of leveler; and

(c) determining the concentration of leveler in the test solution by comparing the electrochemical response measured in (b) to a model relating leveler concentration to known electrochemical responses.

2. The apparatus of claim 1, wherein the controller is further designed or configured to cause delivery of a defined current or potential to the electrode.

3. The apparatus of claim 1, wherein the controller is further designed or configured to cause one or more fluids to dispense into one or more vessels.

4. The apparatus of claim 1, wherein the controller is further designed or configured to adjust the concentration of leveler in an electroplating system by adding a dose of leveler to a plating solution in response to a determined concentration of leveler present in the test solution.

5. An apparatus for monitoring leveler concentrations in a test solution, the apparatus comprising:

an electrode having a metal surface;

one or more electrochemical cells configured to measure an electrochemical response of the electrode in the test solution as cathodic current is supplied to the electrode; and

a controller configured to determine a concentration of leveler in the test solution based on a measured electrochemical response of the electrode by:

(a) exposing the electrode to a pre-acceleration solution comprising at least one accelerator compound and allowing the surface of the electrode to become substantially saturated with the at least one accelerator compound;

(b) providing a first solution with a known concentration of leveler and a second solution with an unknown concentration of leveler, the second solution being the test solution;

(c) preparing a third solution by adding an amount of the second solution to the first solution;

(d) measuring an electrochemical response while plating the electrode in the third solution;

(e) determining the concentration of leveler in the third solution by comparing the electrochemical response obtained in operation (d) to a model relating leveler concentration to known electrochemical responses; and

(f) determining the concentration of leveler in the test solution by relating the known concentration of leveler in the first solution, the determined concentration of leveler in the third solution, and the amount of second solution added in operation (c).

6. The apparatus of claim 1, wherein the controller is further designed or configured to maintain a concentration of leveler in a plating solution within a defined range, wherein the test solution is obtained from the plating solution.

7. The apparatus of claim 6, wherein the defined range of leveler concentration is between about 1 and 1000 parts per million.

8. An apparatus for monitoring leveler concentrations in electroplating solutions, the apparatus comprising:

an electrode having a metal surface;

and

a controller designed or configured to determine a concentration of leveler present in a test solution by:

(a) exposing the electrode to a pre-acceleration solution, the pre-acceleration solution comprising at least one accelerator compound, and allowing the surface of the electrode to become substantially saturated with the at least one accelerator compound before removing the electrode from the pre-acceleration solution;

(b) exposing the substantially saturated electrode to the test solution and measuring an electrochemical response while plating the substantially saturated electrode in the test solution, the test solution having an unknown concentration of leveler; and

(c) determining the concentration of leveler in the test solution by comparing the electrochemical response measured in (b) to a model relating leveler concentration to known electrochemical responses.

9. The apparatus of claim 8, wherein the controller is further designed or configured to cause delivery of a defined current or potential to the electrode.

10. The apparatus of claim 8, wherein the controller is further designed or configured to cause one or more fluids to dispense into one or more vessels.

11. The apparatus of claim 8, wherein the controller is further designed or configured to adjust the concentration of leveler in an electroplating system by adding a dose of leveler to a plating solution in response to a determined concentration of leveler present in the test solution.

12. The apparatus of claim 8, wherein the controller is further designed or configured to maintain a concentration of leveler in a plating solution within a defined range.

13. The apparatus of claim 12, wherein the defined range of leveler concentration is between about 1 and 1000 parts per million.