CLAIMS

1. A method of recovering at least one precious metal from a printed wire board (PWB) comprising solder and at least one precious metal, said method comprising:

(a) contacting a surface of the PWB with a first composition, wherein the PWB and the first composition are in a first vessel;

(b) agitating said first vessel;

(c) dissolving or solubilizing the solder in the first composition, wherein the first composition selectively removes the solder relative to the at least one precious metal;

(d) removing the first composition from the PWB by rinsing;

(e) drying the PWB;

(f) contacting the PWB with a leaching composition, wherein the PWB and the leaching composition are in a second vessel;

(g) producing agitation in said second vessel;

(h) dissolving or solubilizing the at least one precious metal in the leaching composition;

(i) removing the leaching composition from the PWB by rinsing; and

(j) recovering the at least one precious metal from the leaching composition,

wherein the first composition is substantially devoid of at least one of fluoride salts, ferric salts, titanium (IV) salts, abrasive material, fluoroboric acid, and ferric nitrate.

2. The method of claim **1**, wherein at least one component is attached to a surface of the PWB, and the at least one component is separated from the PWB during dissolution or solubilization in the first composition, wherein said at least one component is selected from the group consisting of transistors, capacitors, heat sinks, integrated circuits, resistors, integrated switches, chips, processors, and combinations thereof.

3. The method of claim 2, wherein at least one precious metal is removed from the at least one component using the leaching composition.

4. The method of claim 3, further comprising the step of crushing the PWB component prior to contact with the leaching composition.

5. The method of claim 2, wherein the at least one component is reusable or recyclable and are separated accordingly.

6. The method of claim 1, wherein the solder comprises lead, tin or a lead/tin alloy.

7. The method of claim 1, wherein the first composition comprises at least one oxidizing agent, and at least one passivating agent for passivating precious metals.

8. The method of claim 7, wherein the at least one oxidizing agent comprises nitric acid, ozone, bubbled air, cyclohexylaminosulfonic acid, hydrogen peroxide, oxone, ammonium peroxomonosulfate, ammonium chlorite, ammonium chlorate, ammonium iodate, ammonium perborate, ammonium perchlorate, ammonium periodate, ammonium persulfate, ammonium hypochlorite, sodium persulfate, sodium hypochlorite, potassium iodate, potassium permanganate, potassium persulfate, potassium persulfate, potassium hypochlorite, tetramethylammonium chlorite, tetramethylammonium chlorate, tetramethylammonium iodate, tetramethylammonium perborate, tetramethylammonium perchlorate, tetramethylammonium periodate, tetramethylammonium persulfate, tetrabutylammonium peroxomonosulfate, peroxomonosulfuric acid, urea hydrogen peroxide, peracetic acid, sodium nitrate, potassium nitrate, ammonium nitrate, benzene sulfonic acid derivatives, methanesulfonic acid (MSA), ethanesulfonic acid, 2-hydroxyethanesulfonic acid, n-propanesulfonic acid, isopropanesulfonic acid, isobutenesulfonic acid, n-butanesulfonic acid, n-octanesulfonic acid), benzenesulfonic acid, benzenesulfonic acid derivatives (e.g., 4-methoxybenzenesulfonic

acid, 4-hydroxybenzenesulfonic acid, 4-aminobenzenesulfonic acid, 4-nitrobenzenesulfonic acid, toluenesulfonic acid, hexylbenzenesulfonic acid, heptylbenzenesulfonic acid, octylbenzenesulfonic acid, nonylbenzenesulfonic acid, decylbenzenesulfonic acid, undecylbenzenesulfonic acid, dodecylbenzenesulfonic acid, tridecylbenzenesulfonic acid, tetradecylbenzene sulfonic acid, hexadecylbenzene sulfonic acid, 3-nitrobenzenesulfonic acid, 2-nitrobenzenesulfonic acid, 2-nitronaphthalenesulfonic acid, 3-nitronaphthalenesulfonic acid, 2,3-dinitrobenzenesulfonic acid, 2,4-dinitrobenzenesulfonic acid, 2,5-dinitrobenzenesulfonic acid, 2,6-dinitrobenzenesulfonic acid, 3,5-dinitrobenzenesulfonic acid, 2,4,6-trinitrobenzenesulfonic acid, 3-aminobenzenesulfonic acid, 2-aminobenzenesulfonic acid, 2-aminonaphthalenesulfonic acid, 3-aminonaphthalenesulfonic acid, 2,3-diaminobenzenesulfonic acid, 2,4-diaminobenzenesulfonic acid, 2,5-diaminobenzenesulfonic acid, 2,6-diaminobenzenesulfonic acid, 3,5-diaminobenzenesulfonic acid, 2,4,6-triaminobenzenesulfonic acid, 3-hydroxybenzenesulfonic acid, 2-hydroxybenzenesulfonic acid, 2-hydroxynaphthalenesulfonic acid, 3-hydroxynaphthalenesulfonic acid, 2,3-dihydroxybenzenesulfonic acid, 2,4-dihydroxybenzenesulfonic acid, 2,5-dihydroxybenzenesulfonic acid, 2,6-dihydroxybenzenesulfonic acid, 3,5-dihydroxybenzenesulfonic acid, 2,3,4-trihydroxybenzenesulfonic acid, 2,3,5-trihydroxybenzenesulfonic acid, 2,3,6-trihydroxybenzenesulfonic acid, 2,4,5-trihydroxybenzenesulfonic acid, 2,4,6-trihydroxybenzenesulfonic acid, 3,4,5-trihydroxybenzenesulfonic acid, 2,3,4,5-tetrahydroxybenzenesulfonic acid, 2,3,4,6-tetrahydroxybenzenesulfonic acid, 2,3,5,6-tetrahydroxybenzenesulfonic acid, 2,4,5,6-tetrahydroxybenzenesulfonic acid, 3-methoxybenzenesulfonic acid, 2-methoxybenzenesulfonic acid, 2,3-dimethoxybenzenesulfonic acid, 2,4-

dimethoxybenzenesulfonic acid, 2,5-dimethoxybenzenesulfonic acid, 2,6-dimethoxybenzenesulfonic acid, 3,5-dimethoxybenzenesulfonic acid, 2,4,6-trimethoxybenzenesulfonic acid, and combinations thereof.

9. The method of claim **7**, wherein the at least one oxidizing agent comprises an alkanesulfonic acid selected from the group consisting of methanesulfonic acid, ethanesulfonic acid, 2-hydroxyethanesulfonic acid, n-propanesulfonic acid, isopropanesulfonic acid, isobutenesulfonic acid, n-butanesulfonic acid, and n-octanesulfonic acid.

10. The method of claim **7**, wherein the at least one passivating agent comprises a triazole derivative selected from the group consisting of 1,2,4-triazole, benzotriazole, tolyltriazole, 5-phenyl-benzotriazole, 5-nitro-benzotriazole, 1-amino-1,2,4-triazole, hydroxybenzotriazole, 2-(5-amino-pentyl)-benzotriazole, 1-amino-1,2,3-triazole, 1-amino-5-methyl-1,2,3-triazole, 3-amino-1,2,4-triazole, 3-mercapto-1,2,4-triazole, 3-isopropyl-1,2,4-triazole, 5-phenylthiol-benzotriazole, halo-benzotriazoles, naphthotriazole, 4-methyl-4H-1,2,4-triazole-3-thiol, and 3-amino-5-mercapto-1,2,4-triazole.

11. The method of claim **7**, wherein the first composition further comprises at least one complexing agent and/or at least one organic solvent.

12. The method of claim **7**, wherein the first composition is substantially devoid of organic solvents including ethylene groups.

13. The method of claim **1**, further comprising dissolving at least one base metal using a second composition that selectively dissolves base metal relative to precious metal.

14. The method of claim **13**, wherein the base metal comprises nickel, copper, or combinations thereof.

15. The method of claim **13**, wherein the second composition comprises at least one oxidizing agent, optionally at least one base metal complexing agent, optionally at least one organic solvent, and optionally at least one passivating agent for passivating precious metals.

16. The method of claim **15**, comprising the at least one base metal complexing agent, wherein the at least one complexing agent comprises a species selected from the group consisting of ammonium chloride, sodium chloride, lithium chloride, potassium chloride, ammonium sulfate, hydrochloric acid, sulfuric acid, and combinations thereof.

17. The method of claim **15**, wherein the at least one oxidizing agent comprises a species selected from the group consisting of an alkanesulfonic acid, ozone, nitric acid, bubbled air, cyclohexylaminosulfonic acid, hydrogen peroxide, oxone, ammonium peroxomonosulfate, ammonium chlorite, ammonium chlorate, ammonium iodate, ammonium perborate, ammonium perchlorate, ammonium periodate, ammonium persulfate, ammonium hypochlorite, sodium persulfate, sodium hypochlorite, potassium iodate, potassium permanganate, potassium persulfate, potassium persulfate, potassium hypochlorite, tetramethylammonium chlorite, tetramethylammonium chlorate, tetramethylammonium iodate, tetramethylammonium perborate, tetramethylammonium perchlorate, tetramethylammonium periodate, tetramethylammonium persulfate, tetrabutylammonium peroxomonosulfate, peroxomonosulfuric acid, urea hydrogen peroxide, peracetic acid, sodium nitrate, potassium nitrate, ammonium nitrate, benzene sulfonic acid derivatives.

18. The method of claim **1**, wherein the precious metal comprises gold.

19. The method of claim **18**, wherein the leaching composition is substantially devoid of aqua regia and cyanide-containing components.

20. The method of claim **18**, wherein the leaching composition comprises triiodide ions.

21. The method of claim **20**, wherein the triiodide is generated in situ.

22. The method of claim **1**, wherein the precious metal comprises gold and the gold is precipitated using a disproportionation reaction, a reducing agent, or by electrowinning.

23. The method of claim **1**, wherein the PWB comprises a fiberglass layer, copper film, and adhesive.

24. The method of claim **23**, wherein the adhesive is degraded to liberate the copper film from the fiberglass layer.

25. The method of claim **1**, wherein the leaching composition comprises at least one oxidizing agent, at least one iodide salt or hydroiodic acid, water, and at least one metal passivating agent.

26. The method of claim **25**, wherein the at least one oxidizing agent comprises a species selected from the group consisting of oxone, sodium persulfate, ammonium persulfate, potassium persulfate, nitric acid, hydrogen peroxide,

ferric chloride, ferric nitrate, periodic acid, sodium hypochlorite, or combinations thereof; and

the at least one iodide salt comprises a species selected from the group consisting of lithium iodide, sodium iodide, potassium iodide, ammonium iodide, calcium iodide, magnesium iodide, and tetraalkylammonium iodides, wherein the alkyl groups may be the same as or different from one another and are selected from the group consisting of straight-chained C_1-C_6 alkyls and branched C_1-C_6 alkyls, and

wherein the at least one passivating agent comprises a species selected from the group consisting 1,2,4-triazole, benzotriazole, tolyltriazole, 5-phenyl-benzotriazole, 5-nitro-benzotriazole, 1-amino-1,2,4-triazole, hydroxybenzotriazole, 2-(5-amino-pentyl)-benzotriazole, 1-amino-1,2,3-triazole, 1-amino-5-methyl-1,2,3-triazole, 3-amino-1,2,4-triazole, 3-mercapto-1,2,4-triazole, 3-isopropyl-1,2,4-triazole, 5-phenylthiol-benzotriazole, halo-benzotriazoles, naphthotriazole, 4-methyl-4H-1,2,4-triazole-3-thiol, and 3-amino-5-mercapto-1,2,4-triazole, ascorbic acid, sodium molybdate, and combinations thereof.