WHAT IS CLAIMED IS:

1. A method of recovering graphene from a lithium ion cell or battery, the method comprising:

disassembling a lithium ion cell or battery to separate an anode from a cathode to form a disassembled lithium ion cell or battery;

mixing the disassembled lithium ion cell or battery with an acid at a temperature of about 10°C to about 100°C to form an acidic solution including graphene, lithium, and optionally one or more of soluble organics, soluble metals, and suspended solids;

wherein the acid has a pH of about 2.5 or less and includes hydrochloric acid, sulfuric acid, nitric acid, acetic acid, citric acid, or combinations thereof; and

separating the graphene from the acidic solution.

2. The method of recovering graphene of claim 1, wherein the dissembling including removing a shell surrounding the anode, the cathode, and an electrolyte of the lithium ion cell or battery.

3. The method of recovering graphene of claim 1, wherein the lithium ion cell or battery is a spent lithium-ion cell or battery.

4. The method of recovering graphene of claim 1, wherein the acid includes hydrochloric acid, sulfuric acid, nitric acid, or combinations thereof and has an acid concentration of about 0.5 to about 30 weight percent in an aqueous solution with a pH of about 1 or less.

5. The method of recovering graphene of claim 1, wherein the mixing is for about 1 minute to about 120 minutes.

6. The method of recovering graphene of claim 1, wherein the mixing is at a temperature of about 50ºC to about 70ºC.

7. The method of recovering graphene of claim 1, further comprising delivering the acidic solution to an ultrafiltration membrane to separate a majority of the suspended

solids from a permeate including at least one or more of the acid, the lithium, the soluble organics, and the soluble metals.

8. The method of recovering graphene of claim 7, wherein the ultrafiltration membrane has a pore size of about 0.01 microns to about 0.5 microns and is operated at about 10 to about 100 psi.

9. The method of recovering graphene of claim 1, wherein the lithium ion cell or battery includes a metal oxide cathode, a metal foil anode, an electrolyte, and a polymeric separator.

10. The method of recovering graphene of claim 9, wherein the metal foil anode includes graphene thereon.

11. The method of recovering graphene of claim 9, wherein the metal oxide cathode is an aluminum foil having a coating of cobalt nickel alloy, lithium cobalt oxide, lithium iron phosphate, lithium manganese oxides, lithium fluoride phosphate, lithium moly oxide, nickel cobalt oxide, or combinations thereof.

12. The method of recovering graphene of claim 9, wherein the electrolyte is a polymeric organic, organic solvent, phosphate, fluoride, a lithium salt, phosphate fluoride, or combinations thereof.

13. The method of recovering graphene of claim 9, wherein the polymeric separator is polypropylene, polyethylene, or combinations thereof.

14. An acid treated graphene obtained from a spent lithium-ion cell or battery, the acid treated graphene obtained by disassembling a spent lithium ion cell or battery to separate an anode from a cathode to form a disassembled lithium ion cell or battery, mixing the disassembled lithium ion cell or battery in an acid to form an acidic solution, the mixing at a temperature of about 10°C to about 100°C and the acidic solution including graphene, lithium, and one or more of soluble organics, soluble metals, and suspended solids and wherein the acid has a pH of about 2.5 or less and includes hydrochloric acid, sulfuric acid, nitric acid, acetic acid, citric acid, or combinations thereof, and separating the acid treated graphene from the acidic solution.

15. The acid treated graphene of claim 14, wherein the acid includes hydrochloric acid, sulfuric acid, nitric acid, or combinations thereof and has an acid concentration of about 0.5 to about 30 weight percent in an aqueous solution with a pH of about 1 or less.

16. The acid treated graphene of claim 14, wherein the spent lithium ion cell or battery includes a metal oxide cathode, a metal foil anode, an electrolyte, and a polymeric separator.

17. The acid treated graphene of claim 16, wherein the metal foil anode includes graphene thereon.

18. An acidic solution for recovery of graphene from a lithium ion cell or battery, the acidic solution including an acid and a spent lithium ion cell or battery providing to the acidic solution lithium, graphene, and one or more of soluble organics, soluble metals, and suspended solids, the acid includes hydrochloric acid, sulfuric acid, nitric acid, or combinations thereof and has an acid concentration of about 0.5 to about 30 weight percent in an aqueous solution with a pH of about 2.5 or less.

19. The acidic solution of claim 18, wherein the spent lithium ion cell or battery of the acidic solution includes a metal oxide cathode, a metal foil anode including the graphene, an electrolyte, and a polymeric separator.

20. The acidic solution of claim 18, further including the soluble metals selected from the group consisting of calcium, magnesium, zinc, copper, aluminum, iron, phosphate, fluoride, rare earth metals, cobalt, nickel, or combinations thereof.