Claims

1. A method comprising: producing elemental carbon material from the oxidation of carbide in at least one carbide chemical compound in at least one anode of an electrochemical cell apparatus, wherein the electrochemical cell apparatus is a galvanic cell apparatus , wherein the galvanic cell apparatus further comprises at least one cathode which is a metal cathode, and wherein the galvanic cell apparatus anode is contacted with a solution comprising at least one organic solvent and at least one dissolved salt, and the galvanic cell apparatus cathode is also contacted with a solution comprising at least one organic solvent and at least one dissolved salt, and wherein the elemental carbon material is produced at a reaction pressure of 0.1 torr to 5 atmospheres.

2. The method of claim 1, wherein the carbide chemical compound is a salt-like carbide or an intermediate transition metal carbide.

3. The method of claim 1, wherein the carbide chemical compound is a salt-like carbide.

4. The method of claim 1, wherein the carbide chemical compound is a methanide, an acetylide, or a sesquicarbide.

5. The method of claim 1, wherein the carbide chemical compound is calcium carbide, aluminum carbide, sodium carbide, magnesium carbide, lithium carbide, beryllium carbide, iron carbide, copper carbide, and chromium carbide.

6. The method of claim 1, wherein the carbide chemical compound is calcium carbide or aluminum carbide.

7. The method of claim 1, wherein the carbide chemical compound has sufficient electronic conductivity to function as an anode.

8. The method of claim 1, wherein the carbide chemical compound has an electronic conductivity of at least 10^{-8} S/cm.

9. The method of claim 1, wherein the metal cathode is a zinc, tin, iron, copper, or silver cathode.

10. The method of claim 1, wherein the electrochemical cell apparatus further comprises at least one salt bridge.

11. The method of claim 1, wherein the electrochemical cell apparatus further comprises at least one ion exchange membrane.

12. The method of claim 1, wherein a reaction temperature for producing the elemental carbon material is:

a) 10°C to 90°C; or
b) 15°C to 50°C; or
c) room temperature.

13. The method of claim 1, wherein the reaction pressure for producing the elemental carbon material is:

a) 0.9 to 1.1 atmosphere; or
b) 720 torr to 800 torr.

14. The method of claim 1, wherein the elemental carbon material is produced at 15°C to 50°C and 720 torr to 800 torr.

15. The method of claim 1, wherein the production of elemental carbon material is carried out without use of an external voltage source.

16. The method of claim 1, wherein the electrochemical cell apparatus comprises an external voltage source to regulate the oxidation reaction.

17. The method of claim 1, wherein the production of elemental carbon material is carried out with use of an external voltage source to regulate the oxidation reaction.

18. The method of claim 1, wherein the elemental carbon material is more than 50% sp2 carbon or more than 50% sp3 carbon.

19. The method of claim 1, wherein the elemental carbon material is more than 90% carbon.

20. The method of claim 1, wherein the elemental carbon material comprises two-dimensional plate-like structures.

21. The method of claim 1, wherein the elemental carbon material comprises two-dimensional plate-like structures stacked on top of one another.

22. The method of claim 1, wherein the elemental carbon material comprises at least some three-dimensional structures.

23. The method of claim 1, wherein the elemental carbon material comprises at least one piece which has a lateral dimension of at least one mm.

24. The method of claim 1, wherein the elemental carbon material is subjected to at least one purification step.

25. The method of claim 1, wherein the elemental carbon material is treated with acid and water.

26. The method of claim 1, wherein the elemental carbon material is subjected to at least one step which produces particles of the elemental carbon material.

27. The method of claim 1, wherein the elemental carbon material is subjected to at least one exfoliation step to produce graphene.

28. The method of claim 1, wherein the galvanic cell apparatus produces electrical power to power at least one load which is another electrochemical cell.

29. The method of claim 1, wherein the carbide chemical compound is calcium carbide or aluminum carbide, and wherein the elemental carbon material is produced at 15°C to 50°C and 720 torr to 800 torr.

30. The method of claim 1, wherein the carbide chemical compound is in the form of individual pieces or particles.

31. The method of claim 1, wherein the carbide chemical compound is in the form of individual pieces or particles having a size of less than one cm.

32. The method of claim 1, wherein the carbide chemical compound contacts at least one electronically conductive material.

33. The method of claim 1, wherein the carbide chemical compound is held in an electronically conductive container.

34. The method of claim 1, wherein the solution is free of dissolved carbide chemical compound.

35. The method of claim 1, wherein the anode is an anode electrode structure comprising the at least one carbide chemical compound, wherein optionally the carbide chemical compound is a salt-like carbide; and at least one electronically conductive structural element different from the carbide chemical compound and contacting the at least one carbide chemical compound.

36. The method of claim 35, wherein the electronically conductive structural element is:

a) a metal; or
b) a non-metal; or
c) graphite.

37. The method of claim 35, wherein the electronically conductive structural element is a non-metallic container and the carbide chemical compound is held in the non-metallic container.

38. The method of claim 35, wherein the electronically conductive structural element is a graphite container and the carbide chemical compound is held in the graphite container.

39. The method of claim 35, wherein the electronically conductive structural element is a basket and the carbide chemical compound is held in the basket.

40. The method of claim 35, wherein the electronically conductive structural element is a graphite basket and the carbide chemical compound is held in the graphite basket.

41. The method of claim 1, wherein the carbide chemical compound is in the form of individual pieces or particles having a size of at least one micron.

42. The method of claim 1, wherein the carbide chemical compound is divided into separate portions which are each contacted with at least one electronically conductive structural element.

43. The method of claim 1, wherein the carbide chemical compound is at least 95% pure.

44. The method of claim 1, wherein the elemental carbon material comprises sp1 carbon.

45. The method of claim 1, wherein the elemental carbon material is subjected to at least one exfoliation step.

46. The method of claim 1, wherein the elemental carbon material is subjected to at least one doping step.

47. The method of claim 1, wherein the carbide chemical compound is calcium carbide.