CLAIMS

1. A method of producing a synthetic diamond, the method comprising:

(a) capturing carbon dioxide from an atmosphere in a carbon dioxide column;

(b) performing electrolysis of water to provide hydrogen in an electrolyzer;

(c) reacting the carbon dioxide obtained from step (a) with the hydrogen obtained from step (b) to produce methane, the reaction being performed using methanogens, in a reactor positioned downstream from the carbon dioxide column and the electrolyzer; and

(d) using the hydrogen obtained from step (b) and the methane obtained from step (c) to produce a synthetic diamond by chemical vapor deposition (CVD) in a CVD diamond machine positioned downstream from the electrolyzer and the reactor.

2. The method of claim 1, wherein step (a) comprises capturing the carbon dioxide using a nanotube gas separator.

3. The method of claim 1, wherein step (a) comprises cooling air to liquefy carbon dioxide in the air.

4. The method of claim 3, wherein cooling the air to liquefy carbon dioxide in the air comprises compressing the air and then expanding the air.

5. The method of claim 4, wherein the steps of compressing the air and then expanding the air are repeated.

6. The method of claim 5, wherein the steps are repeated three times.

7. The method of claim 1, wherein step (a) comprises capturing carbon dioxide using an amine-containing sorbent-material.

8. The method of claim 7, wherein capturing carbon dioxide using the amine-containing sorbent material is conducted at a temperature below 25° C.

9. The method of claim 8, wherein the captured carbon dioxide is subsequently released by heating the amine-containing sorbent material to a temperature above 25° C.

10. The method of claim 1, wherein step (b) comprises performing the electrolysis of water using at least one polymer electrolyte membrane (PEM) cell.

11. The method of claim 10, wherein the electrolysis is performed at a temperature below 150° C.

12. The method of claim 1, wherein the methanogens are prokaryotes.

13. The method of claim 12, wherein the prokaryotes are archaea.

14. The method of claim 1, wherein the CVD is carried out at a pressure of between 0.5 kPa and 100 kPa.

15. The method of claim 14, wherein the CVD is carried out at a pressure of substantially 40 kPa.

16. The method of claim 1, wherein the CVD is carried out at a temperature between 700° C. and 1000° C.

17. The method of claim 16, wherein the CVD is carried out at a temperature of substantially 950° C.

18. The method of claim 1, wherein a ratio of hydrogen to methane used in step (d) is in a range of from 1:1 to 9:1.

19. The method of claim 18, wherein the ratio of hydrogen to methane used in step (d) is about 5:1.

20. The method of claim 1, wherein the CVD is carried out on a substrate comprising diamond.

21. The method of claim 1, further comprising a step (e) of reacting oxygen produced from the electrolysis of the water in step (b) with carbon emissions produced by the chemical vapor deposition in step (d) to produce carbon dioxide.

22. The method of claim 21, further comprising reacting the carbon dioxide obtained from the step (e) with the hydrogen obtained from step (b) to produce methane.

23. The method of claim 1, wherein the method further comprises using energy from at least one renewable source to perform at least one of the steps (a)-(d).

24. The method of claim 23, wherein the method further comprises using energy from at least one renewable source to perform the electrolysis.

25. The method of claim 1, wherein the water comprises rainwater.

26. The method of claim 1, wherein the method further comprises: an additional step, after step (d), of annealing the synthetic diamond.

27. The method of claim 1, wherein the method further comprises an additional step of at least one of cutting and polishing the diamond produced in step (d).

28. The method of claim 1, wherein the reaction of step (c) further produces water, and the method further comprises recycling at least a portion of the water to conduct electrolysis in step (b).

29. The method of claim 1, wherein the methanogens produce methane by respiration, and wherein the carbon dioxide obtained from step (a) is converted into methane at a temperature of around 50° C. and at a pressure of around atmospheric pressure.

30. The method of claim 1, wherein step (c) comprises reacting the carbon dioxide obtained from step (a) with the hydrogen obtained from step (b) according to a Sabatier reaction.

31. The method of claim 1, wherein step (c) further comprises purifying the methane produced at step (c).

32. The method of claim 1, further comprising purifying the carbon dioxide captured in step (a) before performing the electrolysis of the water in step (b).

33. The method of claim 32, comprising purifying the carbon dioxide to a purity of at least 99.9999%.

34. The method of claim 33, further comprising compressing the carbon dioxide captured in step (a) with a high purity oil-free air compressor.

35. A method of producing a synthetic diamond, the method comprising:

(a) capturing carbon dioxide from an atmosphere;

(b) performing electrolysis of water to provide hydrogen;

(c) reacting the carbon dioxide obtained from step (a) with the hydrogen obtained from step (b) to produce methane, the reaction being performed using methanogens under conditions that allow the methanogens to create methane as part of a respiration process; and

(d) using the hydrogen obtained from step (b) and the methane obtained from step (c) to produce a synthetic diamond by chemical vapor deposition (CVD).

36. The method of claim 35, wherein the reaction of step (c) is performed at a temperature of around 50° C. and at a pressure of around atmospheric pressure.