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What is claimed is:

1. A method of synthesizing carbon nanomaterials, the method comprising:
 - mixing a lignin and/or source thereof and a catalyst to form a mixture;
 - heating the mixture at a temperature of at least 600° C. for at least 30 minutes; and
 - cooling the heated mixture to form a cooled mixture including graphene.
2. The method of claim 1, wherein the lignin and/or source thereof is selected from a kraft lignin, a thiolignin, a lignosulfonate, a sulfur-free lignin, and combinations thereof.
3. The method of claim 2, wherein the lignin and/or source thereof includes sodium lignosulfonate.

4. The method of claim 1, wherein the catalyst is selected from a platinum-containing catalyst, a nickel-containing catalyst, an iron-containing catalyst, and combinations thereof.

5. The method of claim 4, wherein the catalyst is comprised of nanoparticles.

6. The method of claim 1, wherein the catalyst includes iron nanoparticles, iron nitrate, or a combination thereof.

7. The method of claim 1, wherein the lignin and/or source thereof and catalyst are in a weight ratio of from about 1:1 to about 8:1.

8. The method of claim 7, wherein the lignin and/or source thereof and catalyst are in a weight ratio of about 4:1.

9. The method of claim 1, wherein the heating is conducted at a temperature of from about 600° C. to about 1500° C.

10. The method of claim 9, wherein the heating is conducted at a temperature of about 1000° C.

11. The method of claim 1, wherein the heating is conducted under an inert atmosphere.

12. The method of claim 1, wherein the heating is conducted for a period of from about 30 minutes to about 120 minutes.

13. The method of claim 1, wherein the cooling is conducted under an inert atmosphere.

14. The method of claim 1, wherein, in the cooling step, the mixture is cooled to a temperature of less than about 100° C.

15. The method of claim 1, further comprising, after the cooling step, a step of purifying the mixture to increase a concentration of carbon nanomaterials in the cooled mixture.

16. The method of claim 15, wherein the purifying step includes purifying the mixture with water, an acid, or a combination thereof.

17. A method of synthesizing carbon nanomaterials, the method comprising:

- mixing sodium lignosulfonate and iron nanoparticles to form a mixture;

- heating the mixture at a temperature of about 80° C. to about 1200° C. for about 40 minutes to about 80 minutes under an inert atmosphere; and

- cooling the heated mixture to a temperature of less than about 100° C. under an inert atmosphere to form a cooled mixture including graphene.

18. The method of claim 17, wherein the iron nanoparticles have a diameter of less than about 100 nanometers.

19. The method of claim 17, wherein the sodium lignosulfonate and iron nanoparticles are present in a weight ratio of about 4:1.

20. A method of synthesizing carbon nanomaterials, the method comprising:

- mixing kraft lignin and an iron-containing catalyst to form a mixture;

- heating the mixture at a temperature of about 80° C. to about 1200° C. for about 40 minutes to about 80 minutes under an inert atmosphere; and

- cooling the heated mixture to room temperature under an inert atmosphere to form a cooled mixture including graphene.

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