CLAIM(S):

1. A method for making a solid carbon material comprising:

delivering a liquid comprising at least one liquid organic compound into a reaction region of a reactor;

delivering a gas comprising at least one gaseous organic compound into the reaction region of the reactor; and

inducing a chemical reaction between the at least one liquid organic compound and the at least one gaseous organic compound, wherein:

the chemical reaction occurs in the reaction region of the reactor;

the solid carbon material is made via the reaction;

the solid carbon material is made during the reaction in the form of a dispersion comprising the solid carbon material dispersed in the liquid; and

the chemical reaction is a homogeneous reaction comprising homogeneous nucleation of the solid carbon material in the reaction region of the reactor.

2. The method of claim 1, wherein the chemical reaction comprises gas-liquid mass transfer.

3. The method of claim 1 or 2. wherein a composition of the gas is different from a composition of the liquid.

4. The method of any one of claims 1-3, wherein a composition of the at least one gaseous compound is different from a composition of the at least one liquid organic compound.

5. The method of any one of claims 1-4, wherein the step of delivering the liquid is performed via a first input stream into the reaction region and the step of delivering the gas is performed via a second input stream into the reaction region; wherein the first stream path and the second input stream are different and physically separate.

6. The method of any one of claims 1-5, wherein the step of delivering the liquid and the step of delivering the gas are performed concurrently or the step of delivering the gas is performed after the liquid is delivered to the reaction region.

7. The method of any one of claims 1-6, wherein delivering the gas comprises entraining the gas in the liquid, injecting the gas into the liquid, bubbling the gas into the liquid, or a combination of these.

8. The method of any one of claims 1-7, wherein the gas is delivered directly into the reaction region during the step of delivering the gas.

9. The method of any one of claims 1-8, wherein the step of inducing the chemical reaction comprises inducing a shear force in the liquid.

10. The method of any one of claims 1-9, wherein:

the reactor is a cavitation reactor;

the reaction zone is a cavitation zone of the cavitation reactor; and

the method comprises forming cavitation bubbles in the liquid within the cavitation region of the cavitation reactor.

11. The method of claim 10, wherein during the step of delivering the gas, the gas is delivered directly into or within 1 mm of a cavitation bubble-nucleation region, the cavitation bubble-nucleation region corresponding to nucleation of the cavitation bubbles in the hydrodynamic cavitation reaction during the step of forming.

12. The method of claim 10, the forming step comprising forming a cavitation cloud comprising the cavitation bubbles in the cavitation region of the reactor, wherein the gas is delivered directly inside or within 1 mm of the cavitation cloud.

13. The method of claim 10, the forming step comprising forming a cavitation cloud comprising the cavitation bubbles; wherein the carbon material is formed within the cavitation cloud.

14. The method of any one of claims 1-13, wherein the gaseous organic compound is selected from the group consisting of alkane, alkene, alkyne, cycloalkane, heterocycyloalkane, arene, heteroarene, and a combination thereof, wherein the alkane, alkene, alkyne, cycloalkane, heterocycloalkane, arene, or heteroarene can be optionally substituted with one or more substituents.

15. The method of any one of claims 1-14, wherein the at least one gaseous organic compound is selected from the group consisting of methane, acetylene, ethylene, propane, 1,3-butadiene, butane, and any combination thereof.

16. The method of any one of claims 1-15, the at least one liquid organic compound being selected from the group consisting of methanol, ethanol, isopropyl alcohol, methylpyrrolidone, d-cyclopentadiene, hexane, benzene, toluene, heptane, xylene, dimethyl sulfoxide, mineral oil, motor oil, base oil, hydrogenated castor oil, transmission oil, gear oil, vegetable oil, hydrocarbon base oil, additized oil, non-additized oil, kerosene, diesel fuel, ethylene glycol, propylene glycol, diethylene glycol, triethylamine, trimethylamine, pentane, cyclopentane, cyclohexane, 1,4-dioxane, chloroform, diethyl ether, dichloromethane, tetrahydrofuran, ethyl acetate, acetone, dimethylformamide, acetonitrile, nitromethane, propylene carbonate, formic acid, butanol, propanol, acetic acid, octadecene, oleic acid, oleylamine, octane, diethylene glycol ether, 1,2-dicholorobenze, methyl acetate, tetrachloroethylene, diphenylthiourea, hexafluro-2-propanol, cinnamic acid, trimethylamine, benzenthiol, ethanethiol, ethanedithiol, 4-aminobenzenethiol, acrylic acid, carbon disulfide, 1,2-dichlorobenzene, N-methyl-2-pyrrolidone, and any combination thereof.

17. The method of any one of claims 1-16, wherein the liquid comprises water.

18. The method of any one of claims 1-17, wherein the solid carbon material comprises graphite**,** expanded graphite, a graphite-like material, graphene, a graphene-like material, carbon platelets, carbon nanotubes, carbon onions, other carbon allotrope, a composite comprising graphene, cationic graphene, or any combination thereof.

19. The method of any one of claims 1-18, the carbon material comprising graphene or a graphene-like material.

20. The method of any one of claims 1-19, further comprising functionalizing the solid carbon material to provide a functionalized solid carbon material.

21. The method of any one of claims 1-19, wherein the dispersion is a first dispersion, the chemical reaction is a first chemical reaction, the solid carbon material is a precursor material, the gas is a first gas, and the reactor is a first reactor; the method further comprising:

delivering the first dispersion into a second reactor;

delivering a second gas comprising at least one gaseous organic compound directly into a reaction region of the second reactor; and

inducing a second chemical reaction in the reaction region of the second reactor; wherein:

the second chemical reaction converts the precursor material into a second solid carbon material;

the second carbon material is dispersed in the liquid; and

the precursor material and the second carbon material are different.

22. The method of claim 21, wherein the second reactor is a cavitation reactor and the step of inducing comprises forming cavitation bubbles in the first dispersion within the reaction region of the second reactor.

23. The method of claim 21, wherein the first reactor and the second reactor are the same.