CLAIMS

1. A method of semiconductor processing, comprising:

delivering a carbon-containing precursor and a hydrogen-containing precursor to a processing region of a semiconductor processing chamber, wherein a flowrate ratio of the hydrogen-containing precursor to the carbon-containing precursor is maintained greater than or equal to 2:1;

generating a plasma of the carbon-containing precursor and the hydrogen-containing precursor within the processing region of the semiconductor processing chamber;

forming a layer of graphene on a substrate positioned within the processing region of the semiconductor processing chamber, wherein the substrate is maintained at a temperature less than or equal to 600° C; and

halting flow of the carbon-containing precursor while maintaining the plasma with the hydrogen-containing precursor.

2. The method of semiconductor processing of claim 1, wherein the plasma comprises a capacitively-coupled plasma.

3. The method of semiconductor processing of claim 2, wherein a processing chamber pressure is maintained greater than or equal to 3 Torr.

4. The method of semiconductor processing of claim 1, further comprising:

subsequent to a period of time after halting flow of the carbon-containing precursor, re-starting flow of the carbon-containing precursor; and

forming an additional layer of graphene on the substrate.

5. The method of semiconductor processing of claim 1, wherein the substrate comprises a metal or a dielectric material.

6. The method of semiconductor processing of claim 1, wherein a plasma power is maintained less than or equal to 1000 W during generation of the plasma.

7. The method of semiconductor processing of claim 1, further comprising:

subsequent to halting flow of the carbon-containing precursor, etching the layer of graphene formed on the substrate with plasma effluents of the hydrogen-containing precursor.

8. The method of semiconductor processing of claim 1, wherein the carbon-containing precursor comprises a hydrocarbon.

9. The method of semiconductor processing of claim 1, wherein the hydrogen-containing precursor comprises diatomic hydrogen.

10. A method of semiconductor processing, comprising:

delivering a carbon-containing precursor and a hydrogen-containing precursor to a processing region of a semiconductor processing chamber, wherein a flowrate ratio of the hydrogen-containing precursor to the carbon-containing precursor is maintained greater than or about 2:1; and

forming a layer of graphene on a substrate characterized by a diameter of 200 mm or 300 mm positioned within the processing region of the semiconductor processing chamber, wherein the substrate is maintained at a temperature below or about 600 °C.

11. The method of semiconductor processing of claim 10, wherein the processing region is maintained plasma free while forming the layer of graphene on the substrate.

12. The method of semiconductor processing of claim 10, wherein the substrate comprises cobalt.

13. The method of semiconductor processing of claim 10, wherein a flowrate of the carbon-containing precursor is maintained below or about 100 sccm.

14. The method of semiconductor processing of claim 10, wherein a pressure within the processing region of the semiconductor processing chamber is maintained below or about 10 Torr.

15. The method of semiconductor processing of claim 10, wherein the carbon-containing precursor comprises a hydrocarbon.

16. A method of semiconductor processing, comprising:

delivering a carbon-containing precursor and a hydrogen-containing precursor to a processing region of a semiconductor processing chamber, wherein a flowrate ratio of the carbon-containing precursor to the hydrogen-containing precursor is maintained greater than

or about 1:1, and wherein a flowrate of the carbon-containing precursor is maintained greater than or about 500 sccm; and

forming a layer of graphene on a substrate positioned within the processing region of the semiconductor processing chamber, wherein processing region is maintained plasma free while forming the layer of graphene on the substrate.

17. The method of semiconductor processing of claim 16, wherein the substrate is maintained at a temperature below or about 600° C.

18. The method of semiconductor processing of claim 16, wherein the substrate comprises a metal or dielectric material.

19. The method of semiconductor processing of claim 16, wherein the carbon-containing precursor comprises a hydrocarbon.

20. The method of semiconductor processing of claim 16, wherein the carbon-containing precursor comprises ethane, ethene, propane, propene, or acetylene.