CLAIMS

1. A semiconductor processing method comprising:

providing a boron-containing precursor to a processing region of a semiconductor processing chamber, wherein a substrate is disposed within the processing region of the semiconductor processing chamber;

providing a carbon-containing precursor to the processing region of the semiconductor processing chamber, wherein the carbon-containing precursor is characterized by a carbon-carbon double bond or a carbon-carbon triple bond, and wherein the carbon-containing precursor is characterized by a carbon-to-hydrogen ratio of greater than or equal to 1:3;

thermally reacting the boron-containing precursor and the carbon-containing precursor at a temperature below 650 °C; and

forming a boron-and-carbon-containing layer on the substrate.

2. The semiconductor processing method of claim 1, wherein the processing region of the semiconductor processing chamber is maintained plasma-free while forming the boron-and-carbon-containing layer on the substrate.

3. The semiconductor processing method of claim 1, wherein the boron-and-carbon-containing layer consists essentially of boron, carbon, and hydrogen.

4. The semiconductor processing method of claim 1, wherein the substrate is characterized by one or more features, and wherein the boron-and-carbon-containing layer is formed about the one or more features with a conformality of greater than or equal to 95%.

5. The semiconductor processing method of claim 1, wherein thermally reacting the boron-containing precursor and the carbon-containing precursor is performed at a temperature below or equal to 500 °C.

6. The semiconductor processing method of claim 1, wherein the boron-and-carbon-containing layer is characterized by a boron concentration of greater than

or equal to 40%, and wherein the boron-and-carbon-containing layer is characterized by a root-mean-square roughness of less than or equal to 1.8 nm.

7. The semiconductor processing method of claim 6, wherein the boron-and-carbon-containing layer is characterized by a Young's modulus of greater than or equal to 80 GPa.

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

forming a plasma of a hydrogen-containing or oxygen-containing precursor within the processing region of the semiconductor processing chamber; and

removing the boron-and-carbon-containing layer from the substrate.

9. The semiconductor processing method of claim 8, wherein the plasma is maintained halogen-free while removing the boron-and-carbon-containing layer from the substrate.

10. A semiconductor processing method comprising:

providing a boron-containing precursor to a processing region of a semiconductor processing chamber, wherein a substrate is disposed within the processing region of the semiconductor processing chamber;

providing a hydrocarbon to the processing region of the semiconductor processing chamber, wherein the hydrocarbon is characterized by a carbon-carbon double bond or a carbon-carbon triple bond, and wherein the hydrocarbon is characterized by a carbon-to-hydrogen ratio of greater than or equal to 1:3;

thermally reacting the boron-containing precursor and the hydrocarbon at a temperature between 75 °C and 500 °C; and

forming a boron-and-carbon-containing layer on the substrate,

wherein the processing region of the semiconductor processing chamber is maintained plasma-free during the semiconductor processing method.

11. The semiconductor processing method of claim 10, wherein the boron-and-carbon-containing layer is characterized by a carbon concentration of greater than or equal to 40%.

12. The semiconductor processing method of claim 11, further comprising:

exposing the boron-and-carbon-containing layer to a wet etchant comprising hydroxide; and

removing the boron-and-carbon-containing layer from the substrate.

13. The semiconductor processing method of claim 10, wherein the boron-and-carbon-containing layer is characterized by an extinction coefficient of greater than or equal to 0.01 at 633 nm.

14. The semiconductor processing method of claim 10, wherein the boron-and-carbon-containing layer is characterized by a hydrogen incorporation of less than or equal to 50%.

15. The semiconductor processing method of claim 10, wherein the substrate is characterized by one or more features, and wherein the boron-and-carbon-containing layer is formed about the one or more features with a conformality of greater than or equal to 95%.

16. A semiconductor processing method comprising:

providing a boron-and-hydrogen-containing precursor to a processing region of a semiconductor processing chamber, wherein a substrate is disposed within the processing region of the semiconductor processing chamber;

providing a carbon-containing precursor to the processing region of the semiconductor processing chamber, wherein the carbon-containing precursor is characterized by a carbon-carbon double bond or a carbon-carbon triple bond, and wherein the carbon-containing precursor is characterized by a carbon-to-hydrogen ratio of greater than or equal to 1:3;

thermally reacting the boron-and-hydrogen-containing precursor and the carbon-containing precursor at a temperature below 600 °C; and

forming a boron-and-carbon-containing layer on the substrate, wherein the boron-and-carbon-containing layer consists essentially of boron, carbon, and hydrogen.

17. The semiconductor processing method of claim 16, wherein the processing region of the semiconductor processing chamber is maintained plasma-free while forming the boron-and-carbon-containing layer on the substrate.

18. The semiconductor processing method of claim 16, wherein the boron-and-carbon-containing layer is characterized by a thickness conformality of greater than or equal to 95%.