

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
5 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;
thermally reacting the boron-containing precursor and the carbon-containing
10 precursor at a temperature below about 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.
- 15 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 about 95%.
- 20 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 about 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 about 40%,
25 and wherein the boron-and-carbon-containing layer is characterized by a root-mean-square roughness of less than or about 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 about 80 Gpa.

8. The semiconductor processing method of claim 1, further comprising:
forming a plasma of a hydrogen-containing or oxygen-containing precursor
5 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. The semiconductor processing method of claim 1, wherein the carbon-containing precursor is characterized by a carbon-to-hydrogen ratio of greater than or about 1:3.

11. 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
15 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;
thermally reacting the boron-containing precursor and the hydrocarbon at a
20 temperature between about 75 °C and about 500 °C; and
forming a boron-and-carbon-containing layer on the substrate.

12. The semiconductor processing method of claim 11, wherein the processing region of the semiconductor processing chamber is maintained plasma-free during the semiconductor processing method.

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

14. The semiconductor processing method of claim 13, 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.

5 15. The semiconductor processing method of claim 11, wherein the boron-
and-carbon-containing layer is characterized by an extinction coefficient of greater than or about
0.01 at 633 nm.

16. The semiconductor processing method of claim 11, wherein the boron-
and-carbon-containing layer is characterized by a hydrogen incorporation of less than or about
10 50%.

17. The semiconductor processing method of claim 11, 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 about 95%.

18. A semiconductor processing method comprising:
15 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
20 a carbon-carbon double bond or a carbon-carbon triple bond;
thermally reacting the boron-and-hydrogen-containing precursor and the carbon-
containing precursor at a temperature below about 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.

25 19. The semiconductor processing method of claim 18, wherein the processing
region of the semiconductor processing chamber is maintained plasma-free while forming the
boron-and-carbon-containing layer on the substrate.

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