

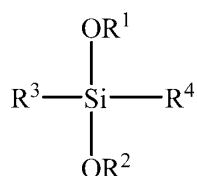
CLAIMS:

1. A method of forming a silicon-and-carbon-containing material, the method comprising:
flowing a silicon-oxygen-and-carbon-containing precursor into a processing region of a semiconductor processing chamber, wherein a substrate is housed within the processing region of the semiconductor processing chamber;
forming a plasma within the processing region of the silicon-oxygen-and-carbon-containing precursor, wherein the plasma is formed at a frequency below 15 MHz; and
depositing a silicon-and-carbon-containing material on the substrate, wherein the silicon-and-carbon-containing material as-deposited is characterized by a dielectric constant below or about 3.5.
2. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the method further comprises flowing oxygen (O₂) gas into the processing region of the semiconductor processing chamber.
3. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the silicon-and-carbon-containing material as-deposited is characterized by a hardness of greater than or about 3 Gpa.
4. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the plasma is formed at a frequency of about 13.56 MHz.
5. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the silicon-and-carbon-containing material as-deposited is characterized by a dielectric constant ranging from about 3.1 to about 3.3.
6. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the silicon-and-carbon-containing material as-deposited is characterized by a hardness of greater than or about 5 Gpa.
7. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the silicon-and-carbon-containing material as-deposited is characterized by a Young's modulus of greater than or about 5 Gpa.

8. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the silicon-and-carbon-containing material as-deposited is characterized by a methyl incorporation less than or about 2.5%.

9. The method of forming a silicon-and-carbon-containing material of claim 1, wherein the silicon-and-carbon-containing material as-deposited is characterized by a Si-C-Si bond incorporation less than or about 0.5%.

10. A method of forming a silicon-and-carbon-containing material, the method comprising: providing a deposition precursor into a processing region of a semiconductor processing chamber, wherein a substrate is housed within the processing region of the semiconductor processing chamber, and wherein the deposition precursor is characterized by Formula 1:



wherein R¹ may include a C₁-C₆ alkyl group, such as -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, -CH₂CH₂CH₂CH₃, -CH₂CH₂CH₂CH₂CH₃, or -CH₂CH₂CH₂CH₂CH₂CH₃,

R² may include a C₁-C₆ alkyl group, such as -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, -CH₂CH₂CH₂CH₃, -CH₂CH₂CH₂CH₂CH₃, or -CH₂CH₂CH₂CH₂CH₂CH₃,

R³ may include -OCH₃, -CH₃, -H, -(CH₂)_nCH₃, -O(CH₂)_nCH₃, -CH=CH₂, -CH₂-CH₂-(CH₂CH₃)₂, or -CH₂-CH(CH₃)₂, and

R⁴ may include -OCH₃, -CH₃, -H, -(CH₂)_nCH₃, -O(CH₂)_nCH₃, -CH=CH₂, -CH₂-CH₂-(CH₂CH₃)₂, or -CH₂-CH(CH₃)₂;

forming a plasma within the processing region of the deposition precursor, wherein the plasma is formed at a frequency less than 15 MHz; and

depositing a silicon-and-carbon-containing material on the substrate, wherein the silicon-and-carbon-containing material as-deposited is characterized by a dielectric constant below or about 3.5.

11. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the method further comprises providing oxygen (O₂) gas into the processing region of the semiconductor processing chamber with the deposition precursor.
12. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the deposition precursor is characterized by ratio of oxygen to silicon of greater than or about 2.
13. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the silicon-and-carbon-containing material as-deposited is characterized by a dielectric constant ranging from about 3.1 to about 3.3.
14. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the silicon-and-carbon-containing material as-deposited is characterized by a hardness of greater than or about 3 Gpa.
15. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the silicon-and-carbon-containing material as-deposited is characterized by a Young's modulus of greater than or about 5 Gpa.
16. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the silicon-and-carbon-containing material as-deposited is characterized by a methyl incorporation less than or about 2.5%.
17. The method of forming a silicon-and-carbon-containing material of claim 10, wherein the silicon-and-carbon-containing material as-deposited is characterized by a Si-C-Si bond incorporation less than or about 0.5%.
18. A method of forming a silicon-and-carbon-containing material, the method comprising:
flowing a silicon-oxygen-and-carbon-containing precursor into a processing region of a semiconductor processing chamber, wherein a substrate is housed within the processing region of the semiconductor processing chamber;
forming a plasma within the processing region of the silicon-oxygen-and-carbon-containing precursor, wherein the plasma is formed at a frequency less of about 13.56 MHz; and

depositing a silicon-and-carbon-containing material on the substrate, wherein the silicon-and-carbon-containing material as-deposited is characterized by a dielectric constant below or about 3.5 and a hardness of greater than about 3 Gpa.

19. The method of forming a silicon-and-carbon-containing material of claim 18, wherein the silicon-and-carbon-containing material as-deposited is characterized by a Young's modulus of greater than or about 5 Gpa.

20. The method of forming a silicon-and-carbon-containing material of claim 18, wherein the silicon-and-carbon-containing material as-deposited is characterized by a Si-C-Si bond incorporation less than or about 0.5%.