CLAIMS

1. A chemical vapor deposition method for producing a dielectric film, the method comprising:

introducing gaseous reagents into a reaction chamber having a substrate provided therein, wherein the gaseous reagents comprise a silicon precursor comprising at least one silicon compound selected from the group consisting of 2,2,5,5-tetramethyl-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-ethoxy-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-methoxy-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-iso-propoxy-1-oxa-2-silacyclopentane, 2,2,6,6-tetramethyl-1-oxa-2-silacyclohexane, 2-methyl-2-ethoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-ethoxy-1-oxa-2-silacyclohexane, 2-methyl-2-methoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-methoxy-1-oxa-2-silacyclohexane, 2-methyl-2-n-propoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-n-propoxy-1-oxa-2-silacyclohexane, 2-methyl-2-iso-propoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-iso-propoxy-1-oxa-2-silacyclohexane, 2,5,5-trimethyl-2-iso-propyl-1-oxa-2-silacyclopentane, 2-methyl-2-iso-propyl-1-oxa-2-silacyclopentane, 2-methyl-2-iso-propyl-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-iso-propyl-1-oxa-2-silacyclohexane, and combinations thereof; and

applying energy to the gaseous reagents in the reaction chamber to induce reaction of the gaseous reagents to deposit a film on the substrate.

2. The method of claim 1 wherein the silicon precursor further comprises a hardening additive.

3. The method of claim 2 wherein the hardening additive comprises tetraethoxysilane.

4. The method of claim 2 wherein the hardening additive comprises tetramethoxysilane.

5. The method of claim 1 which is a plasma enhanced chemical vapor deposition method.

6. The method of claim 1 wherein the gaseous reagents further comprise at least one oxygen source selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, CO, water, H_2O_2, ozone, and combinations thereof.

7. The method of claim 1 wherein the reaction chamber in the applying step comprises at least one gas selected from the group consisting of He, Ar, N_2, Kr, Xe, NH_3, H_2, CO_2, and CO.

8. The method of claim 1 further comprising the step of applying additional energy to the film.

9. The method of claim 8 wherein the additional energy is at least one selected from the group consisting of a thermal treatment, an ultraviolet (UV) treatment, an electron beam treatment, and a gamma radiation treatment.

10. The method of claim 9 wherein the UV treatment occurs during at least a portion of the thermal treatment.

11. The method of claim 1 wherein the gaseous reagents further comprise a porogen precursor; and

wherein the step of applying energy to the gaseous reagents to deposit a film includes co-depositing a sacrificial porogen on the substrate.

12. A composition for use in a deposition process to produce a dielectric film, the composition comprising at least one silicon compound selected from the group consisting of 2,2,5,5-tetramethyl-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-ethoxy-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-methoxy-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-iso-propoxy-1-oxa-2-silacyclopentane, 2,2,6,6-tetramethyl-1-oxa-2-silacyclohexane, 2-methyl-2-ethoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-ethoxy-1-oxa-2-silacyclohexane, 2-methyl-2-methoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-methoxy-1-oxa-2-silacyclohexane, 2-methyl-2-n-propoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-n-propoxy-1-oxa-2-silacyclohexane, 2-methyl-2-iso-propoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-iso-propoxy-1-oxa-2-silacyclohexane, 2,5,5-trimethyl-2-iso-propyl-1-oxa-2-silacyclopentane, 2-methyl-2-iso-propyl-1-oxa-2-silacyclopentane, 2-methyl-2-iso-propyl-1-oxa-2-

silacyclohexane, 2,6,6-trimethyl-2-iso-propyl-1-oxa-2-silacyclohexane, and combinations thereof; and at least one of the following:

a hardening additive;

at least one oxygen source selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, CO, water, H_2O_2, ozone, and combinations thereof;

at least one gas selected from the group consisting of He, Ar, N_2, Kr, Xe, NH_3, H_2, CO_2, and CO; or

a porogen precursor.

13. A composition for a vapor deposition of a dielectric film comprising at least one silicon compound selected from the group consisting of 2,2,5,5-tetramethyl-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-ethoxy-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-methoxy-1-oxa-2-silacyclopentane, 2,5,5-trimethyl-2-iso-propoxy-1-oxa-2-silacyclopentane, 2,2,6,6-tetramethyl-1-oxa-2-silacyclohexane, 2-methyl-2-ethoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-ethoxy-1-oxa-2-silacyclohexane, 2-methyl-2-methoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-methoxy-1-oxa-2-silacyclohexane, 2-methyl-2-n-propoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-n-propoxy-1-oxa-2-silacyclohexane, 2-methyl-2-iso-propoxy-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-iso-propoxy-1-oxa-2-silacyclohexane, 2,5,5-trimethyl-2-iso-propyl-1-oxa-2-silacyclopentane, 2-methyl-2-iso-propyl-1-oxa-2-silacyclopentane, 2-methyl-2-iso-propyl-1-oxa-2-silacyclohexane, 2,6,6-trimethyl-2-iso-propyl-1-oxa-2-silacyclohexane, and combinations thereof; and at least one of the following:

a hardening additive;

at least one oxygen source selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, CO, water, H_2O_2, ozone, and combinations thereof;

at least one gas selected from the group consisting of He, Ar, N_2, Kr, Xe, NH_3, H_2, CO_2, and CO; or

a porogen precursor,

and wherein the composition is substantially free of at least one impurity selected from the group consisting of halides, organosilane impurities, and water.

14. The composition of claim 13, wherein the halides comprise chloride ions.

15. The composition of claim 14, wherein the chloride ions, if present, are present at a concentration of 50 ppm or less.

16. The composition of claim 14, wherein the chloride ions, if present, are present at a concentration of 10 ppm or less.

17. The composition of claim 14, wherein the chloride ions, if present, are present at a concentration of 5 ppm or less.

18. The composition of claim 14, wherein the composition has 0 ppm of chloride ion.

19. The composition of claim 13, wherein the sum of all organosilane impurities based on GC is 1.0 wt. % or less.

20. The composition of claim 13, wherein the sum of all organosilane impurities based on GC is 0.5 wt. % or less.

21. The composition of claim 13 or claim 14, wherein the composition comprises the hardening addictive and the hardening additive comprises tetraethoxysilane.

22. The composition of claim 13 or claim 14, wherein the composition comprises the hardening addictive and the hardening additive comprises tetramethoxysilane.