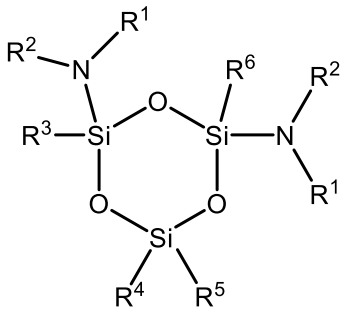
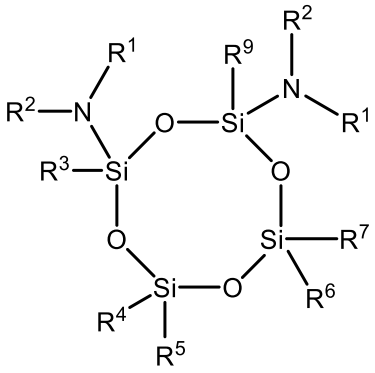
CLAIMS

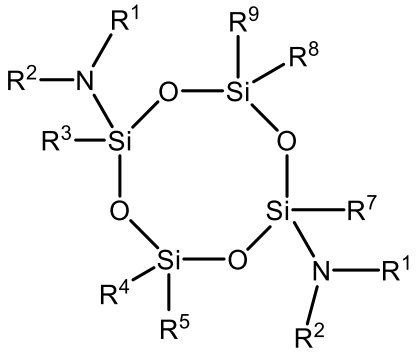
1. A composition comprising at least one organoamino-functionalized cyclic oligosiloxane compound selected from the group consisting of Formulae A-D:



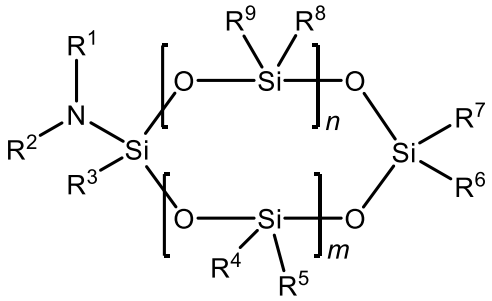
A



B



C



D

wherein R^1 is selected from the group consisting of a linear C_1 to C_{10} alkyl group, a branched C_3 to C_{10} alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_3 to C_{10} heterocyclic group, a C_3 to C_{10} alkenyl group, a C_3 to C_{10} alkynyl group, and a C_4 to C_{10} aryl group; R^2 is selected from the group consisting of hydrogen, a C_1 to C_{10} linear alkyl group, a branched C_3 to C_{10} alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_3 to C_{10} heterocyclic group, a C_3 to C_{10} alkenyl group, a C_3 to C_{10} alkynyl group, and a C_4 to C_{10} aryl group, wherein R^1 and R^2 are either linked to form a cyclic ring structure or are not linked to form a cyclic ring structure; R^{3-9} are each independently selected from the group consisting of hydrogen, a linear C_1 to C_{10} alkyl group, a branched C_3 to C_{10} alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_{10} alkenyl group, a C_2 to C_{10} alkynyl group, a C_4 to

C_{10} aryl group, and an organoamino group, NR^1R^2, wherein R^1 and R^2 are defined above; n = 1, 2, or 3, and m = 2 or 3.

2. The composition of claim 1 further comprising at least one selected from the group consisting of a solvent and a purge gas.

3. The composition of claim 1 wherein each of R^{3-9} is independently selected from the group consisting of hydrogen and a C_1 to C_4 alkyl group.

4. The composition of claim 1, wherein R^1 is selected from the group consisting of a C_3 to C_{10} cyclic alkyl group and a C_4 to C_{10} aryl group.

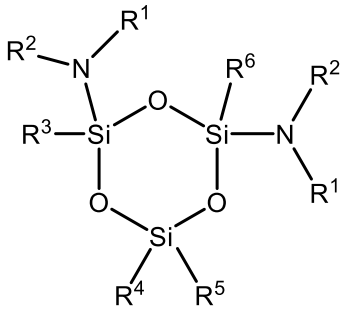
5. The composition of claim 1, wherein the composition is substantially free of one or more impurities selected from the group consisting of a halide, metal ions, metal, and combinations thereof.

6. The composition of claim 1, wherein the organoamino-functionalized cyclic oligosiloxane compound is selected from the group consisting of: 2,4-bis(dimethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(dimethylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(dimethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(dimethylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(dimethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(dimethylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-dimethylamino-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-dimethylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(methylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(methylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(methylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(methylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(methylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(methylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-methylamino-2,4,6,8,10-pentamethylcyclopentasiloxane 2-methylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(iso-propylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(iso-propylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(iso-propylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(iso-propylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(iso-propylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(iso-propylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-iso-propylamino-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-iso-propylamino-2,4,4,6,6,8,8,10,10-

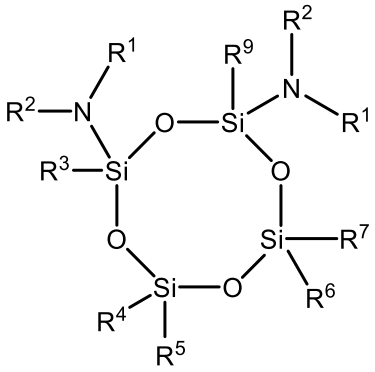
nonamethylcyclopentasiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(N-ethylmethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(N-ethylmethylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-(N-ethylmethylamino)-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-(N-ethylmethylamino)-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(diethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(diethylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(diethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(diethylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(diethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(diethylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-diethylamino-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-diethylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4,6-tris(dimethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4,6,8-tetrakis(dimethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4,6-tris(methylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4,6,8-tetrakis(methylamino)-2,4,6,8-tetramethylcyclotetrasiloxane.

7. A method for depositing a film comprising silicon and oxygen onto a substrate, the method comprising the steps of:

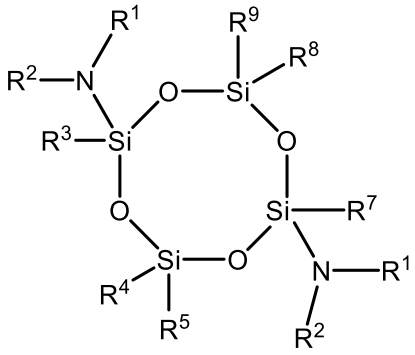
a) providing a substrate in a reactor;
b) introducing into the reactor at least one silicon precursor compound selected from the group consisting of Formulae A-D



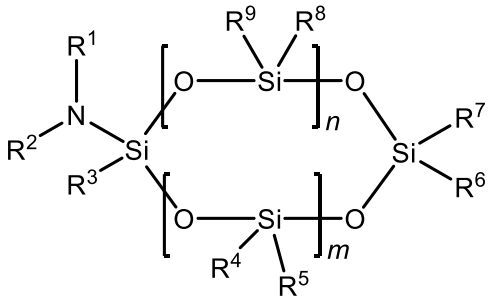
A



B



C



D

wherein R^1 is selected from the group consisting of a linear C_1 to C_{10} alkyl group, a branched C_3 to C_{10} alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_3 to C_{10} heterocyclic group, a C_3 to C_{10} alkenyl group, a C_3 to C_{10} alkynyl group, and a C_4 to C_{10} aryl group; R^2 is selected from the group consisting of hydrogen, a C_1 to C_{10} linear alkyl group, a branched C_3 to C_{10} alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_3 to C_{10} heterocyclic group, a C_3 to C_{10} alkenyl group, a C_3 to C_{10} alkynyl group, and a C_4 to C_{10} aryl group, wherein R^1 and R^2 are either linked to form a cyclic ring structure or are not linked to form a cyclic ring structure; R^{3-9} are each independently selected from the group consisting of hydrogen, a linear C_1 to C_{10} alkyl group, a branched C_3 to C_{10} alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_{10} alkenyl group, a C_2 to C_{10} alkynyl group, a C_4 to C_{10} aryl group, and an organoamino group, NR^1R^2, wherein R^1 and R^2 are defined above; n = 1, 2, or 3, and m = 2 or 3;

c) purging the reactor with a purge gas;

d) introducing at least one of an oxygen-containing source and a nitrogen-containing source into the reactor; and

e) purging the reactor with the purge gas,

wherein the steps b through e are repeated until a desired thickness of film is deposited; and wherein the method is conducted at one or more temperatures ranging from 25 °C to 600 °C.

8. The method of claim 7 wherein each of R^{3-9} is independently selected from the group consisting of hydrogen and a C_1 to C_4 alkyl group.

9. The method of claim 7, wherein R^1 is selected from the group consisting of a C_3 to C_{10} cyclic alkyl group and a C_4 to C_{10} aryl group.

10. The method of claim 7, wherein the at least one silicon precursor compound is selected from the group consisting of 2,4-bis(dimethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(dimethylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(dimethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(dimethylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(dimethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(dimethylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-dimethylamino-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-dimethylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(methylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(methylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(methylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(methylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(methylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(methylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-methylamino-2,4,6,8,10-pentamethylcyclopentasiloxane 2-methylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(iso-propylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(iso-propylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(iso-propylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(iso-propylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(iso-propylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(iso-propylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-iso-propylamino-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-iso-propylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(N-ethylmethylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(N-ethylmethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(N-ethylmethylamino)-2,4,4,6,8,8-

hexamethylcyclotetrasiloxane, 2-(N-ethylmethylamino)-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-(N-ethylmethylamino)-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4-bis(diethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4-bis(diethylamino)-2,4,6,6-tetramethylcyclotrisiloxane, 2,4-bis(diethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4-bis(diethylamino)-2,4,6,6,8,8-hexamethylcyclotetrasiloxane, 2,6-bis(diethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,6-bis(diethylamino)-2,4,4,6,8,8-hexamethylcyclotetrasiloxane, 2-diethylamino-2,4,6,8,10-pentamethylcyclopentasiloxane, 2-diethylamino-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane, 2,4,6-tris(dimethylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4,6,8-tetrakis(dimethylamino)-2,4,6,8-tetramethylcyclotetrasiloxane, 2,4,6-tris(methylamino)-2,4,6-trimethylcyclotrisiloxane, 2,4,6,8-tetrakis(methylamino)-2,4,6,8-tetramethylcyclotetrasiloxane.

11. A silicon and oxygen containing film comprising at least one of the following characteristics: a density of at least 2.1 g/cc; a wet etch rate that is less than 2.5 Å/s as measured in a solution of 1:100 of HF to water dilute HF (0.5 wt% dHF) acid; an electrical leakage of less than 1 e-8 A/cm^2 up to 6 MV/cm; and a hydrogen impurity of less than 5 e20 at/cc as measured by Secondary Ion Mass Spectrometry (SIMS).

12. A stainless steel container housing the composition of claim 1.

13. The stainless steel container of claim 12 further comprising an inert head-space gas selected from helium, argon, nitrogen and a combination thereof.

14. The method of claim 7 wherein the silicon precursor compound further comprising at least one selected from the group consisting of a solvent and an inert gas.