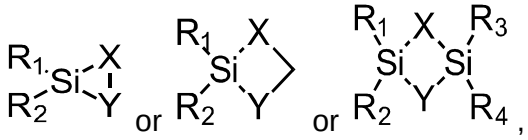
What is claimed is:

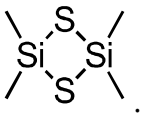
1. A method of depositing a silicon-containing material, the method comprising exposing a substrate to a cyclic silicon precursor and a reactant, the cyclic silicon precursor includes a 3- or 4-membered ring containing silicon,
wherein the cyclic silicon precursor has a general formula of:



where X and Y are independently selected from SiH_2, NH, S, or Se, wherein at least one of X or Y is S, and R_1, R_2, R_3, and R_4 are independently selected from an alkyl group.

2. The method of claim 1, wherein the silicon-containing material comprises silicon nitride.

3. The method of claim 1, wherein the cyclic silicon precursor comprises



.

4. The method of any one of claims 1 to 3, wherein the reactant is selected from the group consisting of hydrazine, alkyl hydrazine, allyl hydrazine, hydrogen (H_2), ammonia (NH_3), $R'NH_2$, R'_2NH, R'_3N, R'_2SiNH_2, $(R'_3Si)_2NH$, and $(R'_3Si)_3N$, where each R' is independently H or an alkyl group having 1-12 carbon atoms.

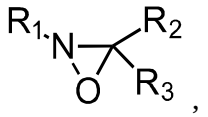
5. The method of any one of claims 1 to 4, wherein the silicon-containing material comprises silicon nitride comprising a nitrogen containing content in a range of from 1% to 40% on an atomic basis.

6. The method of claim 1, wherein the silicon-containing material comprises silicon oxide, and the reactant is selected from the group consisting of an oxaziridine and a P/S/N oxide.

7. The method of claim 6, wherein the reactant is an oxaziridine.

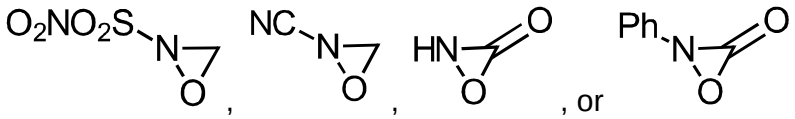
8. The method of claim 7, wherein the silicon oxide comprises greater than 98 atomic % of silicon and oxygen atoms.

9. The method of claim 7, wherein the oxaziridine comprises a compound with a general formula of:



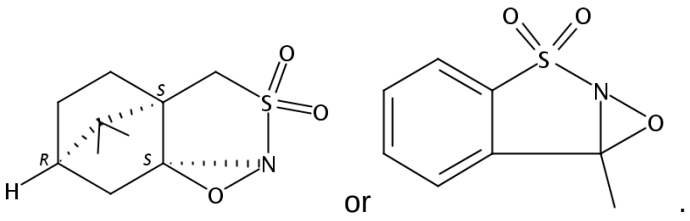
where R_1, R_2 and R_3 are independently selected from H, SO_2NO_2, CN, C1-C8 alkyl, C1-C8 perfluoroalkyl, pyridine, aryl, substituted aryl, perfluoroaryl, SO_2-NO_2 substituted aryl, or R_2 and R_3 are combined to form a carbonyl.

10. The method of claim 7, wherein the oxaziridine comprises one or more of:

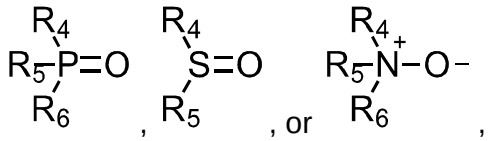


11. The method of claim 7, wherein the oxaziridine is bicyclic.

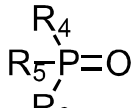
12. The method of claim 11, wherein the oxaziridine comprises one or more of:

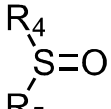


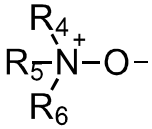
13. The method of claim 6, wherein the P/S/N oxide comprises a compound with a general formula of:



where R_4, R_5 and R_6 are independently selected from H, alkyl, or aryl, and R_4 and R_5 may join to form a three to six membered ring including at least one P, S or N heteroatom.

14. The method of claim 13, wherein  comprises one or more of H_3PO, $(CH_3)_3PO$, $(C_2H_5)_3PO$, MPPO (3-methyl-1-phenyl-2-phospholene 1-oxide), 3-methyl-1-phenyl-2-phospholene 1-oxide, neopentylene phosphite (5,5-Dimethyl-1,3,2-dioxaphosphinane 2-oxide), HASPO-1 (4,4,5,5-Tetramethyl-1,3,2-dioxaphospholane 2-oxide), 2-Methyl-4,4,5,5-tetramethyl-1,3,2-dioxaphospholan-2-one, or diphenylphosphine oxide.

15. The method of claim 13, wherein  comprises one or more of H_2SO, or MPSO (methyl phenyl sulfoxide).

16. The method of claim 13, wherein  comprises one or more of $H_3N{\rightarrow}O$, trimethylamine n-oxide, pyridine-n-oxide, TEMPO ((2,2,6,6-Tetramethylpiperidin-1-yl)oxyl), N-hydroxyphthalimide, or 4-methylmorpholine n-oxide.