CLAIMS

We claim:

1. A method for selectively passivating a surface of a substrate, wherein the surface of the substrate comprises at least a first surface comprising silicon nitride and at least a second surface comprising a material other than silicon nitride, the method comprising the steps of:

a. optionally, treating the surface with hydrogen plasma, argon plasma, or ammonia plasma; and

b. exposing the surface to at least one organic halide having a structure according to Formula I:

R-X (I),

wherein R is selected from the group consisting of a substituted or unsubstituted C_1 to C_{18} linear alkyl group, a substituted or unsubstituted branched C_3 to C_{18} alkyl group, a substituted or unsubstituted C_3 to C_8 cyclic alkyl group, a substituted or unsubstituted C_3 to C_{10} heterocyclic group, a substituted or unsubstituted C_3 to C_{18} alkenyl group, a substituted or unsubstituted C_4 to C_{18} aryl group, a substituted or unsubstituted C_5 to C_{20} arylalkyl group, and a substituted or unsubstituted C_3 to C_{10} alkynyl group, wherein X is a halide, and wherein the at least one organic halide selectively reacts with the silicon nitride to passivate the first surface thereby leaving the second surface substantially unreacted.

2. The method of claim 1, further comprising the following steps which are performed prior to steps a and b:

contacting the surface of the substrate with a wet chemical composition;

rinsing the surface with deionized water; and

drying the surface,

wherein the wet chemical composition comprises at least one selected from the group consisting of a composition comprising H_2O_2 (28 % aq.), NH_4O_4 (28-30 %), and H_2O; HF (0.01 % - 5% (aq.)); peroxide; RCA clean chemicals SC-1 and SC-2; and a mixture of H_2SO_4 / H_2O_2.

3. The method of claim 1, wherein the second surface comprises at least one selected from the group consisting of SiO_2, a metal oxide, copper, cobalt, tungsten, amorphous silicon, polysilicon, monocrystalline silicon, germanium, and amorphous hydrogenated germanium.

4. The method of claim 3, wherein the second surface comprises SiO_2.

5. The method of claim 1, wherein the at least one organic halide is a C_1 to C_{18} linear alkyl group having a structure C_nH_{2n+1}, wherein n is 1 to 18.

6. The method of claim 5, wherein the at least one organic halide is selected from the group consisting of bromomethane, iodomethane, bromoethane, iodoethane, bromopropane, iodopropane, bromobutane, iodobutane, bromopentane, iodopentane, bromohexane, iodohexane, bromoheptane, iodoheptane, bromooctane, iodooctane, bromononane, iodononane, bromodecane, iododecane, bromoundecane, iodoundecane, bromododecane, iododecane, bromotridecane, iodotridecane, bromotetradecane, iodotetradecane, bromopentadecane, iodopentadecane, bromohexadecane, iodohexadecane, bromoheptadecane, iodoheptadecane, bromooctadecane, and iodooctadecane.

7. The method of claim 1, wherein R is a branched C_3 to C_{18} alkyl group having a structure C_nH_{2n+1}, wherein n is 1 to 18.

8. The method of claim 7, wherein the at least one organic halide is selected from the group consisting of isopropyl bromide, isopropyl iodide, isobutyl bromide, isobutyl iodide, isopentyl bromide, isopentyl iodide, isohexyl bromide (1-bromo-4-methylpentane), isohexyl iodide (1-iodo-4methylpentane), isoheptyl bromide, isoheptyl iodide, isooctyl bromide, isooctyl iodide, isononyl bromide, isononyl iodide, isodecyl bromide, isodecyl iodide, isoundecyl bromide, isoundecyl iodide, isododecyl bromide, isododecyl iodide, isotridecyl bromide, isotridecyl iodide, isotetradecyl bromide,

isotetradecyl iodide, isopentadecyl bromide, isopentadecyl iodide, isohexadecyl bromide, isohexadecyl iodide, isoheptadecyl bromide, isoheptadecyl iodide, isooctadecyl bromide, and isooctadecyl iodide.

9. The method of claim 1, wherein R is a substituted or unsubstituted C_3 to C_8 cyclic alkyl group.

10. The method of claim 9, wherein the at least one organic halide is selected from the group consisting of cyclopropyl bromide, cyclopropyl iodide, cyclobutyl bromide, cyclobutyl iodide, cyclopentyl bromide, cyclopentyl iodide, cyclohexyl bromide, cyclohexyl iodide, cycloheptyl bromide, cycloheptyl iodide, cyclooctyl bromide, cyclooctyl iodide, 1-bromo1-methyl-cyclohexane, and 1-iodo-1-methyl-cyclohexane.

11. The method of claim 1, wherein R comprises a substituted or unsubstituted C_4 to C_{18} aryl group.

12. The method of claim 11, wherein the at least one organic halide is selected from the group consisting of bromobenzene, iodobenzene, benzyl bromide, and benzyl iodide.

13. The method of claim 1, wherein R is an unsubstituted C_1 to C_{18} linear alkyl group or R is a substituted or unsubstituted branched C_3 to C_{18} alkyl group.

14. The method of claim 13, wherein the at least one organic halide is selected from the group consisting of methyl bromide, methyl iodide, ethyl bromide, ethyl iodide, propyl bromide, propyl iodide, isopropyl bromide, isopropyl iodide, n-butyl bromide, n-butyl iodide, sec-butyl bromide, sec-butyl iodide, tert-butyl bromide, tert-butyl iodide, n-pentyl bromide, n-pentyl iodide, sec-pentyl bromide, sec-pentyl iodide, tert-pentyl bromide, tert-pentyl iodide, n-hexyl bromide, n-hexyl iodide, sec-hexyl bromide, sec-hexyl iodide, tert-hexyl bromide, tert-hexyl iodide, n-heptyl bromide, n-heptyl iodide, sec-heptyl bromide, sec-heptyl iodide, tert-heptyl bromide, tert-heptyl iodide, n-octyl

bromide, n-octyl iodide, sec-octyl bromide, sec-octyl iodide, tert-octyl bromide, tert-octyl iodide, n-bromononane, n-iodononane, sec- bromononane, sec- iodononane, tert-bromononane, tert-iodononane, n-bromodecane, n-iododecane, sec-bromodecane, sec-iododecane, tert-bromodecane, tert-iododecane, n-bromoundecane, n-iodoundecane, sec-bromoundecane, sec-iodoundecane, tert-bromoundecane, tert-iodoundecane, n-bromododecane, n-iododododecane, sec-bromododecane, sec-iododododecane, tert-bromododecane, tert-iododododecane, n-bromotridecane, n-iodotridecane, sec-bromotridecane, sec-iodotridecane, tert-bromotridecane, tert-iodotridecane, n-bromotetradecane, n-iodotetradecane, sec-bromotetradecane, sec-iodotetradecane, tert-bromotetradecane, tert-iodotetradecane, n-bromopentadecane, n-iodopentadecane, sec-bromopentadecane, sec-iodopentadecane, tert-bromopentadecane, tert-iodopentadecane, n-bromohexadecane, n-iodohexadecane, sec-bromohexadecane, sec-iodohexadecane, tert-bromohexadecane, tert-iodohexadecane, n-bromoheptadecane, n-iodoheptadecane, sec-bromoheptadecane, sec-iodoheptadecane, tert-bromoheptadecane, tert-iodoheptadecane, n-bromooctadecane, n-iodooctadecane, sec-bromooctadecane, sec-iodooctadecane, tert-bromooctadecane, tert-iodooctadecane, 1,1,3,3-tetramethylbutylbromide, 1,1,3,3-tetramethylbutyliodide, 1-methylheptylbromide, and 1-methylheptyliodide.

15. The method of claim 1, wherein R is a substituted or unsubstituted C_5 to C_{20} arylalkyl group.

16. The method of claim 15, wherein the at least one organic halide is benzyl bromide or benzyl iodide.

17. The method of claim 1, wherein step b. is conducted with a vapor of the at least one organic halide.

18. A method of selectively depositing a film on a surface of a substrate wherein the surface of the substrate comprises at least a first surface comprising silicon nitride and at least a second surface comprising a material other than silicon nitride, the method comprising the steps of:

a. optionally, treating the surface with hydrogen plasma or ammonia plasma;

b. exposing the surface to at least one organic halide having a structure according to Formula I:

R-X (I),

wherein, R is selected from the group consisting of a substituted or unsubstituted C_1 to C_{18} linear alkyl group, a substituted or unsubstituted branched C_2 to C_{18} alkyl group, a substituted or unsubstituted C_3 to C_8 cyclic alkyl group, a substituted or unsubstituted C_3 to C_{10} heterocyclic group, a substituted or unsubstituted C_3 to C_{18} alkenyl group, a substituted or unsubstituted C_4 to C_{18} aryl group, a substituted or unsubstituted C_5 to C_{20} arylalkyl group, and a substituted or unsubstituted C_3 to C_{10} alkynyl group, wherein the at least one organic halide selectively reacts with the silicon nitride to passivate the first surface thereby leaving the second surface substantially unreacted; and

c. exposing the surface of the substrate to one or more deposition precursors to deposit a film on the second surface selectively over the first surface.

19. The method of claim 18, further comprising the following steps which are performed prior to steps a and b and c:

contacting the surface of the substrate with a wet chemical composition;

rinsing the surface with deionized water; and

drying the surface,

wherein the wet chemical composition comprises at least one selected from the group consisting of a composition comprising H_2O_2 (28 % aq), NH_4O_4 (28-30 %), and H_2O; HF (0.01 % - 5% (aq)); peroxide; RCA clean chemicals SC-1 and SC-2; and a mixture of H_2SO_4 / H_2O_2.

20. The method of claim 18, wherein the second surface comprises at least one selected from the group consisting of SiO_2, a metal oxide, copper, cobalt, tungsten, amorphous silicon, polysilicon, monocrystalline silicon, germanium, and amorphous hydrogenated germanium.