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;

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

R-OH (I),

wherein R is selected from the group consisting of a substituted or unsubstituted C_4 to C_{18} linear alkyl group, a substituted or unsubstituted branched C_4 to C_{18} alkyl group, a substituted or unsubstituted C_4 to C_8 cyclic alkyl group, a substituted or unsubstituted C_3 to C_{10} heterocyclic group, a substituted or unsubstituted C_4 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_4 to C_{10} alkynyl group, and wherein the at least one alcohol selectively reacts with the silicon nitride to passivate the first surface thereby leaving the second surface substantially unreacted; and

c. depositing a metal film or a metal nitride film onto the substrate via atomic layer deposition.

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, carbon doped silicon oxide, 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 alcohol is a C_4 to C_{18} linear alkyl group having a structure C_nH_{2n+1}, wherein n is 4 to 18.

6. The method of claim 5, wherein the at least one alcohol is a linear C_8 to C_{18} alcohol selected from the group consisting of 1-octanol, 1-nonanol, 1-decanol, 1-undecanol, 1-dodecanol, 1-tridecanol, 1-tetradecanol, 1-pentadecanol, 1-hexadecanol, 1-heptadecanol, 1-octadecanol, 8-chloro-1-octanol, and pentadecafluoro-1-octanol.

7. The method of claim 1, wherein R is a branched C_4 to C_{18} alkyl group having a formula C_nH_{2n+1}, wherein n is 4 to 18.

8. The method of claim 7, wherein the at least one alcohol is selected from the group consisting of iso-butyl alcohol, iso-pentyl alcohol, iso-hexyl alcohol, iso-heptyl alcohol, iso-octyl alcohol, iso-nonyl alcohol, iso-decyl alcohol, iso-undecyl alcohol, iso-dodecyl alcohol, iso-tridecyl alcohol, iso-tetradecyl alcohol, iso-pentadecyl alcohol, iso-hexadecyl alcohol, iso-heptadecyl alcohol, and iso-octadecyl alcohol.

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 alcohol is selected from the group consisting of cyclopropyl alcohol, cyclobutyl alcohol, cyclopentyl alcohol, cyclohexyl alcohol, cycloheptyl alcohol, cyclooctyl alcohol, and 1-methyl cyclohexanol.

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 alcohol is selected from the group consisting of phenol, p-cresol, 4-methyphenol, 4-fluoro-phenol, 4-n-octyl-phenol, 4-n-pentyl-phenol, and 4-hexa-phenol.

13. The method of claim 1, wherein R is an unsubstituted C_8 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 alcohol is selected from the group consisting of 1-octanol, 1-nonanol, 1-decanol, 1-undecanol, 1-dodecanol, 1-tridecanol, 1-tetradecanol, 1-pentadecanol, 1-hexadecanol, 1-heptadecanol, 1-octadecanol, 8-chloro-1-octanol, pentadecafluoro-1-octanol, iso-butyl alcohol, iso-pentyl alcohol, iso-hexyl alcohol, iso-heptyl alcohol, iso-octyl alcohol, iso-nonyl alcohol, iso-decyl alcohol, iso-undecyl alcohol, iso-dodecyl alcohol, iso-tridecyl alcohol, iso-tetradecyl alcohol, iso-pentadecyl alcohol, iso-hexadecyl alcohol, iso-heptadecyl alcohol, and iso-octadecyl alcohol.

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 alcohol is benzyl alcohol.

17. 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 alcohol having a structure according to Formula I:

R-OH (I),

wherein, R is selected from the group consisting of a substituted or unsubstituted C_4 to C_{18} linear alkyl group, a substituted or unsubstituted branched C_4 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 alcohol 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 metal film on the second surface selectively over the first surface.

18. The method of claim 17, wherein the metal film comprises a metal or a metal nitride; and

wherein the metal is selected from the group consisting of Ru, Al, Ti, Ta, Mo, Co, Rh, Ir, Fe, Ru, Os, Mo, Mn, Tc, Re, Cu, Ag, Au, Ni, Pd, Pt, and combinations thereof; or

wherein the metal nitride is selected from the group consisting of tantalum nitride, titanium nitride, tungsten nitride, tungsten carbonitride, molybdenum nitride, copper silicon nitride, and combinations thereof.

19. The method of claim 1, further comprising

wherein a thickness of metal film or metal nitride film deposited on the first surface is less than a thickness of metal film or metal nitride film deposited on the second surface;

wherein the second surface comprises silicon dioxide; and

wherein a deposition selectivity of the second surface to the first surface is greater than about 0.1, more preferably greater than about 0.2, and most preferably greater than about 0.3.

20. The method of claim 1, wherein R comprises a fluorine-substituted C_4 to C_{18} linear alkyl group having a structure $C_nF_{2n+1}CH_2$-OH, wherein n is 1 to 17.

21. The method of claim 20, wherein the at least one alcohol is selected from the group consisting of $C_3F_7CH_2$-OH, $C_4F_9CH_2$-OH, $C_5F_{11}CH_2$-OH, $C_6F_{13}CH_2$-OH, $C_7F_{15}CH_2$-OH, $C_8F_{17}CH_2$-OH, and $C_9F_{19}CH_2$-OH.

22. The method of claim 1, wherein R is a chlorine-substituted C_1 to C_{18} linear alkyl group having a structure $C_nCl_{2n+1}CH_2$-OH, wherein n is 1 to 17.

23. The method of claim 22, wherein the at least one alcohol is selected from the group consisting of CCl_3CH_2-OH, $C_2Cl_5CH_2$-OH, $C_3Cl_7CH_2$-OH, $C_4Cl_9CH_2$-OH, $C_5Cl_{11}CH_2$-OH, $C_6Cl_{13}CH_2$-OH, $C_7Cl_{15}CH_2$-OH, $C_8Cl_{17}CH_2$-OH, $C_9Cl_{19}CH_2$-OH, and 8-chloro-1-octanol.

24. The method of claim 15, wherein the at least one alcohol is selected from the group consisting of phenylmethanol, 2-phenyl-1-ethanol, 3-phenyl-1-propanol, 4-phenyl-1-butanol, 5-phenyl-1-pentanol, 6-phenyl-1-hexanol, 7-phenyl-1-heptanol, 8-phenyl-1-octanol, and combinations thereof.