CLAIMS

1. A method to deposit a film comprising silicon and oxide onto a substrate comprises steps of:

   a) providing a substrate in a reactor;

   b) introducing into the reactor at least one silicon precursor comprising a compound having the following formula A:

   $$R^1_nSi(NR^2R^3)_mH_{4-m-n} \qquad A$$

   wherein R^1 is independently selected from a linear C_1 to C_6 alkyl group, a branched C_3 to C_6 alkyl group, a C_3 to C_6 cyclic alkyl group, a C_2 to C_6 alkenyl group, a C_3 to C_6 alkynyl group, a C_4 to C_{10} aryl group; wherein R^2 and R^3 are each independently selected from the group consisting of hydrogen, a C_1 to C_6 linear alkyl group, a branched C_3 to C_6 alkyl group, a C_3 to C_6 cyclic alkyl group, a C_2 to C_6 alkenyl group, a C_3 to C_6 alkynyl group, a C_4 to C_{10} aryl group, wherein R^2 and R^3 in Formula A ~~are selected from R^2 and R^3~~ are linked to form a cyclic ring structure, ~~and~~ or R^2 and R^3 are not linked to form a cyclic ring structure; n=1, 2, 3; and m=1, 2;

   c) purging the reactor with purge gas;

   d) introducing an oxygen-containing source into the reactor; and

   e) purging the reactor with purge gas; and

   wherein steps b through e are repeated until a desired thickness of film is deposited;

   wherein a density of the film is about 1.8g/cc or greater; and

   wherein the method is conducted at one or more temperatures ranging from about 25°C to 300°C.

2. The method of claim 1, wherein the compound is selected from the group consisting of dimethylaminotrimethylsilane, ~~dimethylaminotrimethylsilane,~~ di-iso-propylaminotrimethylsilane, piperidinotrimethylsilane, 2,6-dimethylpiperidinotrimethylsilane, di-sec-butylaminotrimethylsilane, iso-propyl-sec-butylaminotrimethylsilane, tert-butylaminotrimethylsilane, iso-propylaminotrimethylsilane, diethylaminodimethylsilane, dimethylaminodimethylsilane, di-iso-propylaminodimethylsilane, piperidinodimethylsilane, 2,6-dimethylpiperidinodimethylsilane, di-sec-

butylaminodimethylsilane, iso-propyl-sec-butylaminodimethylsilane, tert-butylaminodimethylsilane, Iso-propylaminodimethylsilane, tert-pentylaminodimethylaminosilane, dimethylaminomethylsilane, di-iso-propylaminomethylsilane, iso-propyl-sec-butylaminomethylsilane, 2,6-dimethylpiperidinomethylsilane, di-sec-butylaminomethylsilane, bis(dimethylamino)methylsilane, bis(diethylamino)methylsilane, bis(di-iso-propylamino)methylsilane, bis(iso-propyl-sec-butylamino)methylsilane, bis(2,6-dimethylpiperidino)methylsilane, bis(iso-propylamino)methylsilane, bis(tert-butylamino)methylsilane, bis(sec-butylamino)methylsilane, bis(tert-pentylamino)methylsilane, bis(cyclohexylamino)methylsilane, bis(iso-propylamino)dimethylsilane, bis(iso-butylamino)dimethylsilane, bis(sec-butylamino)dimethylsilane, bis(tert-butylamino)dimethylsilane, bis(tert-pentylamino)dimethylsilane, bis(cyclohexylamino)dimethylsilane, and combinations.

3. The method of claim 1, wherein the oxygen-containing source is selected from the group consisting of an ozone, an oxygen plasma, a plasma comprising oxygen and argon, a plasma comprising oxygen and helium, an ozone plasma, a water plasma, a nitrous oxide plasma, a carbon dioxide plasma, and combinations thereof.

4. The method of claim 1 wherein the oxygen-containing source comprises plasma.

5. The method of claim 4 wherein the plasma is generated in situ.

6. The method of claim 4 wherein the plasma is generated remotely.

7. The method of claim 4 wherein a density of the film is about 2.1g/cc or greater.

8. The method of claim 1 wherein the film further comprises carbon.

~~9. The method of claim 8 wherein a density of the film is about 1.8g/cc or greater.~~

~~10.~~9. The method of claim 8 wherein a carbon content of the film is 0.5 atomic weight percent (at.%) as measured by x-ray photospectroscopy or greater.

~~11.~~10. A method to deposit a film selected from a silicon oxide film- and a carbon doped silicon oxide film onto a substrate, the method comprising steps of:

a. providing the substrate in a reactor;
b. introducing into the reactor at least one silicon precursor comprising a compound having the following formula:

$$R^1_nSi(NR^2R^3)_mH_{4-m-n}$$

wherein R^1 is independently selected from a linear C_1 to C_2 alkyl group, R^2 is selected from a C_1 to C_6 linear alkyl group, a branched C_3 to C_6 alkyl group; R^3 is hydrogen; n=1 or 2; and m=2;

c. purging the reactor with a purge gas;
d. introducing an oxygen-containing source into the reactor; and
e. purging reactor with purge gas; and

wherein steps b through e are repeated until a desired thickness of film is deposited; wherein the density of the film is about 2.1g/cc or greater; and wherein the method is conducted at one or more temperatures ranging from about 25°C to about 300°C.

~~12.~~11. The method of claim ~~11~~10, wherein the at least one silicon precursor is selected from the group consisting of bis(iso-propylamino)methylsilane, bis(iso-butylamino)methylsilane, bis(sec-butylamino)methylsilane, bis(tert-butylamino)methylsilane, bis(tert-pentylamino)methylsilane, ~~bis(cyclohexylamino)methylsilane,~~ bis(iso-propylamino)dimethylsilane, bis(iso-butylamino)dimethylsilane, bis(sec-butylamino)dimethylsilane, bis(tert-butylamino)dimethylsilane, and bis(tert-pentylamino)dimethylsilane~~, and bis(cyclohexylamino)dimethylsilane~~.

~~13.~~12. The method of claim ~~11~~10, wherein the oxygen-containing source is selected from the group consisting of an ozone, an oxygen plasma, a plasma comprising oxygen and argon, a plasma comprising oxygen and helium, an

ozone plasma, a water plasma, a nitrous oxide plasma, a carbon dioxide plasma, and combinations thereof.

~~14.~~13. The method of claim ~~11~~ 10 wherein the oxygen-containing source comprises plasma.

~~15. The method of claim 14 wherein the density of the film is about 2.1g/cc or greater.~~

~~16.~~14. The method of claim ~~14~~13, wherein the plasma is generated in situ.

~~17.~~15. The method of claim ~~14~~13, wherein the plasma is generated remotely.

~~18.~~16. A composition for depositing a film selected from a silicon oxide or a carbon doped silicon oxide film using a vapor deposition process, the composition comprising: a compound having the following formula B:

$$R^1{}_nSi(NR^2H)_mH_{4-m-n} \qquad B$$

wherein R^1 is independently selected from a linear C_1 to C_2 alkyl group, R^2 is independently selected from a C_1 to C_6 linear alkyl group and a branched C_3 to C_6 alkyl group; n=1 or 2; and m=2;
wherein said film is a silicon oxide film having a density of about 2.1 g/cc or greater or a carbon doped silicon oxide film having a density of about 1.8 g/cc or greater.

~~19.~~17. The composition of claim ~~18~~16, wherein the compound is selected from the group consisting of bis(iso-propylamino)methylsilane, bis(iso-butylamino)methylsilane, bis(sec-butylamino)methylsilane, bis(tert-butylamino)methylsilane, bis(tert-pentylamino)methylsilane, ~~bis(cyclohexylamino)methylsilane,~~ bis(iso-propylamino)dimethylsilane, bis(iso-butylamino)dimethylsilane, bis(sec-butylamino)dimethylsilane, bis(tert-butylamino)dimethylsilane, bis(tert-pentylamino)dimethylsilane, ~~bis(cyclohexylamino)dimethylsilane,~~ and combinations thereof.

~~20.~~18. A silicon precursor for depositing a film comprising silicon and oxide, the silicon precursor comprising ~~at least one selected from the group consisting of~~ bis(sec-butylamino)methylsilane~~, bis(tert-butylamino)methylsilane, and bis(cyclohexylamino)methylsilane~~.