CLAIMS

1. A bisaminoalkoxysilane compound having a Formula I:

$$R^1Si(NR^2R^3)(NR^4R^5)OR^6 \quad I$$

where R^1 is selected from a hydrogen atom, a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched 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} aromatic hydrocarbon group; R^2 and R^4 are each independently selected from a hydrogen atom, a C_4 to C_{10} branched 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, and a C_4 to C_{10} aromatic hydrocarbon group; R^3 and R^5 are each independently selected from a C_4 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_{10} alkenyl group and a C_2 to C_{10} alkynyl group; R^6 is selected from a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched 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, and a C_4 to C_{10} aromatic hydrocarbon group; or wherein R^2 and R^3, R^4 and R^5, or both in Formula I can be linked together to form a ring; or wherein R^2 and R^4 in Formula I can be linked together to form a diamino group.

2. The bisaminoalkoxysilane compound of Claim 1, wherein R^1 is a methyl group; R^2 and R^4 are each hydrogen atoms; R^3 and R^5 are each selected from tert-butyl and tert-pentyl; and R^6 is selected from a C_1 to C_3 linear alkyl group and a C_3 to C_5 branched alkyl group.

3. The bisaminoalkoxysilane compound of Claim 1 wherein the compound is at least one selected from the group consisting of bis(tert-butylamino)methoxymethylsilane, bis(tert-butylamino)ethoxymethylsilane, bis(tert-butylamino)isoproxymethylsilane, bis(cis-2,6-dimethylpiperidino)methoxymethylsilane, and bis(cis-2,6-dimethylpiperidino)ethoxymethylsilane.

4. A method for forming a silicon-containing film on at least one surface of a substrate comprising:

providing the substrate in a reactor; and

forming the silicon-containing film on the at least one surface by a deposition process using at least one precursor comprising a bisaminoalkoxysilane compound having a Formula I:

$$R^1Si(NR^2R^3)(NR^4R^5)OR^6 \qquad I$$

where R^1 is selected from a hydrogen atom, a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched 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} aromatic hydrocarbon group; R^2, R^3, R^4, and R^5 are each independently selected from a hydrogen atom, a C_4 to C_{10} branched 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, and a C_4 to C_{10} aromatic hydrocarbon group; R^6 is selected from a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched 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, and a C_4 to C_{10} aromatic hydrocarbon group; or wherein R^2 and R^3, R^4 and R^5, or both in Formula I can be linked together to form a ring; or wherein R^2 and R^4 in Formula I can be linked together to form a diamino group.

5. The method of Claim 4, wherein R^1 is a methyl group; R^2 and R^4 are each hydrogen atoms; R^3 and R^5 are each selected from tert-butyl and tert-pentyl; and R^6 is selected from a C_1 to C_3 linear alkyl group and a C_3 to C_5 branched alkyl group.

6. The method of Claim 4, wherein the compound is at least one selected from the group consisting of bis(tert-butylamino)methoxymethylsilane, bis(tert-butylamino)ethoxymethylsilane, bis(tert-butylamino)isoproxymethylsilane, bis(cis-2,6-dimethylpiperidino)methoxymethylsilane, and bis(cis-2,6-dimethylpiperidino)ethoxymethylsilane.

7. The method of Claim 4, wherein R^3 and R^5 are each independently selected from a C_4 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_{10} alkenyl group and a C_2 to C_{10} alkynyl group.

8. The method of any one of Claims 4 to 7, wherein the deposition process is selected from the group consisting of cyclic chemical vapor deposition (CCVD), thermal chemical vapor deposition, plasma enhanced chemical vapor deposition (PECVD), high density PECVD, photon assisted CVD, plasma-photon assisted (PPECVD), cryogenic chemical vapor deposition, chemical assisted vapor deposition, hot-filament chemical vapor deposition, CVD of a liquid polymer precursor, low energy CVD (LECVD), and flowable chemical vapor deposition.

9. The process of any one of Claims 4 to 7, wherein the deposition process is selected from the group consisting of atomic layer deposition (ALD), plasma enhanced ALD (PEALD), and plasma enhanced cyclic CVD (PECCVD) process.

10. The process of any one of Claims 4 to 7, wherein the deposition process is flowable chemical vapor deposition (FCVD).

11. A method for depositing a silicon-containing film on at least a portion of a substrate having a surface feature in a flowable chemical vapor deposition process, the method comprising the steps of:

placing a substrate having a surface feature into a reactor wherein the reactor is maintained at one or more temperatures ranging from -20°C to about 400°C;

introducing into the reactor at least one precursor comprising a bisaminoalkoxysilane compound having a Formula I:

$$R^1Si(NR^2R^3)(NR^4R^5)OR^6 \qquad I$$

where R^1 is selected from a hydrogen atom, a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched 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} aromatic hydrocarbon group; R^2, R^3, R^4, and R^5 are each independently selected from a hydrogen atom, a C_4 to C_{10} branched 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, and a C_4 to C_{10} aromatic hydrocarbon group; R^6 is selected from a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched 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, and a C_4 to C_{10} aromatic hydrocarbon group; or wherein R^2 and R^3, R^4 and R^5, or both in Formula I can be linked together to form a ring; or wherein R^2 and R^4 in Formula I can be linked together to form a diamino group and a nitrogen source, wherein the bisaminoalkoxysilane compound reacts with the nitrogen source to form a nitride containing film on at least a portion of the surface feature;

introducing a source selected from an oxygen source, a nitrogen-containing source, or both to react with the bisaminoalkoxysilane compound on the substrate to form a flowable film on at least a portion of the surface feature;

treating the flowable film with an oxygen source at one or more temperatures ranging from about 100°C to about 1000°C to form a solid silicon and oxygen containing film on at least a portion of the surface feature.

12. The method of Claim 11, wherein R^1 is a methyl group; R^2 and R^4 are each hydrogen atoms; R^3 and R^5 are each selected from tert-butyl and tert-pentyl; and R^6 is selected from a C_1 to C_3 linear alkyl group and a C_3 to C_5 branched alkyl group.

13. The method of Claim 11, wherein the compound is at least one selected from the group consisting of bis(tert-butylamino)methoxymethylsilane, bis(tert-butylamino)ethoxymethylsilane, bis(tert-butylamino)isoproxymethylsilane, bis(cis-2,6-dimethylpiperidino)methoxymethylsilane, and bis(cis-2,6-dimethylpiperidino)ethoxymethylsilane.

14. The method of Claim 11, wherein R^3 and R^5 are each independently selected from a C_4 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_{10} alkenyl group and a C_2 to C_{10} alkynyl group.

15. The method of any one of claims 11 to 14 further comprising exposing the flowable film to ultraviolet irradiation at one or more temperatures ranging from about 100°C to about 1000°C.

16. The method of any one of claims 11 to 15 wherein the oxygen source is selected from the group consisting of water, oxygen plasma, ozone and combination thereof.

17. The method of any one of claims 11 to 16 wherein the nitrogen-containing source is selected from the group consisting of ammonia, hydrazine, monoalkylhydrazine, dialkylhydrazine, organic amines, a plasma comprising nitrogen and hydrogen, ammonia plasma, nitrogen plasma, and organic amine plasma.

18. The method of any one of claims 11 to 17 wherein the steps are repeated until the surface feature is substantially filled with the solid silicon and oxygen containing film.