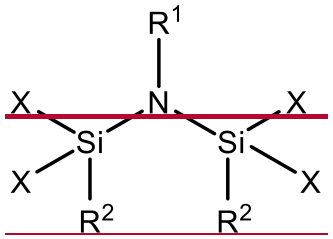
CLAIMS

1. A composition for forming a silicon-containing film, the composition comprising a silazane precursor selected from the group consisting of 1,1,1,3,3,3-hexachloro-2-methyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-sec-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-tert-butyldisilazane, 1,1,1,3,3-pentachloro-2-methyldisilazane, 1,1,1,3,3-pentachloro-2-ethyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyldisilazane, 1,1,1,3,3-pentachloro-2-methyl-3-methyl-disilazane, 1,1,1,3,3-pentachloro-2-ethyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyl-3-methyldisilazane, 1,1,1,3,3,3-hexabromo-2-methyldisilazane, 1,1,1,3,3,3-bromo-2-ethyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-iso-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-butyldisilazane, 1,1,1,3,3,3-bromo-2-sec-butyldisilazane, 1,1,1,3,3,3-bromo-2-iso-butyldisilazane, 1,1,1,3,3,3-bromo-2-tert-butyldisilazane, 1,1,1,3,3,3-hexaiodo-2-methyldisilazane, 1,1,1,3,3,3-iodo-2-ethyldisilazane, 1,1,1,3,3,3-iodo-2-n-propyldisilazane, 1,1,1,3,3,3-iodo-2-n-butyldisilazane, 1,1,1,3,3,3-iodo-2-iso-propyldisilazane, 1,1,1,3,3,3-iodo-2-iso-butyldisilazane, 1,1,1,3,3,3-iodo-2-sec-butyl-disilazane, 1,1,1,3,3,3-iodo-2-tert-butyl-disilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-sec-butyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-methyldisilazane , 1,1,3,3-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-2-n-propyldisilazane, 1,1,3,3-tetrachloro-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-2-n-butyldisilazane, 1,1,3,3-tetrachloro-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-2-sec-butyldisilazane, 1,1,3,3-tetrachloro-2-tert-butyldisilazane, 1,1,3,3-tetrabromo-2-methyldisilazane, 1,1,3,3-tetrabromo-2-ethyldisilazane, 1,1,3,3-tetrabromo-2-n-propyldisilazane, 1,1,3,3-tetrabromo-2-iso-propyldisilazane, 1,1,3,3-tetrabromo-2-n-butyldisilazane, 1,1,3,3-tetrabromo-2-iso-butyldisilazane, 1,1,3,3-tetrabromo-2-sec-butyldisilazane, 1,1,3,3-tetrabromo-2-tert-butyldisilazane, 1,1,3,3-tetraiodo-2-methyldisilazane, 1,1,3,3-tetraiodo-2-ethyldisilazane, 1,1,3,3-tetraiodo-2-n-propyldisilazane, 1,1,3,3-tetraiodo-2-iso-propyldisilazane, 1,1,3,3-

tetraiodo-2-n-butyldisilazane, 1,1,3,3-tetraiodo-2-iso-butyldisilazane, 1,1,3,3-tetraiodo-2-sec-butyldisilazane, 1,1,3,3-tetraiodo-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-2-cyclohexyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclohexyldisilazane, represented by the following Formula I below:



I

wherein R^1 is selected from the group consisting of a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_3 to C_{10} alkenyl group, a linear or branched C_3 to C_{10} alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, an electron withdrawing group, and a C_6 to C_{10} aryl group; R^2 is selected from the group consisting of hydrogen, a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_3 to C_6 alkenyl group, a linear or branched C_2 to C_6 alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, a C_6 to C_{10} aryl group, a linear or branched C_1 to C_6 fluorinated alkyl group, an electron withdrawing group, a C_4 to C_{10} aryl group, and a halide selected from the group consisting of Cl, Br, and I; and X is a halide selected from the group consisting of Cl, Br, and I, and

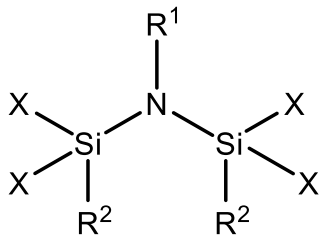
wherein the composition is free of organoamines, halide ions, metal ions.

2. The composition of claim 1 wherein the silazane precursor is selected from the group consisting of 1,1,1,3,3,3-hexachloro-2-methyldisilazane, 1,1,1,3,3,3-hexachloro-2-ethyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-butyldisilazane, 1,1,1,3,3,3-hexabromo-2-methyldisilazane, 1,1,1,3,3-pentachloro-2-methyldisilazane, 1,1,1,3,3-pentachloro-2-ethyldisilazane, 1,1,1,3,3-pentachloro-2-n-

~~propyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyldisilazane, 1,1,1,3,3-pentachloro-2-methyl-3-methyl-disilazane, 1,1,1,3,3-pentachloro-2-ethyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyl-3-methyldisilazane, 1,1,1,3,3,3-bromo-2-ethyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-butyldisilazane, 1,1,1,3,3,3-bromo-2-sec-butyldisilazane 1,1,1,3,3,3-bromo-2-iso-butyldisilazane, 1,1,1,3,3,3-bromo-2-tert-butyldisilazane, 1,1,1,3,3,3-hexaiodo-2-methyldisilazane, 1,1,1,3,3,3-iodo-2-ethyldisilazane, 1,1,1,3,3,3-iodo-2-n-propyldisilazane, 1,1,1,3,3,3-iodo-2-n-butyldisilazane, 1,1,1,3,3,3-iodo-2-iso-propyldisilazane, 1,1,1,3,3,3-iodo-2-sec-butyl-disilazane, 1,1,1,3,3,3-iodo-2-tert-butyl-disilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-methyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-sec-butyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-methyldisilazane , 1,1,3,3-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-n-propyldisilazane, 1,1,3,3-tetrachloro-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-2-n-butyldisilazane,1,3,3-tetrachloro-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-2-sec-butyldisilazane, 1,1,3,3-tetrachloro-2-tert-butyldisilazane, 1,1,3,3-tetrabromo-2-methyldisilazane, 1,1,3,3-tetrabromo-2-ethyldisilazane, 1,1,3,3-tetrabromo-n-propyldisilazane, 1,1,3,3-tetrabromo-2-iso-propyldisilazane, 1,1,3,3-tetrabromo-2-n-butyldisilazane, 1,1,3,3-tetrabromo-2-iso-butyldisilazane, 1,1,3,3-tetrabromo-2-sec-butyldisilazane, 1,1,3,3-tetrachloro-2-tert-butyldisilazane, 1,1,3,3-tetraiodo-2-methyldisilazane, 1,1,3,3-tetraiodo-2-ethyldisilazane, 1,1,3,3-tetraiodo-n-propyldisilazane, 1,1,3,3-tetraiodo-2-iso-propyldisilazane, 1,1,3,3-tetraiodo-2-n-butyldisilazane, 1,1,3,3-tetraiodo-2-iso-butyldisilazane, 1,1,3,3-tetraiodo-2-sec-butyldisilazane, 1,1,3,3-tetraiodo-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-2-cyclohexyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclopentyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclohexyldisilazane.~~

~~3~~2. A composition for forming a silicon-containing film, the composition comprising:

(a) at least one silazane represented by Formula I:



I

wherein R^1 is selected from the group consisting of a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_3 to C_{10} alkenyl group, a linear or branched C_3 to C_{10} alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, an electron withdrawing group, and a C_6 to C_{10} aryl group; R^2 is selected from the group consisting of hydrogen, a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_3 to C_6 alkenyl group, a linear or branched C_3 to C_6 alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, a C_6 to C_{10} aryl group, a linear or branched C_1 to C_6 fluorinated alkyl group, an electron withdrawing group, a C_4 to C_{10} aryl group, and a halide selected from the group consisting of Cl, Br, and I; and X is a halide selected from Cl, Br, and I; and

(b) a solvent, wherein the solvent has a boiling point, wherein the difference between the boiling point of the solvent and that of the at least one silazane is 40°C or less, and wherein the composition is substantially free of organoamines, halide ions, and metal ions

43. The composition of claim ~~3~~2 wherein the silazane precursor comprises at least one selected from the group consisting of 1,1,1,3,3,3-hexachloro-2-methyldisilazane, 1,1,1,3,3,3-hexachloro-2-ethyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane, ~~1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane,~~ 1,1,1,3,3,3-hexachloro-2-iso-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-sec-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-tert-butyldisilazane, 1,1,1,3,3-pentachloro-2-methyldisilazane, 1,1,1,3,3-pentachloro-2-ethyldisilazane, 1,1,1,3,3-pentachloro-2-n-

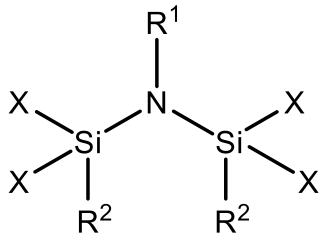
propyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyldisilazane, 1,1,1,3,3-pentachloro-2-methyl-3-methyl-disilazane, 1,1,1,3,3-pentachloro-2-ethyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyl-3-methyldisilazane, 1,1,1,3,3,3-hexabromo-2-methyldisilazane, 1,1,1,3,3,3-bromo-2-ethyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, ~~1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane,~~ 1,1,1,3,3,3-bromo-2-iso-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-butyldisilazane, 1,1,1,3,3,3-bromo-2-sec-butyldisilazane, 1,1,1,3,3,3-bromo-2-iso-butyldisilazane, 1,1,1,3,3,3-bromo-2-tert-butyldisilazane, 1,1,1,3,3,3-hexaiodo-2-methyldisilazane, 1,1,1,3,3,3-iodo-2-ethyldisilazane, 1,1,1,3,3,3-iodo-2-n-propyldisilazane, 1,1,1,3,3,3-iodo-2-n-butyldisilazane, 1,1,1,3,3,3-iodo-2-iso-propyldisilazane, 1,1,1,3,3,3-iodo-2-iso-butyldisilazane, 1,1,1,3,3,3-iodo-2-sec-butyl-disilazane, 1,1,1,3,3,3-iodo-2-tert-butyl-disilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-methyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-sec-butyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-methyldisilazane , 1,1,3,3-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-2-n-propyldisilazane, 1,1,3,3-tetrachloro-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-2-n-butyldisilazane, 1,1,3,3-tetrachloro-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-2-sec-butyldisilazane, 1,1,3,3-tetrachloro-2-tert-butyldisilazane, 1,1,3,3-tetrabromo-2-methyldisilazane, 1,1,3,3-tetrabromo-2-ethyldisilazane, 1,1,3,3-tetrabromo-2-n-propyldisilazane, 1,1,3,3-tetrabromo-2-iso-propyldisilazane, 1,1,3,3-tetrabromo-2-n-butyldisilazane, 1,1,3,3-tetrabromo-2-iso-butyldisilazane, 1,1,3,3-tetrabromo-2-sec-butyldisilazane, 1,1,3,3-tetra~~chloro~~bromo-2-tert-butyldisilazane, 1,1,3,3-tetraiodo-2-methyldisilazane, 1,1,3,3-tetraiodo-2-ethyldisilazane, 1,1,3,3-tetraiodo-2-n-propyldisilazane, 1,1,3,3-tetraiodo-2-iso-propyldisilazane, 1,1,3,3-tetraiodo-2-n-butyldisilazane, 1,1,3,3-tetraiodo-2-iso-butyldisilazane, 1,1,3,3-tetraiodo-2-sec-butyldisilazane, 1,1,3,3-tetraiodo-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-2-cyclohexyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclohexyldisilazane.

~~54~~. The composition of claim ~~32~~ wherein the solvent comprises at least one selected from the group consisting of ether, tertiary amine, alkyl hydrocarbon, aromatic hydrocarbon, and tertiary aminoether.

~~65~~. A method for forming a silicon-containing film on at least one surface of a substrate by a deposition process selected from a chemical vapor deposition process and an atomic layer deposition process, the method comprising:

providing the at least one surface of the substrate in a reaction chamber;

introducing at least one silazane precursor represented by the following Formula I below:



I

wherein R^1 is selected from the group consisting of a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_3 to C_{10} alkenyl group, a linear or branched C_3 to C_{10} alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, an electron withdrawing group, and a C_6 to C_{10} aryl group; R^2 is selected from hydrogen, a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_2 to C_6 alkenyl group, a linear or branched C_3 to C_6 alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, a C_6 to C_{10} aryl group, a linear or branched C_1 to C_6 fluorinated alkyl group, an electron withdrawing group, a C_4 to C_{10} aryl group, and a halide selected from the group consisting of Cl, Br, and I; and X is a halide selected from the group consisting of Cl, Br, and I; and

introducing a nitrogen-containing source into the reactor wherein the at least one silazane precursor and the nitrogen-containing source react to form the film on the at least one surface, wherein the silazane is substantially free of organoamines, halide ions, and metal ions.

~~7~~6. The method of claim ~~6~~5 wherein the at least one silazane is selected from the group consisting of 1,1,1,3,3,3-hexachloro-2-methyldisilazane, 1,1,1,3,3,3-hexachloro-2-ethyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane, ~~1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane,~~ 1,1,1,3,3,3-hexachloro-2-iso-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-sec-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-tert-butyldisilazane, 1,1,1,3,3-pentachloro-2-methyldisilazane, 1,1,1,3,3-pentachloro-2-ethyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyldisilazane, 1,1,1,3,3-pentachloro-2-methyl-3-methyl-disilazane, 1,1,1,3,3-pentachloro-2-ethyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyl-3-methyldisilazane, 1,1,1,3,3,3-hexabromo-2-methyldisilazane, 1,1,1,3,3,3-bromo-2-ethyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, ~~1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane,~~ 1,1,1,3,3,3-bromo-2-iso-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-butyldisilazane, 1,1,1,3,3,3-bromo-2-sec-butyldisilazane, 1,1,1,3,3,3-bromo-2-iso-butyldisilazane, 1,1,1,3,3,3-bromo-2-tert-butyldisilazane, 1,1,1,3,3,3-hexaiodo-2-methyldisilazane, 1,1,1,3,3,3-iodo-2-ethyldisilazane, 1,1,1,3,3,3-iodo-2-n-propyldisilazane, 1,1,1,3,3,3-iodo-2-n-butyldisilazane, 1,1,1,3,3,3-iodo-2-iso-propyldisilazane, 1,1,1,3,3,3-iodo-2-iso-butyldisilazane, 1,1,1,3,3,3-iodo-2-sec-butyl-disilazane, 1,1,1,3,3,3-iodo-2-tert-butyl-disilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-methyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-sec-butyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-methyldisilazane , 1,1,3,3-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-2-n-propyldisilazane, 1,1,3,3-tetrachloro-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-2-n-butyldisilazane, 1,1,3,3-tetrachloro-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-2-sec-butyldisilazane, 1,1,3,3-tetrachloro-2-tert-butyldisilazane, 1,1,3,3-tetrabromo-2-methyldisilazane, 1,1,3,3-tetrabromo-2-ethyldisilazane, 1,1,3,3-tetrabromo-2-n-propyldisilazane, 1,1,3,3-tetrabromo-2-iso-propyldisilazane, 1,1,3,3-tetrabromo-2-n-butyldisilazane, 1,1,3,3-tetrabromo-2-iso-butyldisilazane, 1,1,3,3-tetrabromo-2-sec-butyldisilazane, 1,1,3,3-tetra~~chloro~~bromo-2-tert-butyldisilazane, 1,1,3,3-tetraiodo-2-

methyldisilazane, 1,1,3,3-tetraiodo-2-ethyldisilazane, 1,1,3,3-tetraiodo-2-n-propyldisilazane, 1,1,3,3-tetraiodo-2-iso-propyldisilazane, 1,1,3,3-tetraiodo-2-n-butyldisilazane, 1,1,3,3-tetraiodo-2-iso-butyldisilazane, 1,1,3,3-tetraiodo-2-sec-butyldisilazane, 1,1,3,3-tetraiodo-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-2-cyclohexyldisilazane, 1,1,3,3-tetrachloro-1,3,-dimethyl-2-cyclopentyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclohexyldisilazane.

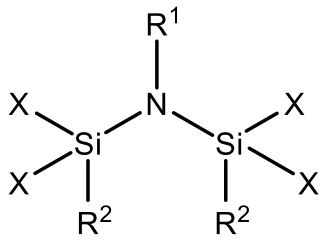
~~8~~7. The method of claim ~~6~~5 wherein the nitrogen-containing source is selected from the group consisting of ammonia, hydrazine, monoalkylhydrazine, dialkylhydrazine, nitrogen, nitrogen/hydrogen, ammonia plasma, nitrogen plasma, nitrogen/hydrogen plasma, and mixtures thereof.

~~9~~8. The method of claim ~~6~~5 wherein the silicon-containing film is selected from the group consisting of silicon nitride and silicon carbonitride.

~~10~~9. A method of forming a silicon-containing film wherein the film is selected from an amorphous and a crystalline film from a deposition process selected from by plasma enhanced atomic layer deposition and plasma enhanced cyclic chemical vapor deposition, the method comprising:

placing one or more substrates into a reactor which is heated to one or more temperatures ranging from ambient temperature to about 1000°C;

introducing at least one silazane precursor represented by the following Formula I below:



I

wherein R^1 is selected from the group consisting of a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_3 to C_{10} alkenyl group, a linear or branched C_3 to C_{10} alkynyl group, a C_3 to C_{10} cyclic alkyl group, a C_2 to C_6 dialkylamino group, an electron withdrawing group, and a C_6 to C_{10} aryl group; R^2 is selected from the group consisting of hydrogen, a linear or branched C_1 to C_{10} alkyl group, a linear or branched C_2 to C_6 alkenyl group, a linear or branched C_3 to C_6 alkynyl group, a C_3 to C_{10} cyclic alkyl group a C_2 to C_6 dialkylamino group, a C_6 to C_{10} aryl group, a linear or branched C_1 to C_6 fluorinated alkyl group, an electron withdrawing group, a C_4 to C_{10} aryl group, and a halide selected from the group consisting of Cl, Br, and I; and X is a halide selected from the group consisting of Cl, Br, and I, wherein the silazane is substantially free of organoamines, halide ions, metal ions;

purging the reactor with a purge gas;

providing a plasma source into the reactor to at least partially react with the at least one silazane precursor and deposit the silicon-containing film onto the one or more substrates; and

purging the reactor with a purge gas.

~~11~~10. The method of claim ~~6~~9 wherein the plasma source is selected from the group consisting of a plasma comprising hydrogen and argon, a plasma comprising hydrogen and helium plasma, an argon plasma, a helium plasma, and mixtures thereof.

~~12~~11. The method of claim ~~10~~9 wherein the at least one silazane is selected from the group consisting of 1,1,1,3,3,3-hexachloro-2-methyldisilazane, 1,1,1,3,3,3-hexachloro-2-ethyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-iso-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane, ~~1,1,1,3,3,3-hexachloro-2-n-propyldisilazane, 1,1,1,3,3,3-hexachloro-2-n-butyldisilazane,~~ 1,1,1,3,3,3-hexachloro-2-iso-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-sec-butyldisilazane, 1,1,1,3,3,3-hexachloro-2-tert-butyldisilazane, 1,1,1,3,3-pentachloro-2-methyldisilazane, 1,1,1,3,3-pentachloro-2-ethyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyldisilazane, 1,1,1,3,3-pentachloro-2-methyl-3-methyl-disilazane, 1,1,1,3,3-pentachloro-2-ethyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-n-propyl-3-methyldisilazane, 1,1,1,3,3-pentachloro-2-iso-propyl-3-methyldisilazane, 1,1,1,3,3,3-

hexabromo-2-methyldisilazane, 1,1,1,3,3,3-bromo-2-ethyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane, ~~1,1,1,3,3,3-bromo-2-n-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-propyldisilazane,~~ 1,1,1,3,3,3-bromo-2-iso-propyldisilazane, 1,1,1,3,3,3-bromo-2-n-butyldisilazane, 1,1,1,3,3,3-bromo-2-sec-butyldisilazane, 1,1,1,3,3,3-bromo-2-iso-butyldisilazane, 1,1,1,3,3,3-bromo-2-tert-butyldisilazane, 1,1,1,3,3,3-hexaiodo-2-methyldisilazane, 1,1,1,3,3,3-iodo-2-ethyldisilazane, 1,1,1,3,3,3-iodo-2-n-propyldisilazane, 1,1,1,3,3,3-iodo-2-n-butyldisilazane, 1,1,1,3,3,3-iodo-2-iso-propyldisilazane, 1,1,1,3,3,3-iodo-2-iso-butyldisilazane, 1,1,1,3,3,3-iodo-2-sec-butyl-disilazane, 1,1,1,3,3,3-iodo-2-tert-butyl-disilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-methyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-n-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-sec-butyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-methyldisilazane , 1,1,3,3-tetrachloro-2-ethyldisilazane, 1,1,3,3-tetrachloro-2-n-propyldisilazane, 1,1,3,3-tetrachloro-2-iso-propyldisilazane, 1,1,3,3-tetrachloro-2-n-butyldisilazane, 1,1,3,3-tetrachloro-2-iso-butyldisilazane, 1,1,3,3-tetrachloro-2-sec-butyldisilazane, 1,1,3,3-tetrachloro-2-tert-butyldisilazane, 1,1,3,3-tetrabromo-2-methyldisilazane, 1,1,3,3-tetrabromo-2-ethyldisilazane, 1,1,3,3-tetrabromo-2-n-propyldisilazane, 1,1,3,3-tetrabromo-2-iso-propyldisilazane, 1,1,3,3-tetrabromo-2-n-butyldisilazane, 1,1,3,3-tetrabromo-2-iso-butyldisilazane, 1,1,3,3-tetrabromo-2-sec-butyldisilazane, 1,1,3,3-tetra~~chloro~~bromo-2-tert-butyldisilazane, 1,1,3,3-tetraiodo-2-methyldisilazane, 1,1,3,3-tetraiodo-2-ethyldisilazane, 1,1,3,3-tetraiodo-2-n-propyldisilazane, 1,1,3,3-tetraiodo-2-iso-propyldisilazane, 1,1,3,3-tetraiodo-2-n-butyldisilazane, 1,1,3,3-tetraiodo-2-iso-butyldisilazane, 1,1,3,3-tetraiodo-2-sec-butyldisilazane, 1,1,3,3-tetraiodo-2-tert-butyldisilazane, 1,1,3,3-tetrachloro-2-cyclopentyldisilazane, 1,1,3,3-tetrachloro-2-cyclohexyldisilazane, 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclopentyldisilazane, and 1,1,3,3-tetrachloro-1,3-dimethyl-2-cyclohexyldisilazane.