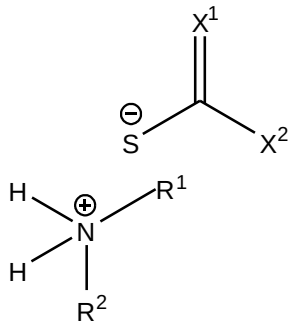
CLAIMS

1. A method of forming a metal-containing film, the method comprising:

forming a blocking layer on a first substrate surface by a first deposition process, the first deposition process comprising vaporizing a compound corresponding in structure to Formula I:



(I)

wherein

R^1 and R^2 are each independently a C_1–C_{20}-alkyl, each optionally substituted with one or more of a trifluoromethyl group, a hydroxyl group, a nitrile group, an alkoxy group, and an amino group;

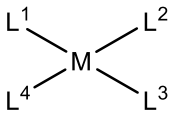
X^1 is O or S; and

X^2 is selected from the group consisting of R^3, NR^4R^5, $–SR^6$, and $–OR^7$; wherein R^3, R^4, R^5, R^6, and R^7 each independently are a C_1–C_{20}-alkyl, each optionally substituted with one or more of a trifluoromethyl group, a hydroxyl group, a nitrile group, an alkoxy group, and an amino group; and wherein at least one of R^1 and R^4 are dodecyl; and

forming the metal-containing film on a second substrate surface by a second deposition process, the second deposition process comprising vaporizing at least one metal complex;

wherein the first substrate surface comprises a metal material and the second substrate surface comprises a dielectric material or a metal oxide.

2. The method of claim 1, wherein the metal complex corresponds in structure to Formula III:



(III)

wherein M is Hf; and

L^1, L^2, L^3, and L^4 are each independently selected from the group consisting of a C_1–C_8-alkyl group, a C_1–C_8-alkoxy group, and a Cp group optionally substituted with at least one C_1–C_8-alkyl.

3 The method of claim 1 or 2, wherein the metal complex is $(MeCp)_2Hf(OMe)(Me)$.

4. The method of any one of claims 1 and 2 to 3, wherein the metal of the metal-containing film is present in an amount of less than about 15 at.% on the blocking layer.

5. The method of any one of claims 1 and 2 to 4, wherein the first substrate surface and the second substrate surface are present on the same substrate or on different substrates.

6. The method of any one of claims 1 and 2 to 5, wherein the metal material comprises W, Co, Cu or a combination thereof.

7. The method of any one of claims 1 and 2 to 6, wherein the dielectric material comprises SiO_2, SiN, or a combination thereof, or the metal oxide material comprises HfO_2, ZrO_2, SiO_2, Al_2O_3, or a combination thereof.

8. The method of any one of claims 1 and 2 to 7, wherein the compound corresponding in structure to Formula (I), the compound corresponding in structure to Formula (II), or a combination thereof is delivered at a temperature of less than about 150°C.

9. The method of any one of claims 1 and 2 to 8, further comprising vaporizing at least one co-reactant selected from the group consisting of hydrogen, hydrogen plasma, oxygen, air, water, ammonia, a hydrazine, a borane, a silane, ozone, and a combination of any two or more thereof.

10. The method of any one of claims 1 and 2 to 9, wherein the method is used for a DRAM or CMOS application.

11. The method of any one of claims 1 and 2 to 10, wherein R^1, R^2, R^3, R^4, R^5, R^6, and R^7 are each independently a C_1–C_{15}-alkyl, each optionally substituted with one or more of a trifluoromethyl group, a hydroxyl group, a nitrile group, an alkoxy group, and an amino group.

12. The method of any one of claims 1 and 2 to 11, wherein X^2 is NR^4R^5.

13. The method of any one of claims 1 and 2 to 12, wherein R^1 is a C_1–C_{15}-alkyl, R^2 is C_1–C_4-alkyl, each optionally substituted with one or more of a trifluoromethyl group, a hydroxyl group, a nitrile group, an alkoxy group, and an amino group; X^1 is S; and X^2 is NR^4R^5, wherein R^4 is a C_1–C_{15}-alkyl, R^5 is C_1–C_4-alkyl, each optionally substituted with one or more of a trifluoromethyl group, a hydroxyl group, a nitrile group, an alkoxy group, and an amino group.

14. The method of any one of claims 1 and 2 to 13, wherein the compound corresponding in structure to Formula (I) is N-dodecyl-N-methyl carbamodithioic acid N-dodecyl-N-methylammonium salt.