What is claimed is:

1. An ALD or ALD-like process for selectively depositing a Ru-containing layer or film on a metal substrate disposed proximate to a dielectric material comprising the steps of:

(i) passivating the dielectric material by exposing a surface of the dielectric material with a surface conversion material; and

(ii) selectively depositing an Ru-containing layer on a surface of the metal substrate using an Ru(I) precursor in combination with a co-reactant.

2. The process of claim 1, wherein the dielectric material comprises Si.

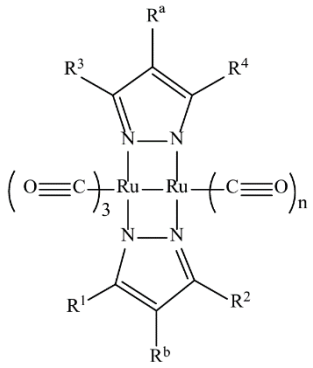
3. The process of claim 1, wherein the surface conversion material converts an -OH group to a less reactive or non-reactive group.

4. The process of claim 1, wherein the surface conversion material comprises one or more of DMATMS and OTS.

5. The process of claim 1, wherein step (i) is performed at a temperature in the range of approximately 150 °C to approximately 350 °C.

6. The process of claim 1, wherein step (i) comprises pulsing the surface conversion material from about 0.1 seconds to about 10 seconds.

7. The process of claim 1, wherein the Ru(I) precursor comprises a ruthenium pyrazolate precursor of Formula 1:

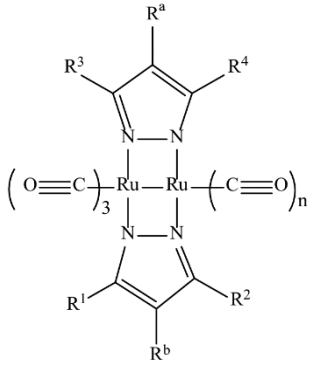


wherein

R^1, R^2, R^3 and R^4 are each independently selected from the group of H, a substituted or unsubstituted C_1 to C_{20} linear, cyclic or branched alkyl and a substituted or unsubstituted C_1 to C_{20} linear or branched or cyclic halogenated alkyl,

R^a and R^b are each independently selected from the group of H, a substituted or unsubstituted C_1 to C_{20} linear, cyclic or branched alkyl and a substituted or unsubstituted C_1 to C_{20} linear or branched or cyclic halogenated alkyl, and n = 2 or 3.

8. The process of claim 1, wherein the Ru(I) precursor comprises a ruthenium pyrazolate precursor of Formula 1:



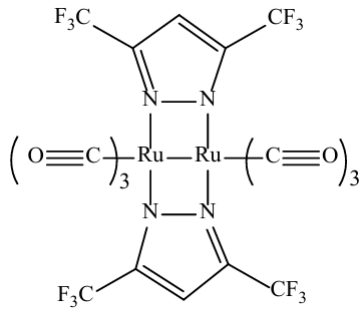
wherein

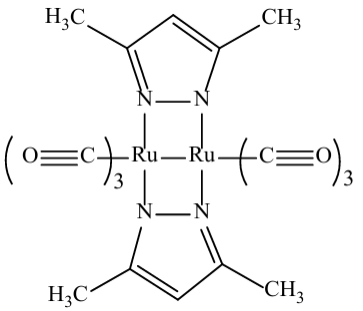
R^1, R^2, R^3 and R^4 are each independently one of $-CH_3$, $-CF_3$, $-CH_2CH_3$, $CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-CH_2CH(CH_3)_2$ and $-C(CH_3)_3$;

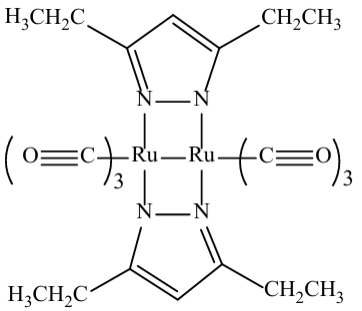
R^a and R^b are each H, and

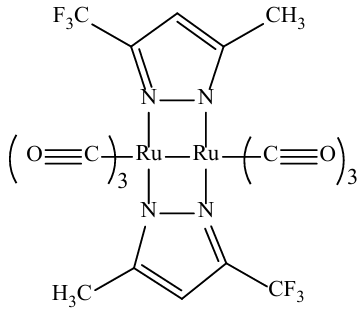
N = 3.

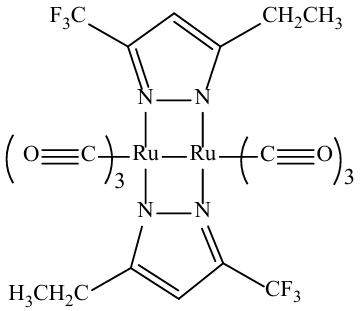
9. The process of claim 1, wherein the Ru(I) precursor comprises one or more ruthenium pyrazolate precursor, selected from the group of:

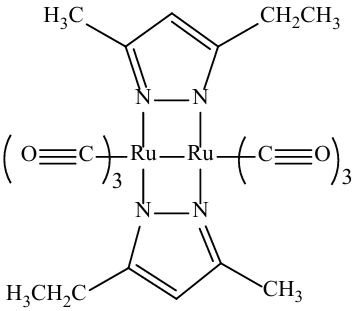


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,




,


and


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10. The process of claim 1, wherein the co-reactant comprises one or more of H_2 and NH_3.

11. The process of claim 1, wherein the metal substrate comprises one or more of Ru, TiN, W, Cu and Co.

12. The process of claim 1, wherein step (ii) is performed at a temperature in the range of approximately 150 °C to approximately 350 °C.

13. The process of claim 1, wherein step (ii) is conducted at a pressure between about 5 torr and about 15 torr.

14. The process of claim 1, wherein the process is conducted with an Ru(I) precursor pulse time of between about 1 second and about 20 seconds.

15. The process of claim 1, wherein the process is conducted with a co-reactant pulse time between about 20 seconds and about 60 seconds.

16. The process of 1, wherein step (i) and step (ii) are both performed at approximately the same temperature.