CLAIMS

1. A method of depositing a Co containing film on a substrate having a first surface in a reactor, comprising:

providing the substrate to the reactor;

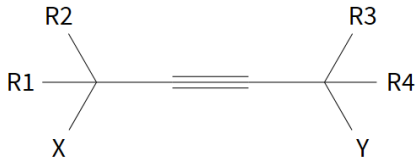
providing a Co precursor to the reactor;

contacting the substrate with the Co precursor; and

forming the Co containing film on the substrate;

wherein the Co precursor is selected from the group consisting of:

1) (functionalized alkyne) dicobalt hexacarbonyl compound where dicobalt hexacarbonyl $Co_2(CO)_6$ is bonded to a structure of:



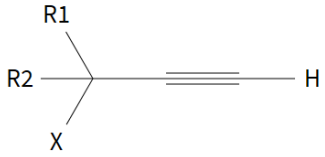
wherein X or Y each individually contains at least one member selected from the group consisting of OR, NR_2, PR_2, and Cl; and R, R_1, R_2, R_3, or R_4 each is individually selected from the group consisting of hydrogen, linear hydrocarbon, branched hydrocarbon, and combinations thereof;

2) (functionalized alkyne) dicobalt hexacarbonyl compound where dicobalt hexacarbonyl $Co_2(CO)_6$ is bonded to a structure of:



wherein X contains at least one member selected from the group consisting of OR, NR_2, PR_2, and Cl; and R, R_1, R_2, R_3, R_4 or R_5 each is individually selected from the group consisting of hydrogen, linear hydrocarbon, branched hydrocarbon, and combinations thereof;

3) (functionalized alkyne) dicobalt hexacarbonyl compound where dicobalt hexacarbonyl $Co_2(CO)_6$ is bonded to a structure of:

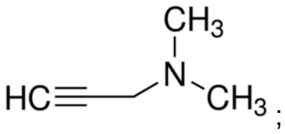


wherein X contains at least one member selected from the group consisting of OR, NR_2, PR_2, and Cl; and R, R_1, or R_2 each is individually selected from the group consisting of hydrogen, linear hydrocarbon, branched hydrocarbon, and combinations thereof;

and

4) (functionalized alkyne) dicobalt hexacarbonyl having mono-substituted alkyne complex; wherein the mono-substituted alkyne complex and the (functionalized alkyne) dicobalt hexacarbonyl is selected from the group consisting of:

(a) N,N-Dimethylpropargylamine having a structure of:

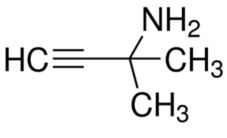


;

and

the cobalt compound is (N,N-Dimethylpropargylamine) dicobalt hexacarbonyl;

(b) (1,1-Dimethylpropargylamine) having a structure of:

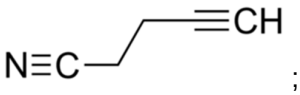


;

and

the cobalt compound is (1,1-Dimethylpropargylamine) dicobalt hexacarbonyl;

(c) 4-Pentynenitrile having a structure of:

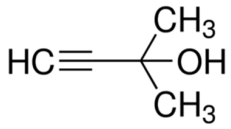


;

and

the cobalt compound is (4-Pentynenitrile) dicobalt hexacarbonyl;

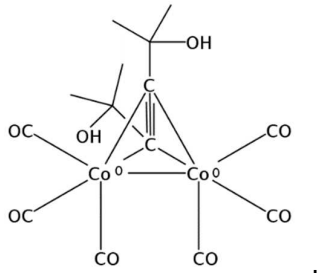
(d) (1,1-Dimethylpropargylalcohol) having a structure of:



and

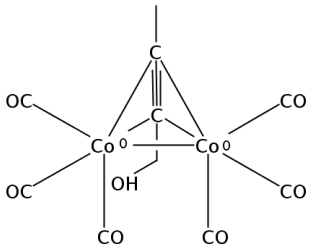
the cobalt compound is (1,1-Dimethylpropargylalcohol) dicobalt hexacarbonyl.

2. The method of claim 1, wherein the Co precursor of 1) is (μ-η^2,η^2-2,5-Dimethyl-3-hexyne-2,5-diol)dicobalt hexacarbonyl:



.

3. The method of claim 1, wherein the Co precursor of 2) is (μ-[(2,3-η:2,3-η)-2-butyn-1-ol)dicobalt hexacarbonyl:



.

4. The method of claim 1, wherein the Co precursor of 3) is (1,1-Dimethylpropargylalcohol)dicobalt hexacarbonyl.

5. The method of claim 1, wherein the Co precursor is (1,1-Dimethylpropargylalcohol) dicobalt hexacarbonyl.

6. The method of claim 1, wherein the substrate is selected from a group consisting of silicon, silicon oxide, PVD TaN, copper, cobalt, metal nitride and combinations thereof.

7. The method of claim 1, wherein the Co containing film is selected from a group consisting of cobalt film, cobalt oxide film, cobalt silicide film, cobalt nitride film, and combinations thereof.

8. The method of claim 1, wherein the Co film is deposited by a method selected from a group consisting of thermal CVD, thermal ALD, plasma-enhanced ALD (PEALD), plasma enhanced chemical vapor deposition (PECVD), and plasma enhanced cyclic chemical vapor deposition (PECCVD).

9. The method of claim 1, wherein the substrate has a first surface and a second surface; and

   (1) the Co film is deposited on the first surface while no deposition occurs on the second surface; or

   (2) thickness of the Co containing film deposited on the first surface is more than 50 times of thickness of the Co containing film deposited on the second surface.

10. The method of claim 9, wherein the first surface is a metal surface; and the second surface is a dielectric surface.

11. The method of claim 10, wherein the metal is copper or cobalt; and the second surface is SiO_2.

12. The method of claim 9, wherein the first surface is metal nitride and the second surface is a metal surface or a dielectric surface.

13. The method of claim 12, wherein the first surface is tantalum nitride; and the second surface is a surface selected from the group consisting of copper, cobalt, SiO_2 and combinations thereof.