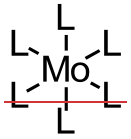
~~What is claimed is:~~

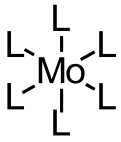
CLAIMS

1. A metal coordination complex comprising molybdenum(IV) or molybdenum(III), wherein the metal coordination complex ~~substantially free of halogen and carbonyl.~~

~~2.~~ ~~The metal coordination complex of claim 1 having~~has a structure of Formula (I):



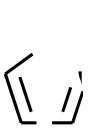
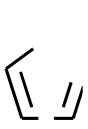
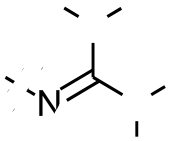
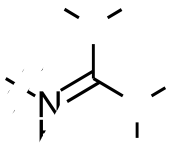
(I)



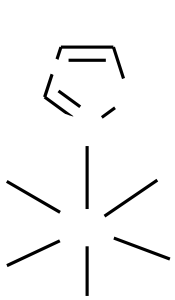
(I) ,

wherein L is independently selected from the group consisting of pyrazolo, pyrazolato, guanidino, and iminato~~.~~, and

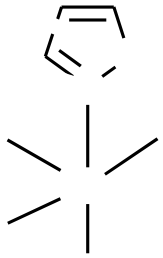
wherein the metal coordination complex comprises less than 5% of halogen and carbonyl.

~~3.~~ 2. The metal coordination complex of claim ~~2~~1, wherein L is independently selected from the group consisting of  ,  ,  , and  , and R is an unsubstituted or substituted C_1-C_{10} alkyl group.

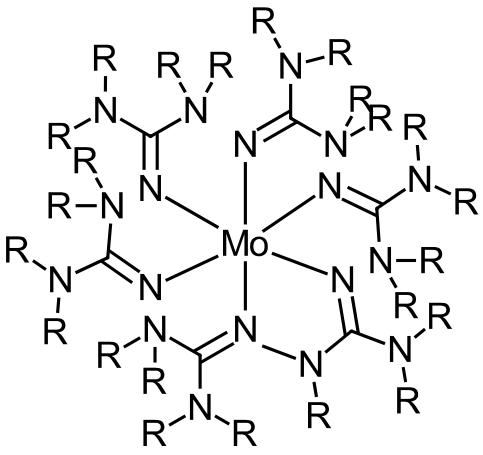
~~4.~~3. The metal coordination complex of claim ~~2~~1, wherein the structure of Formula (I) is selected from the group consisting of



,

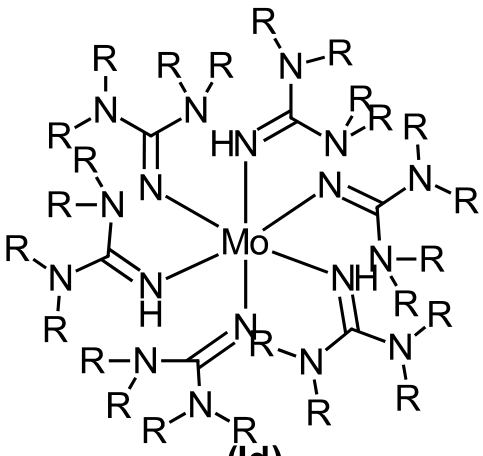


,



(Ic)

, and



(Id)

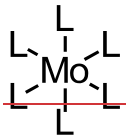
.

~~5. A method of depositing a film, the method comprising:~~

~~exposing a substrate to a molybdenum(IV) precursor or a molybdenum(III) precursor; and~~

~~exposing the substrate to a reactant to form a molybdenum-containing film on the substrate.~~

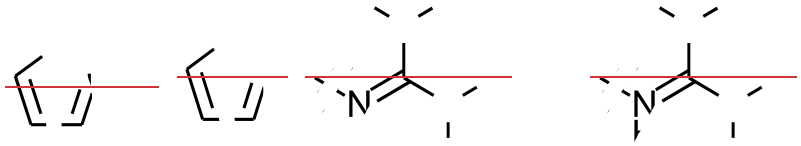
~~6. The method of claim 5, wherein the molybdenum(IV) precursor or a molybdenum(III) precursor has a structure of Formula (I):~~



(I)

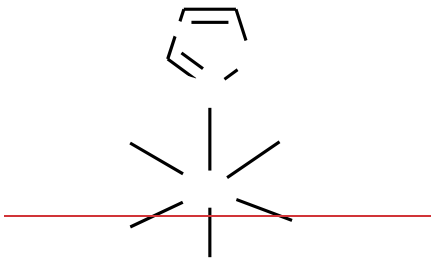
wherein L is independently selected from the group consisting of pyrazolo, pyrazolato, guanidino, and iminato.

7. The method of claim 6, wherein L is independently selected from the group

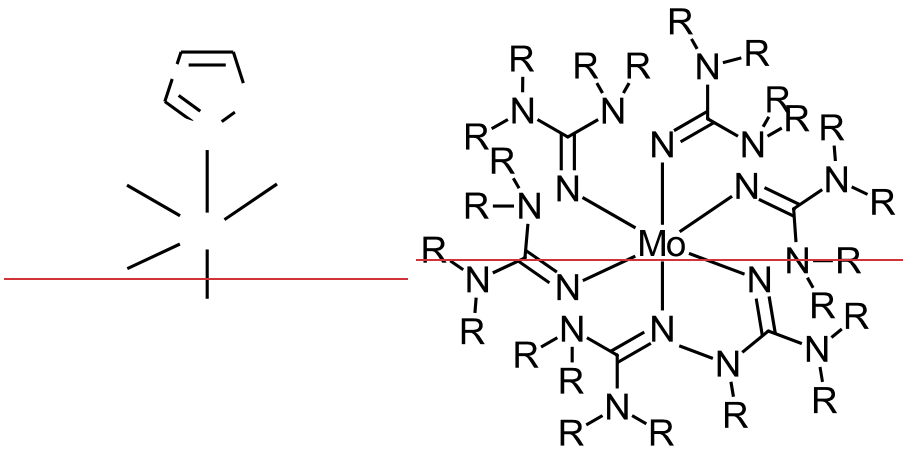


consisting of , , , and , and R is an unsubstituted or substituted C_1-C_{10} alkyl group.

8. The method of claim 6, wherein the structure of Formula (I) is selected from the

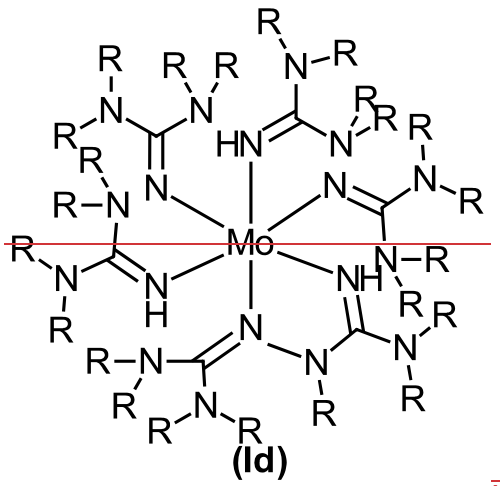


group consisting of ,



(Ic)

; , ~~and~~



(Id)

.

~~9. The method of claim 5, wherein the reactant comprises one or more of an oxidizing agent and a reducing agent.~~

~~10. The method of claim 5, wherein the molybdenum film comprises one or more of a molybdenum metal (elemental Mo) film, a molybdenum oxide film, a molybdenum carbide film, a molybdenum silicide film, and a molybdenum nitride film.~~

11. The method of claim 5, wherein the substrate is exposed to the molybdenum(IV) precursor or the molybdenum(III) precursor and the reactant sequentially.

12. The method of claim 5, wherein the substrate is exposed to the molybdenum(IV) precursor or the molybdenum(III) precursor and the reactant simultaneously.

13. The method of claim 5, further comprising purging the substrate of the molybdenum(IV) precursor or the molybdenum(III) precursor prior to exposing the substrate to the reactant.

14. The method of claim 13, wherein purging comprises one or more of applying a vacuum or flowing a purge gas over the substrate.

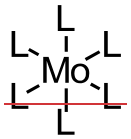
15. The method of claim 14, wherein the purge gas comprises one or more of nitrogen (N_2), helium (He), and argon (Ar).

16. The method of claim 5, further comprising repeating the method to provide a molybdenum-containing film having a thickness of about 0.3 to about 100 nm.

17. A method of depositing a film, the method comprising:

forming a molybdenum-containing film in a process cycle comprising sequential exposure of a substrate to a molybdenum(IV) precursor or a molybdenum(III) precursor, purge gas, reactant, and purge gas.

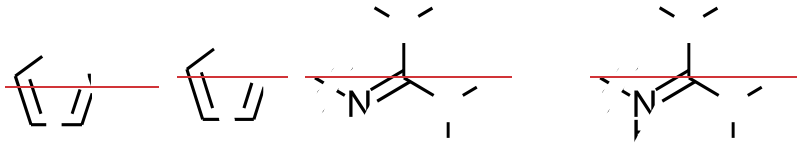
18. The method of claim 17, wherein the molybdenum(IV) precursor or a molybdenum(III) precursor has a structure of Formula (I):



(I)

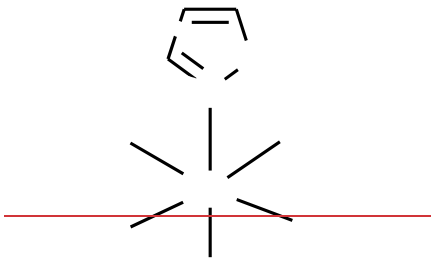
wherein L is independently selected from the group consisting of pyrazolo, pyrazolato, guanidino, and iminato.

19. The method of claim 18, wherein L is independently selected from the group

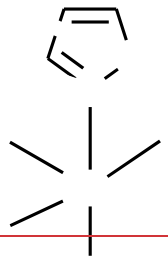


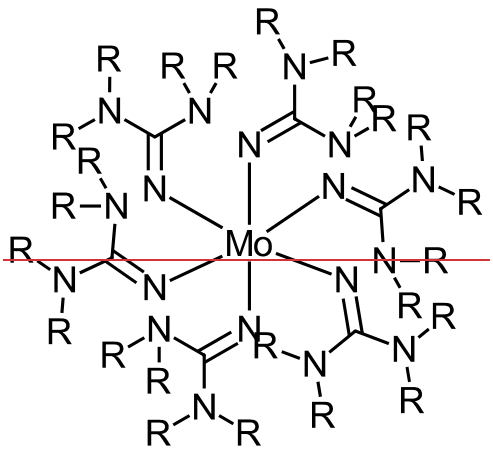
consisting of , , , and , and R is an unsubstituted or substituted C_1-C_{10} alkyl group.

20. The method of claim 18, wherein the structure of Formula (I) is selected from

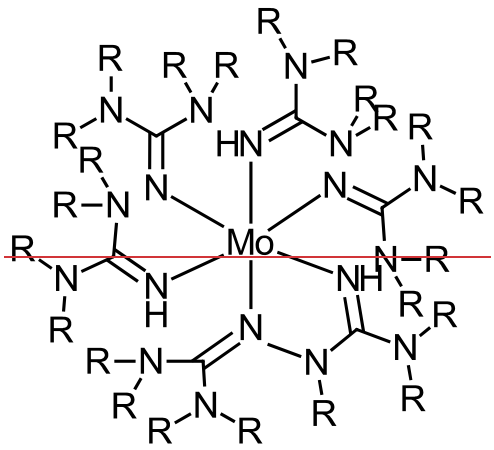


the group consisting of ,





(Ic)



(Id)