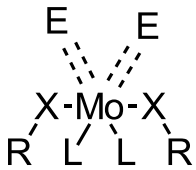
~~What is claimed is:~~

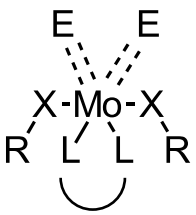
CLAIMS

~~1.~~ A metal coordination complex comprising molybdenum(VI), the metal coordination complex ~~substantially free of halogen and carbonyl.~~

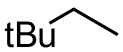
~~2.~~1. ~~The metal coordination complex of claim 1~~ having a structure of Formula (I) or of Formula (II):



(I)



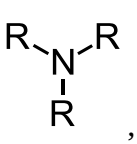
(II)

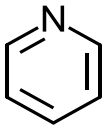
wherein E is independently selected from an oxo- group, an imido-group, and a sulfido-group, X is independently selected from O, SiR_2, and CR_2, L is a nitrogen-or phosphorus-coordinating ligand, and R is independently ~~an unsubstituted or substituted C_1-C_{10} alkyl group.~~ selected from Me-, Et-, iPr-, tBu-, and 

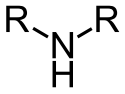
substituents.

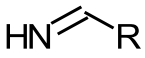
~~3.~~2. The metal coordination complex of claim ~~2~~1, wherein E independently comprises O, N-tBu, or S.

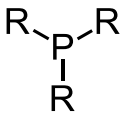
~~4.~~3. The metal coordination complex of claim ~~2~~1, wherein the structure is of Formula (I) and L is selected from the group consisting of



,


,


,


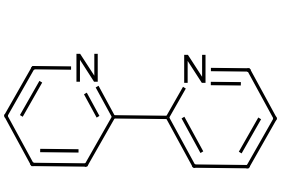
, and


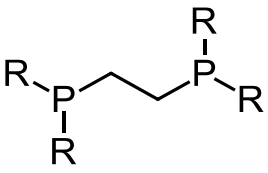
.

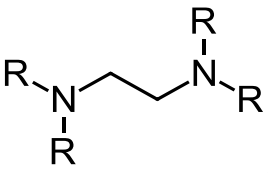
~~5.~~4. The metal coordination complex of claim ~~2~~1, wherein the structure is of Formula (II) and



is selected from the group consisting of



,


, and


.

~~6. The metal coordination complex of claim 2, wherein R is independently selected from Me-, Et-, iPr-, tBu-, and~~ 

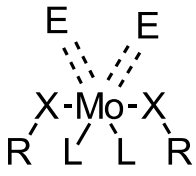
~~substituents.~~

~~7.~~5. A method of depositing a film, the method comprising:

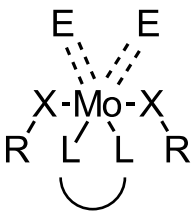
exposing a substrate to a molybdenum(VI) precursor~~; and~~

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

~~The method of claim 7~~, wherein the ~~-~~molybdenum (VI) precursor has a structure of Formula (I) or of Formula (II):



(I)



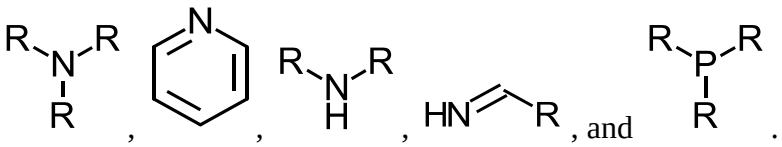
(II)

wherein E is independently selected from an oxo- group, an imido-group, and a sulfido-group, X is independently selected from O, SiR_2, and CR_2, L is a nitrogen-~~and~~or phosphorus-coordinating ligand, and R is independently ~~an unsubstituted or substituted C_1-C_{10} alkyl group.~~ selected from Me-, Et-, iPr-, tBu-, and xv substituents; and

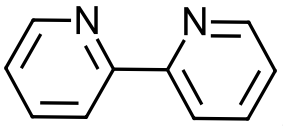
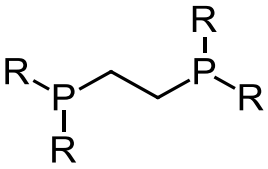
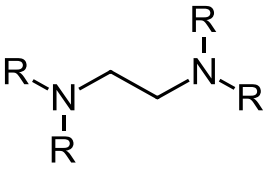
exposing the substrate to a reactant to form a molybdenum film on the substrate.

~~8.~~6. The method of claim ~~8~~5, wherein E independently comprises O, N-tBu, or S.

~~9.~~7. The method of claim ~~8~~5, wherein the structure is of Formula (I) and L is selected from the group consisting of

, , , , and .

~~10.~~8. The method of claim ~~8~~5, wherein the structure is of Formula (II) and  is selected from the group consisting of

, , and .

~~11.~~9. The method of claim ~~7~~ 5, wherein the reactant comprises one or more of an oxidizing agent and a reducing agent.

~~12.~~10. The method of claim ~~7~~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.

~~13.~~11. The method of claim ~~7~~5, wherein the substrate is exposed to the molybdenum(VI) precursor and the reactant sequentially.

~~14.~~12. The method of claim ~~7~~5, wherein the substrate is exposed to the molybdenum(VI) precursor and the reactant simultaneously.

~~15.~~13. The method of claim ~~7~~5, further comprising purging the substrate of the molybdenum(VI) precursor prior to exposing the substrate to the reactant.

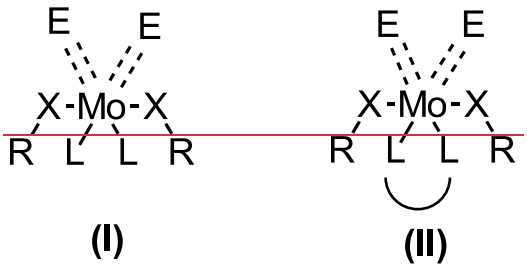
~~16.~~14. The method of claim ~~16~~13, wherein purging comprises one or more of applying a vacuum or flowing a purge gas over the substrate.

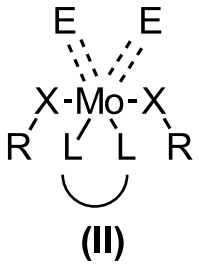
~~17.~~15. The method of claim ~~7~~5, further comprising repeating the method to provide a molybdenum film having a thickness in a range of from about 0.3 nm to about 100 nm.

~~18.~~A ~~method of depositing a film, the method~~metal coordination complex comprising~~:~~

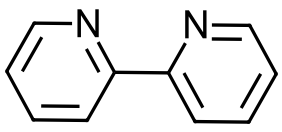
~~forming a molybdenum-containing film in a process cycle comprising sequential exposure of a substrate to a~~ molybdenum(VI~~) precursor, purge gas, reactant, and purge gas.~~

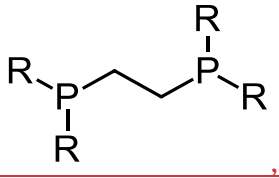
~~19.~~16. ~~The method of claim 19, wherein the molybdenum(VI) precursor has~~), the metal coordination complex having a structure of Formula (~~I) or of Formula (~~II):

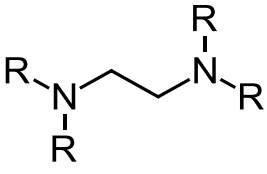




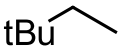
wherein E is independently selected from an oxo- group, an imido-group, and a sulfido-group, X is independently selected from O, SiR_2, and CR_2, ~~L is a nitrogen-or phosphorus-coordinating ligand,~~  is selected from the group consisting of



, 

, and 

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

~~20.~~17. The metal coordination complex of claim -16, wherein R is independently selected from Me-, Et-, iPr-, tBu-, and  substituents.