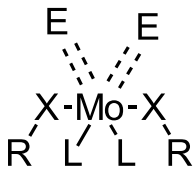
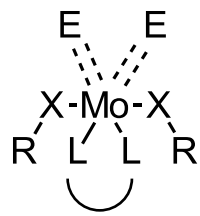
CLAIMS

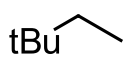
1. A metal coordination complex comprising molybdenum(VI), the metal coordination complex having a structure of Formula (I) or of Formula (II):



(I)

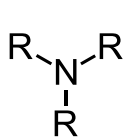
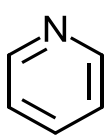
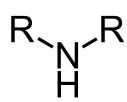
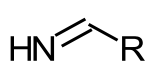
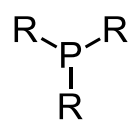


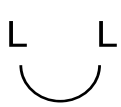
(II)

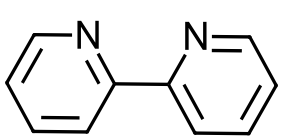
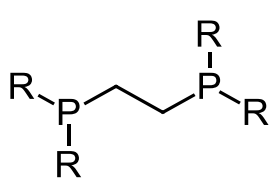
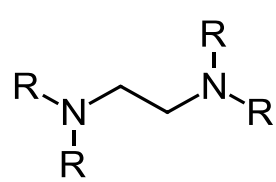
wherein E is independently selected from an oxo- group, an imido-group, and a sulfido-group, X is independently selected from O, SiR_2, and CR_2, L is a nitrogen-or phosphorus-coordinating ligand, and R is independently selected from Me-, Et-, iPr-, tBu-, and  substituents.

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

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

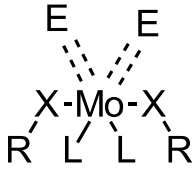
 ,  ,  ,  , and  .

4. The metal coordination complex of claim 1, wherein the structure is of Formula (II) and  is selected from the group consisting of

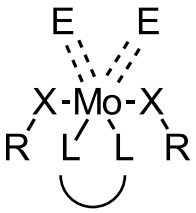
 ,  , and  .

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

exposing a substrate to a molybdenum(VI) precursor, wherein the molybdenum (VI) precursor has a structure of Formula (I) or of Formula (II):



(I)



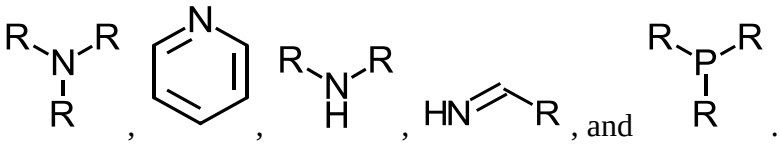
(II)

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-or phosphorus-coordinating ligand, and R is independently selected from Me-, Et-, iPr-, tBu-, and xv substituents; and

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

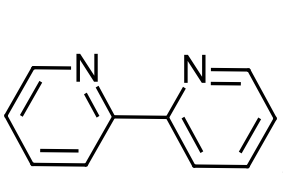
6. The method of claim 5, wherein E independently comprises O, N-tBu, or S.

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



8. The method of claim 5, wherein the structure is of Formula (II) and 

is selected from the group consisting of



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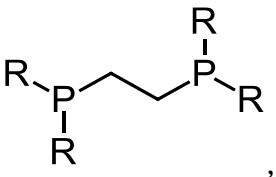
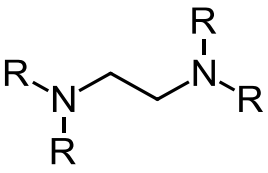


, and


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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(VI) precursor and the reactant sequentially.

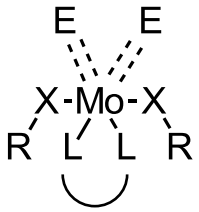
12. The method of claim 5, wherein the substrate is exposed to the molybdenum(VI) precursor and the reactant simultaneously.

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

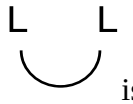
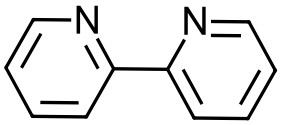
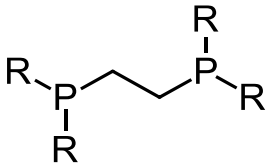
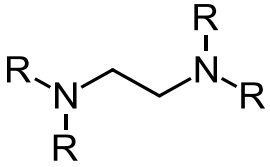
14. The method of claim 13, wherein purging comprises one or more of applying a vacuum or flowing a purge gas over the substrate.

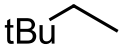
15. The method of claim 5, further comprising repeating the method to provide a molybdenum film having a thickness in a range of from about 0.3 nm to about 100 nm.

16. A metal coordination complex comprising molybdenum(VI), the metal coordination complex having a structure of Formula (II):



(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,  is selected from the group consisting of  ,  , and  , and R is independently an unsubstituted or substituted C_1-C_{10} alkyl group.

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