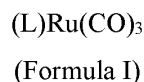


WHAT IS CLAIMED IS:

1. A pulsed chemical vapor deposition (CVD) method for depositing a ruthenium-containing film, the pulsed CVD method comprising at least one deposition cycle, wherein the deposition cycle comprises:
 - a. pulsing a zerovalent Ru precursor with a carrier gas in the absence of a co-reactant onto a surface of a substrate; and
 - b. delivering a purge gas to the surface of the substrate.

2. The method of claim 1, wherein the zerovalent Ru precursor corresponds in structure to Formula I:



wherein: L is selected from the group consisting of a linear or branched C₂-C₆-alkenyl, a linear or branched C₁-C₆-alkyl, a C₃-C₆ cycloalkenyl, and a linear, branched, or cyclic dienyl-containing moiety; and wherein L is optionally substituted with one or more substituents independently selected from the group consisting of C₂-C₆-alkenyl, C₁-C₆-alkyl, alkoxy and NR¹R²; wherein R¹ and R² are independently alkyl or hydrogen; or

wherein the zerovalent Ru precursor is (ethylbenzyl)(1-ethyl-1,4-cyclohexadienyl)ruthenium.

3. The method of claim 2, wherein L is a linear, branched, or cyclic dienyl-containing moiety.
4. The method of claim 2 or claim 3, wherein L is a linear, branched, or cyclic dienyl-containing moiety selected from the group consisting of butadienyl, pentadienyl, hexadienyl, cyclohexadienyl, heptadienyl and octadienyl.
5. The method of any one of claims 2 to 4, wherein the zerovalent Ru precursor is selected from the group consisting of:

(η^4 -buta-1,3-diene)tricarbonylruthenium;

(η^4 -2,3-dimethylbuta-1,3-diene)tricarbonylruthenium;

(η^4 -2-methylbuta-1,3-diene)tricarbonylruthenium; and
(cyclohexadiene)tricarbonylruthenium.

6. The method of any one of the previous claims, wherein the pulsing the zerovalent Ru precursor is for greater than or equal to about 1 second.
7. The method of any one of the previous claims, wherein the pulsing the zerovalent Ru precursor is for about 1 second to about 10 seconds.
8. The method of any one of the previous claims, wherein the pulsing the zerovalent Ru precursor is performed at a pressure of about 0.1 Torr to about 5 Torr.
9. The method of any one of the previous claims, wherein the delivering the purge gas is for at least about 30 seconds.
10. The method of any one of the previous claims, wherein the delivering the purge gas is for about 30 seconds to about 5 minutes.
11. The method of any one of the previous claims, wherein the delivering the purge gas is for about 2 minutes to about 4 minutes.
12. The method of any one of the previous claims, wherein during the pulsing of the zerovalent Ru precursor and the carrier gas and/or during the delivering of the purge gas, a temperature of the substrate is less than or equal to a thermal decomposition temperature of the zerovalent Ru precursor.
13. The method of claim 12, wherein the temperature of the substrate is about 150°C to about 250°C.
14. The method of claim 12 or 13, wherein the temperature of the substrate is about 200°C to about 230°C.
15. The method of any one of the previous claims, wherein the substrate comprises one or more of SiO₂, Al₂O₃, TiN, WN, and WCN.

16. The method of any one of the previous claims, wherein the zerovalent Ru precursor is preheated to a temperature of about 20°C to about 50°C before pulsing.
17. The method of any one of the previous claims, wherein the carrier gas and the purge gas are each independently selected from the group consisting of Ar, N₂, He, CO, and a combination thereof.
18. The method of any one of the previous claims, wherein the carrier gas is preheated to a temperature of about 20°C to about 100°C before pulsing.
19. The method of any one of the previous claims, wherein the ruthenium-containing film has a resistivity of about 30 μΩ-cm to about 180 μΩ-cm.
20. The method of any one of the previous claims, wherein the ruthenium-containing film has a growth rate of about 0.1 Å/cycle to about 2 Å/cycle.
21. The method of any one of the previous claims, further comprising annealing the ruthenium-containing film at a temperature of about 300°C to about 500°C.
22. The method of claim 21, wherein the annealed ruthenium-containing film has a resistivity of about 20 μΩ-cm to about 60 μΩ-cm.