

Claims:

1. A method for processing a substrate, comprising:
 - selectively depositing a first layer of metal within at least one feature on a substrate;
 - depositing a second layer of metal atop the first layer of metal and at least on sidewalls defining the at least one feature;
 - depositing a third layer of metal atop the second layer of metal and within the feature to at least completely fill the at least one feature; and
 - removing some of the second layer of metal or some of the second layer of metal and some of the third layer of metal so that remaining portions of the second layer of metal and the third layer of metal are flush with a top surface of the at least one feature.
2. The method of claim 1, further comprising removing metal oxide from at least a surface of a base layer of the substrate, the base layer made from at least one of aluminum (Al), copper (Cu), cobalt (Co), molybdenum (Mo), ruthenium (Ru), titanium (Ti), or tungsten (W).
3. The method of claim 2, wherein depositing the first layer of metal comprises using a first process chamber,
 - wherein depositing the second layer of metal comprises using a second process chamber,
 - wherein depositing the third layer of metal comprises using at least one of the first process chamber or a third process chamber,
 - wherein removing at least some of the third layer of metal and at least some of the second layer of metal comprises using a fourth process chamber, and
 - wherein removing the metal oxide comprises using a fifth process chamber.
4. The method as in any of claims 1 to 3, wherein the first process chamber and the third process chamber are configured to perform chemical vapor deposition,
 - wherein the second process chamber is configured to perform physical vapor deposition,

wherein the fourth process chamber is configured to perform chemical-mechanical polishing, and

wherein the fifth process chamber is configured to perform at least one of a preclean or an etch process.

5. The method of claim 1, wherein depositing the first layer of metal, the second layer of metal, and the third layer of metal comprises depositing at least one of Al, Co, Cu, Mo, Ru, Ti, and/or W.

6. The method of claim 1, wherein the at least one feature is at least one of a via, trench, or dual damascene via-chain.

7. The method of claim 1, wherein the first layer of metal is deposited within the at least one feature to one of a height of about one-third ($1/3$) to about two-thirds ($2/3$) of a height of the at least one feature or a height of about 30 nm to about 600 nm.

8. The method as in any of claims 1 to 3 or 5 to 7, wherein depositing the first layer of metal, depositing the second layer of metal, and depositing the third layer of metal are performed using a cluster tool, and wherein removing some of the second layer of metal or some of the second layer of metal and some of the third layer of metal is performed using a stand-alone apparatus.

9. A method for processing a substrate, comprising:
selectively depositing a first layer of metal within at least one feature on a substrate;

depositing a second layer of metal atop the first layer of metal and at least on sidewalls defining the at least one feature;

depositing a third layer of metal atop the second layer of metal to one of partially fill, completely fill or overfill the at least one feature; and

removing some of the sidewalls, some of the third layer of metal, and some of the second layer of metal so that remaining portions of the second layer of metal

and the third layer of metal are flush with each other and remaining portions of the sidewalls.

10. The method of claim 9, further comprising removing metal oxide from at least a surface of a base layer of the substrate, the base layer made from at least one of aluminum (Al), copper (Cu), cobalt (Co), molybdenum (Mo), ruthenium (Ru), titanium (Ti), or tungsten (W).

11. The method of claim 10, wherein depositing the first layer of metal comprises using a first process chamber,

wherein depositing the second layer of metal comprises using a second process chamber,

wherein depositing the third layer of metal comprises using at least one of the first process chamber or a third process chamber,

wherein removing at least some of the sidewalls, at least some of the third layer of metal, and at least some of the second layer of metal comprises using a fourth process chamber, and

wherein removing the metal oxide comprises using a fifth process chamber.

12. The method as in any of claims 9 to 11, wherein the first process chamber and the third process chamber are configured to perform chemical vapor deposition,

wherein the second process chamber is configured to perform physical vapor deposition,

wherein the fourth process chamber is configured to perform chemical-mechanical polishing, and

wherein the fifth process chamber is configured to perform at least one of a preclean or an etch process.

13. The method of claim 9, wherein depositing the first layer of metal, the second layer of metal, and the third layer of metal comprises depositing at least one of Al, Co, Cu, Mo, Ru, Ti, or W.

14. The method of claim 9, wherein the at least one feature is at least one of a via, trench, or dual damascene via-chain.

15. The method as in any of claims 9 to 11, 13 or 14, wherein the first layer of metal is deposited within the at least one feature to one of a height of about one-third ($1/3$) to about two-thirds ($2/3$) of a height of the at least one feature or a height of about 30 nm to about 600 nm.

16. A nontransitory computer readable storage medium having stored thereon instructions that when executed by a processor perform a method for processing a substrate, comprising:

selectively depositing a first layer of metal within at least one feature on a substrate;

depositing a second layer of metal atop the first layer of metal and at least on sidewalls defining the at least one feature;

depositing a third layer of metal atop the second layer of metal to one of partially fill, completely fill or overfill the at least one feature; and

removing some of the sidewalls, some of the third layer of metal, and some of the second layer of metal so that remaining portions of the second layer of metal and the third layer of metal are flush with each other and remaining portions of the sidewalls.

17. The nontransitory computer readable storage medium of claim 16, further comprising removing metal oxide from at least a surface of a base layer of the substrate, the base layer made from at least one of aluminum (Al), copper (Cu), cobalt (Co), molybdenum (Mo), ruthenium (Ru), titanium (Ti), or tungsten (W).

18. The nontransitory computer readable storage medium of claim 17, wherein depositing the first layer of metal comprises using a first process chamber,

wherein depositing the second layer of metal comprises using a second process chamber,

wherein depositing the third layer of metal comprises using at least one of the first process chamber or a third process chamber,

wherein removing at least some of the sidewalls, at least some of the third layer of metal, and at least some of the second layer of metal comprises using a fourth process chamber, and

wherein removing the metal oxide comprises using a fifth process chamber.

19. The nontransitory computer readable storage medium as in any of claims 16 to 18, wherein the first process chamber and the third process chamber are configured to perform chemical vapor deposition,

wherein the second process chamber is configured to perform physical vapor deposition,

wherein the fourth process chamber is configured to perform chemical-mechanical polishing, and

wherein the fifth process chamber is configured to perform at least one of a preclean or an etch process.

20. The nontransitory computer readable storage medium as in any of claims 16 to 18, wherein depositing the first layer of metal, the second layer of metal, and the third layer of metal comprises depositing at least one of Al, Co, Cu, Mo, Ru, Ti, and/or W.