

CLAIMS

1. A method for processing a substrate, comprising:
 - selectively depositing a first layer of metal within at least one feature on the substrate, wherein the first layer is deposited using a chemical vapor deposition process chamber;
 - depositing a second layer of metal atop the first layer of metal and at least on sidewalls defining the at least one feature, wherein the second layer is deposited using a physical vapor deposition process chamber;
 - 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, wherein the third layer is deposited using the chemical vapor deposition process chamber or using another chemical vapor deposition process chamber; and
 - removing 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 removing at least some of the third layer of metal and at least some of the second layer of metal comprises using a further process chamber, and
 - wherein removing the metal oxide comprises using a yet further process chamber.

4. The method as in claim 3,
wherein the further process chamber is configured to perform
chemical-mechanical polishing, and
wherein the yet further 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 one-third ($1/3$)
to two-thirds ($2/3$) of a height of the at least one feature or a height of 30 nm
to 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 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, wherein the first layer is deposited using a chemical vapor deposition process chamber;

depositing a second layer of metal atop the first layer of metal and at least on sidewalls defining the at least one feature, wherein the second layer is deposited using a physical vapor deposition process chamber;

depositing a third layer of metal atop the second layer of metal to partially fill the at least one feature, wherein the third layer is deposited using the chemical vapor deposition process chamber or using another chemical vapor deposition process chamber; 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 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 further process chamber, and

wherein removing the metal oxide comprises using a yet further process chamber.

12. The method as in claim 11,

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

wherein the yet further 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 one-third ($1/3$) to two-thirds ($2/3$) of a height of the at least one feature or a height of 30 nm to 600 nm.

16. A nontransitory computer readable storage medium having stored thereon instructions that when executed by a processor perform a method as in any of claims 1 to 15.