CLAIMS

The invention claimed is:

1. A method for depositing copper-containing material within a plurality of openings comprising physical vapor deposition of the copper-containing material under conditions in which the deposited copper-containing material is at a temperature of greater than 100°C.

2. The method of claim 1 wherein the deposition comprises at least one iteration of the following sequence:

sputter deposit the copper-containing material utilizing a plasma, with a temperature of the sputter-deposited material being greater than 100°C; and

while maintaining the temperature of the sputter-deposited material at greater than 100°C, extinguishing the plasma and providing a sufficient duration of time for the sputter-deposited material to surface diffuse into cavities to avoid pinching-off the cavities.

3. The method of claim 1 wherein the temperature is in a range of from about 300°C to about 600°C.

4. The method of claim 1 wherein the temperature is in a range of from about 500°C to about 600°C.

5. The method of claim 1 wherein noble gas is utilized to sputter copper-containing material from a target during the physical vapor deposition.

6. The method of claim 1 further comprising, prior to the physical vapor deposition of the copper-containing material, forming a composition containing metal and nitrogen within the openings to line the openings.

7. The method of claim 6 wherein the metal comprises one or both of ruthenium and cobalt.

8. The method of claim 1 further comprising, prior to the physical vapor deposition of the copper-containing material, lining the openings with a metal-containing material that comprises one or both of ruthenium and cobalt.

9. The method of claim 1 further comprising, prior to the physical vapor deposition of the copper-containing material:

lining the openings with a first metal; and

nitriding the first metal by exposing the first metal to a source of nitrogen.

10. The method of claim 9 wherein the metal consists of one or both of ruthenium and cobalt.

11. A method for providing electrically conductive material within a plurality of openings, comprising:

lining the openings with a metal-containing composition; and

at least one iteration of the following:

physically vapor depositing copper-containing material over the metal-containing composition, the physical vapor depositing being conducted under conditions that maintain a temperature of the deposited copper to be less than or equal to about 0°C to form a copper-containing material coating having a first conformation; and

annealing the copper-containing material coating under conditions in which the copper-containing material is at a temperature within a range of from about 180°C to about 250°C to reflow the copper-containing material of said coating and thereby form a second conformation of the copper-containing material.

12. The method of claim 11 wherein the metal-containing composition consists of one or both of ruthenium and cobalt.

13. The method of claim 11 wherein the metal-containing composition consists of nitrogen in combination with one or both of ruthenium and cobalt.

14. The method of claim 11 wherein the first conformation of the copper-containing material leaves some voids within the openings, and the second conformation of the copper-containing material displaces the voids from the openings.

15. A method for providing electrically conductive material within a plurality of openings, comprising:

lining the openings with a composition containing metal and nitrogen; and

at least partially filling the lined openings with copper-containing material.

16. The method of claim 15 wherein the at least partially filling the openings with copper-containing material utilizes physical vapor deposition of the copper-containing material under conditions such that the deposited copper-containing material is at a temperature of greater than 100°C.

17. The method of claim 16 wherein the temperature is within a range of from about 300°C to about 600°C.

18. The method of claim 15 wherein the at least partially filling the openings with copper-containing material utilizes:

deposition of the copper-containing material under conditions that maintain a temperature of the deposited copper-containing material to be less than or equal to about 40°C to form a first conformation of the copper-containing material; and

after said deposition, annealing the copper-containing material under conditions that have a temperature of the deposited copper-containing material within a range of from about 180°C to about 250°C to reflow the copper-containing material and thereby form a second conformation of the copper-containing material.

19. The method of claim 18 wherein the first conformation of the copper-containing material leaves some recesses within the openings, and the second conformation of the copper-containing material displaces the recesses from the openings.

20. The method of claim 15 wherein the forming the lined opening comprises deposition of the composition containing metal and nitrogen along sidewalls of the openings.

21. The method of claim 20 wherein the metal consists of one or both of ruthenium and cobalt.

22. The method of claim 20 wherein the deposition of the composition containing metal and nitrogen uses one or more of ALD, CVD and PVD.

23. The method of claim 15 wherein the forming the lined opening comprises:

coating sidewalls of the openings with the metal; and

nitriding the metal by exposing the metal to a source of nitrogen.

24. The method of claim 23 wherein the metal comprises of one or both of ruthenium and cobalt.

25. The method of claim 23 wherein the metal comprises a transition metal alloyed with one or both of ruthenium and cobalt.

26. The method of claim 23 wherein the metal comprises tantalum alloyed with one or both of ruthenium and cobalt.

27. The method of claim 23 wherein the nitriding comprises exposure of the metal to one or more of NH_3, NH_2, and N_2.

28. A semiconductor construction, comprising:

an opening extending into an electrically insulative material;

a metal nitride liner lining sidewalls of the opening; and

copper-containing material within the opening and directly against the metal nitride liner.

29. The construction of claim 28 wherein the metal of the metal nitride liner comprises of one or both of ruthenium and cobalt.

30. The construction of claim 28 wherein the metal of the metal nitride liner comprises a transition metal alloyed with one or both of ruthenium and cobalt.

31. The construction of claim 30 wherein the metal nitride liner is directly against the electrically insulative material.

32. The construction of claim 28 wherein the metal of the metal nitride liner comprises tantalum alloyed with one or both of ruthenium and cobalt.

33. The construction of claim 28 wherein the metal of the metal nitride liner comprises tantalum alloyed with one or both of ruthenium and cobalt; wherein the electrically insulative material comprises silicon oxide-containing electrically insulative material; and wherein the metal nitride liner is directly against the silicon oxide containing electrically insulative material.

34. The construction of claim 28 wherein the metal of the metal nitride liner consists of ruthenium.

35. The construction of claim 28 wherein the metal of the metal nitride liner consists of cobalt

CLAIMS

1. A semiconductor construction, comprising:

an electrically insulative material directly on a surface of a semiconductor substrate, the electrically insulative material consisting of one or more materials selected from the group consisting of silicon dioxide, borophosphosilicate glass, and phosphosilicate glass;

an opening extending only partially into the electrically insulative material, the opening having a pair of vertically opposing sidewalls that each meet a bottom of the opening, the bottom of the opening extending across the width of the opening and being disposed above the surface of the semiconductor substrate;

a metal liner directly contacting the electrically insulative material of sidewalls and bottom of the opening, the metal liner consisting of one or more transition metals combined with one or both of cobalt and ruthenium; and

copper-containing material within the opening and directly against the metal-comprising liner.

2. The construction of claim 1 wherein the metal liner comprises ruthenium and a transition metal.

3. The construction of claim 1 wherein the metal liner comprises cobalt.

4. The construction of claim 1 wherein the copper-containing material is reflowed copper being free of detectible voids.