

What is claimed is:

# CLAIMS

1. A method of selectively depositing a carbon film, the method comprising:  
~~providing~~exposing a substrate comprising ~~a first material and a second material, the first material having~~ an exposed first material surface, ~~the second material having~~ and an exposed second material surface, ~~the first material comprising a metal; and~~  
~~exposing the substrate~~ to a carbon precursor to form a carbon film with a first thickness on the exposed first material surface and a second thickness on the exposed second material surface, the first material comprising a metal, the carbon precursor comprising a carbon-containing species consisting essentially of carbon and hydrogen atoms, and the first thickness being greater than the second thickness.
2. The method of claim 1, wherein the metal comprises one or more of Ti, Co, Ni, Cu, Ru, Rh, Pd, Ag, Hf, Ta, W, Re, Ir, Pt, or Au.
- 2.3. The method of claim 1, wherein the first material comprises a substantially pure metal or metal alloy.
- 3.4. The method of claim 1, wherein the first material comprises a metal nitride, metal carbide, metal silicide, metal oxide, metal sulfide, metal selenide, metal telluride or combinations thereof.
- 4.5. The method of claim 1, wherein the second material comprises a dielectric material.
6. The method of claim 1, wherein the substrate is maintained at a temperature in a range of about 100 °C to about 700 °C.

7. The method of claim 1, wherein the carbon precursor comprises one or more of  $C_2H_2$ ,  $C_2H_4$ ,  $C_3H_6$ , or  $CH_4$ .

5.8. The method of claim 1, wherein the carbon precursor further comprises hydrogen gas, nitrogen gas or argon gas.

6.9. A method of forming a carbon pillar, the method comprising:

~~providing~~exposing a substrate surface comprising a ~~first metal-containing material and a second dielectric material, the first metal-containing material having an~~ exposed first surface ~~with a first dimension, the second dielectric material having an~~ and a exposed second surface, ~~the exposed first surface and the exposed second surface forming a substrate surface; and~~

~~exposing the substrate~~ to a carbon precursor to form a carbon pillar comprising a carbon material on the exposed first surface, a first metal-containing material having the exposed first surface with a first dimension, a second dielectric material having the exposed second surface, the carbon precursor comprising a carbon-containing species consisting essentially of carbon and hydrogen atoms, the carbon pillar and the exposed first surface having the same first dimension.

7.10. The method of claim ~~69~~, wherein the first metal-containing material comprises cobalt.

11. The method of claim ~~69~~, wherein the carbon precursor comprises a C1-C4 hydrocarbon.

8.12. The method of claim 11, wherein the carbon precursor comprises at least one unsaturated bond.

9.13. The method of claim ~~69~~, wherein the carbon precursor further comprises hydrogen gas, nitrogen gas or argon gas.

10.14. The method of claim ~~6~~9, wherein substantially no carbon material is deposited on the exposed second surface.

15. The method of claim ~~6~~9, wherein the substrate is maintained at a temperature in a range of about 100 °C to about 700 °C.

11.16. The method of claim 9, wherein the exposed first surface is recessed from the exposed second surface to form a substrate feature, the substrate feature comprising at least one sidewall of the second dielectric material and ~~a bottom of~~ the exposed first surface of the first metal-containing material, the carbon pillar extending above the exposed second surface.

12.17. The method of claim ~~11~~16, wherein the carbon pillar has sides substantially orthogonal to the substrate surface.

13.18. A method of forming a self-aligned via, the method comprising:

recessing first conductive lines on a first insulating layer on a substrate, the first conductive lines extending along a first direction on the first insulating layer;

forming carbon pillars on the recessed first conductive lines;

depositing a second insulating layer between the carbon pillars;

removing the carbon pillars to form trenches in the second insulating layer;

depositing a third insulating layer in the trenches onto the recessed first conductive lines to form filled trenches; and

selectively etching the third insulating layer from the filled trenches to form a via opening to the first conductive line.

14.19. The method of claim ~~13~~18, further comprising depositing a substantially conformal etch stop layer after removing the carbon pillars and before depositing the third insulating layer.

~~15.~~—The method of claim ~~13~~18, further comprising:

16.20. depositing a second conductive material into the via opening; ~~and,~~

~~depositing a plurality of second conductive lines on the second insulating layer and in contact with the second conductive material in the via opening, the second conductive lines extending along a second direction on the second insulating layer.~~