CLAIMS

1. A method for producing a self-aligned structure, the method comprising:

providing a substrate with a substrate surface with at least one feature formed therein, the at least one feature extending a distance into the substrate from the substrate surface and having a sidewall and bottom;

forming a metal-containing film in the at least one feature and not outside the at least one feature;

exposing the metal-containing film to a silicon precursor to form a self-aligned structure of metal silicide that expands from the at least one feature; and

depositing a material around the self-aligned structure and removing the self-aligned structure to form a self-aligned via.

2. The method of claim 1, wherein the self-aligned structure has a volume in the range of greater than 1 to less than 2 times the volume of the metal-containing film within the feature.

3. The method of claim 1, wherein forming the metal-containing film within the at least one feature comprises forming a metal-containing film on the substrate surface and within the at least one feature and removing the metal-containing film from the substrate surface outside of the at least one feature.

4. The method of claim 1, wherein the self-aligned structure is substantially orthogonal to the substrate surface.

5. The method of claim 1, wherein the metal-containing film comprises one or more of Co, Mo, W, Ta, Ti, Ru, Rh, Cu, Fe, Mn, V, Nb, Hf, Zr, Y, Al, Sn, Cr, Os, U or La.

6. The method of claim 1, wherein a plasma of the silicon precursor is exposed to metal-containing film.

7. The method of claim 1, wherein the silicon precursor comprises one or more of trimethylsilane, silane, disilane, dichlorosilane, trichlorosilane or trisilylamine.

8. The method of claim 1, further comprising exposing the metal-containing film to a doping agent to form a doped metal silicide.

9. The method of claim 8, wherein the doped metal silicide comprises carbon, nitrogen, or oxygen.

10. The method of claim 9, wherein the self-aligned structure comprises a metal carbosilicide (MSiC) and the doping agent comprises ethyne or ethane.

11. The method of claim 9, wherein the self-aligned structure comprises a metal nitrosilicide (MSiN) and the doping agent comprises one or more of ammonia or nitrogen.

12. The method of claim 9, wherein the self-aligned structure comprises a metal oxysilicide (MSiO) and the doping agent comprises an oxygen-containing precursor.

13. The method of claim 1, wherein the rate of formation of the self-aligned structure is controlled by exposing the substrate to hydrogen during silicidation.

14. The method of claim 1, further comprising reducing the volume of the self-aligned structures by exposing the self-aligned structures to a hydrogen plasma.

15. The method of claim 5, wherein the metal-containing film consists essentially of W.

16. The method of claim 1, wherein silicidizing the metal-containing film occurs at a temperature in a range of greater than or equal to about 200 ºC and less than or equal to about 600 °C.

17. The method of claim 1, wherein the self-aligned structure is removed by a exposing the self-aligned structure to a metal fluoride etchant.

18. A method for producing a self-aligned structure, the method comprising:

providing a substrate with a substrate surface with at least one feature formed therein, the at least one feature extending a distance into the substrate from the substrate surface and having a sidewall and bottom;

forming a tungsten film on the substrate surface and in the at least one feature;

removing the tungsten film from the substrate surface outside of the at least one feature; and

exposing the tungsten film to a silicon precursor and hydrogen to form a self-aligned structure of tungsten silicide that expands from the at least one feature at a predetermined rate, the self-aligned structure having a volume of about two times the tungsten film within the feature.

19. A method for producing a self-aligned via, the method comprising:

providing a substrate with a substrate surface with at least one feature formed therein, the at least one feature extending a distance into the substrate from the substrate surface and having a sidewall and bottom;

forming a tungsten film on the substrate surface and in the at least one feature;

removing the tungsten film from the substrate surface outside of the at least one feature;

exposing the tungsten film to a silicon precursor to form a self-aligned structure of tungsten silicide that expands from the at least one feature at a predetermined rate;

depositing a material around the self-aligned structure; and

exposing the self-aligned structure to a hydrogen plasma and an etchant to remove the self-aligned structure and form a self-aligned via.