

What is claimed is:

1. A method for producing a self-aligned structure, the method comprising:
providing a substrate with a substrate surface with at least one feature
5 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; and
10 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.
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.
- 15 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.
- 20 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
25 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.
- 30 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.
- 5 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.
- 10 11. The method of claim 10, wherein the self-aligned structure comprises a metal nitrosilicide (MSiN) and the doping agent comprises one or more of ammonia or nitrogen.
- 15 12. The method of claim 10, wherein the self-aligned structure comprises a metal oxysilicide (MSiO) and the doping agent comprises an oxygen-containing precursor.
- 20 13. The method of claim 1, further comprising depositing a material around the self-aligned structure and removing the self-aligned structure to form a self-aligned via.
14. 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.
- 25 15. 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.