

CLAIMS

What is claimed is:

1. A method comprising:

providing a feature on a substrate, the feature comprising a metal surface having a
5 layer of metal oxide formed thereon and a dielectric surface; and

exposing the feature to a metal halide to remove the layer of metal oxide from the
metal surface.
2. The method of claim 1, further comprising filling the feature with a conductive material.
3. The method of claim 2, wherein the conductive material directly contacts the metal surface
10 and the dielectric surface without an interposed layer.
4. The method of claim 2, wherein filling the feature with a conductive material comprises
depositing a nucleation layer of the conductive material prior to depositing bulk conductive
material.
5. The method of claim 2, wherein filling the feature with a conductive material comprises
15 depositing bulk conductive material without depositing a nucleation layer.
6. The method of claim 1, wherein filling the feature comprises an atomic layer deposition or
chemical vapor deposition process, including plasma enhanced or thermal processes, to
deposit bulk conductive material.
7. The method of claim 6, wherein deposition of the bulk conductive material is selective to the
20 metal surface with respect to the dielectric surface.
8. The method of claim 6, wherein deposition of the bulk conductive material is non-selective
to the metal and dielectric surfaces.
9. The method of any of claim 2, wherein exposing the feature to the metal halide and filling
the feature with a conductive material are performed in the same chamber.
- 25 10. The method of claim 2, wherein exposing the feature to the metal halide and filling the
feature with a conductive material are performed in different stations of the same chamber.

11. The method of any of claim 2, wherein exposing the feature to the metal halide and filling the feature with a conductive material are performed in different chambers.
12. The method of claim 1, wherein the conductive material is selected from molybdenum (Mo), ruthenium (Ru), tungsten (W), iridium (Ir), chromium (Cr), cobalt (Co), and titanium nitride (TiN).
13. The method of claim 1, wherein the metal surface is a one of a titanium nitride (TiN) surface, a molybdenum nitride (MoN_x) surface, a tungsten nitride (WN) surface, a tungsten carbon nitride (WC_xN_y) surface, a tungsten carbide (WC_x) surface, a titanium aluminum carbide (TiAl_xC_y) surface, or a tantalum nitride (TaN) surface.
14. The method of any of claims 1–13, wherein the metal of the metal halide is one of: Mo, W, Cr, Ti, Ta, and vanadium (V).
15. The method of any of claims 1–13, wherein the metal halide is one of tungsten hexafluoride (WF_6), tungsten hexachloride (WCl_6), tungsten pentachloride (WCl_5), tungsten hexabromide (WBr_6).
16. The method of any of claims 1–13, wherein the metal halide is one of molybdenum hexafluoride (MoF_6) and molybdenum pentachloride (MoCl_5).
17. The method of any of claims 1–13, wherein the metal halide is one of niobium pentachloride (NbCl_5) and niobium pentabromide (NbBr_5).
18. The method of any of claims 1–13, wherein the metal halide is one of tantalum pentafluoride (TaF_5) and tantalum pentachloride (TaCl_5).
19. The method of any of claims 1–13, wherein the metal halide is one of vanadium pentafluoride (VF_5), chromium pentafluoride (CrF_5), and titanium tetrachloride (TiCl_4).
20. The method of claim 1, further comprising performing a reducing treatment to remove residual halogen after removing the layer of metal oxide.