CLAIMS

1. A method of filling a feature in a substrate, comprising:

depositing a seed layer of tungsten nitride in the feature via a physical vapor deposition (PVD) process, wherein the seed layer of tungsten nitride has a nitrogen concentration of 18 to 35 atomic percent;

depositing a liner layer of tungsten on the seed layer of tungsten nitride in the feature via a PVD process; and

subsequently filling the feature with a tungsten bulk fill via a chemical vapor deposition (CVD) process.

2. The method of claim 1, wherein the seed layer of tungsten nitride is 10 to 60 angstroms thick.

3. The method of claim 1, wherein the liner layer of tungsten is 30 to 300 angstroms thick.

4. The method of claim 1, further comprising performing a planarization process on the substrate after filling the feature with the tungsten bulk fill.

5. The method of claim 1, wherein the substrate consists essentially of silicon oxide.

6. The method of any of claims 1 to 5, further comprising performing a nitrogen radical treatment before filling the feature with the tungsten bulk fill to provide an incubation delay for the CVD process.

7. The method of claim 6, wherein the nitrogen radical treatment includes flowing nitrogen at a rate of 1 sccm to 20 sccm with a duration of 2 seconds to 20 seconds.

8. The method of any of claims 1 to 5, further comprising depositing a nucleation layer using a mixture of tungsten hexafluoride (WF_6) with silane (SiH_4) or diborane (B_2H_6) via an atomic layer deposition (ALD) process after depositing the liner layer of tungsten.

9. The method of claim 8, wherein the nucleation layer is 10 angstroms to 60 angstroms in thickness.

10. The method of any of claims 1 to 5, wherein a width of the feature is between 5 and 65 nanometers.

11. The method of any of claims 1 to 5, wherein depositing the liner layer of tungsten is performed at a temperature of 20 to 350 degrees Celsius.

12. The method of any of claims 1 to 5, wherein the liner layer is thicker than the seed layer.

13. The method of any of claims 1 to 5, wherein the tungsten bulk fill is performed using tungsten hexafluoride (WF_6) and hydrogen (H_2) as precursors.

14. The method of any of claims 1 to 5, wherein an aspect ratio of the feature is between 1:1 and 15:1.

15. A non-transitory computer readable medium comprising a plurality of instructions for execution by one or more processors, that when executed, perform the method of any of claims 1 to 14.