CLAIMS

1. A method comprising:

providing a semiconductor substrate to a chamber having a chamber pressure less than 100 torr, wherein the semiconductor substrate comprises a partially fabricated three-dimensional (3-D) NAND structure comprising sidewalls and a plurality of openings in the sidewalls leading to a plurality of features having a plurality of interior regions fluidically accessible through the openings;

depositing a material on the semiconductor substrate by multiple ALD cycles, wherein each cycle comprises flowing into the chamber in sequence:

a reducing agent;

a first purge gas;

a tungsten precursor; and

a second purge gas; and

wherein flowing the first purge gas and the second purge gas comprises flowing purging gas from a first accumulator with a first charge pressure, followed by flowing purging gas from a second accumulator with a second charge pressure within 5 seconds of flowing the purging gas from the first accumulator, and the first charge pressure and the second charge pressure are between 400 torr and 1000 torr.

2. A method comprising:

providing a semiconductor substrate to a chamber having a chamber pressure;

depositing a material on the semiconductor substrate by multiple ALD cycles, wherein each cycle comprises flowing into the chamber in sequence:

a reactant; and

a purge gas; wherein flowing the purge gas comprises flowing purging gas from a first accumulator with a first charge pressure, followed by flowing purging gas from a second accumulator with a second charge pressure.

3. The method of claim 2, wherein the first charge pressure and second charge pressure are at least two times greater than the chamber pressure.

4. The method of claim 2, wherein the chamber pressure before flowing the purge gas or the second purge gas is less than 100 torr.

5. The method of claim 2, wherein the first charge pressure and second charge pressure are between 400 torr and 1000 torr.

6. The method of claim 2, wherein the purging gas is helium, nitrogen, argon, or xenon.

7. The method of claim 2, wherein the reactant comprises a reducing agent.

8. The method of claim 7, wherein the reducing agent is B_2H_6, SiH_4, or H_2.

9. The method of claim 2, wherein the reactant comprises a metal precursor.

10. The method of claim 9, wherein the metal precursor is a metal halide.

11. The method of claim 9, wherein the metal precursor is a metal oxyhalide.

12. The method of claim 9, wherein the metal precursor is a tungsten precursor.

13. The method of claim 12, wherein the tungsten precursor is one of tungsten hexafluoride (WF_6), tungsten hexachloride (WCl_6), tungsten pentachloride (WCl_5), tungsten tetrachloride (WCl_4), tungsten dichloride (WCl_2), tungsten oxytetrachloride ($WOCl_4$) or tungsten dichloride dioxide (WO_2Cl_2).

14. The method of claim 9, wherein the metal precursor is a molybdenum precursor.

15. The method of claim 14, wherein the molybdenum precursor is one of: molybdenum pentachloride ($MoCl_5$), molybdenum hexafluoride (MoF_6), molybdenum dichloride dioxide (MoO_2Cl_2), molybdenum oxytetrachloride ($MoOCl_4$), and molybdenum oxytetrachloride ($MoOF_4$).

16. The method of any one of claims 2–15, wherein flowing the purge gas is a choked flow.

17. The method of any one of claims 2–15, wherein flowing purging gas from the first accumulator is at least partially a choked flow.

18. The method of claim 17, wherein flowing purging gas from the second accumulator occurs during the choked flow portion of flowing purging gas from the first accumulator.

19. The method of any one of claims 2–15, wherein the flowing purging gas from the second accumulator occurs less than 5 seconds after flowing purging gas from the first accumulator.

20. The method of any one of claims 2–15, wherein the semiconductor substrate comprises a partially fabricated three-dimension (3-D) NAND structure comprising sidewalls and a plurality of openings in the sidewalls leading to a plurality of features having a plurality of interior regions fluidically accessible through the openings.