CLAIMS

~~What is claimed is~~Claims:

1. An apparatus, comprising:

a process chamber;

a precursor gas source;

a reactant gas source;

an inhibitor gas source;

a passivation gas source;

a gas inlet, in fluid connection with the process chamber;

a switching manifold, wherein the switching manifold in a first position provides a fluid connection between the inhibitor gas source and the gas inlet, wherein the switching manifold in a second position provides a fluid connection between the precursor gas source and the gas inlet, wherein the switching manifold in a third position provides a fluid connection between the reactant gas source and the gas inlet, wherein the switching manifold in a fourth position provides a fluid connection between the passivation gas source and the gas inlet; and wherein the switching manifold prevents the gas inlet from being in fluid connection with at least two of the precursor gas source, the reactant gas source, the passivation gas source, and the inhibitor gas source at a same time; and

a controller controllably connected to the switching manifold.

2. The apparatus, as recited in claim 1, further comprising:

a substrate support within the process chamber; and

a showerhead within the process chamber in fluid connection with the gas inlet.

3. The apparatus, as recited in claim 2, wherein the showerhead is disposed above the substrate support and is grounded.

4. The apparatus, as recited in claim 3, further comprising:

a low-frequency RF source electrically connected to the substrate support, wherein the low-frequency RF source provides an RF signal with a frequency in a range of 100 kHz to 1 MHz to the substrate support; and

a high-frequency RF source electrically connected to the substrate support, wherein the high-frequency RF source provides an RF signal with a frequency in a

range of 10 MHz to 100 MHz to the substrate support.

5. The apparatus, as recited in claim 4, wherein the controller comprises:

at least one processor; and

computer readable media, comprising:

computer code for providing a plurality of cycles, wherein each cycle comprises:

providing an inhibitor deposition, comprising placing the switching manifold in the first position; and

providing at least one atomic layer deposition cycle, comprising:

placing the switching manifold in the second position; and

placing the switching manifold in the third position.

6. The apparatus, as recited in claim 5, wherein the controller is controllably connected to the high-frequency RF source and the low-frequency RF source, wherein the computer readable media, further comprises:

computer code for providing a first high-frequency excitation power when the switching manifold is placed in the first position;

computer code for providing a first low-frequency bias power when the switching manifold is placed in the first position;

computer code for providing a second high-frequency excitation power when the switching manifold is placed in the second position;

computer code for providing a second low-frequency bias power when the switching manifold is placed in the second position; and

computer code for providing a third high-frequency excitation power when the switching manifold is placed in the third position; and

computer code for providing a third low-frequency bias power when the switching manifold is placed in the third position.

7. The apparatus, as recited in claim 6, wherein the second high-frequency excitation power is less than 500 watts, and the second low-frequency bias power is less than 500 watts, the third high-frequency excitation power is greater than 125 watts, and the third low-frequency bias power is greater than 25 watts.

8. The apparatus, as recited in claim 7, wherein the first high-frequency excitation power is greater than 250 watts.

9. The apparatus, as recited in claim 8, wherein the computer code for providing a plurality of cycles, further comprises placing the switching manifold in a fourth position and wherein the computer readable media further comprises computer code for providing a fourth high-frequency excitation power when the switching manifold is placed in the fourth position, wherein the fourth high-frequency excitation power is greater than 250 watts.

10. The apparatus, as recited in claim 1, wherein the precursor gas source provides a silicon containing precursor and the reactant gas source provides an oxidizing gas.

11. The apparatus, as recited in claim 1, further comprising a purge gas source in fluid connection with the switching manifold, wherein in the first position, the second position, the third position, and the fourth position, the switching manifold prevents the purge gas source from being in fluid connection with the gas inlet, and wherein the switching manifold has a fifth position, wherein the fifth position provides a fluid connection between the purge gas source and the gas inlet and prevents the gas inlet from being in fluid connection with the precursor gas source, the reactant gas source, the passivation gas source, and the inhibitor gas source.

12. A method for filling features in a substrate, comprising:

a) selectively depositing an inhibitor layer at a selected depth of the features; and

b) providing an atomic layer deposition process or a chemical vapor deposition process to deposit a deposition layer within the features, wherein the deposition layer is selectively inhibited on parts of the features where the inhibitor layer is deposited.

13. The method, as recited in claim 12, further comprising repeating steps a and b.

14. The method, as recited in claim 12, further comprising after b then c) providing a passivation process, wherein the passivation process removes remaining inhibitor layer and then repeating steps a and b.

15. The method, as recited in claim 12, wherein the selectively depositing the inhibitor layer, comprises:

flowing an inhibitor gas;

transforming the inhibitor gas into an inhibitor plasma; and

stopping the flow of the inhibitor gas.

16. The method, as recited in claim 15, wherein the selectively depositing the inhibitor layer further comprises applying a selective bias.

17. An apparatus, comprising:

a process chamber;

a chemical vapor deposition gas source;

an inhibitor gas source;

a passivation gas source;

a gas inlet, in fluid connection with the process chamber;

a switching manifold, wherein the switching manifold in a first position provides a fluid connection between the inhibitor gas source and the gas inlet, wherein the switching manifold in a second position provides a fluid connection between the chemical vapor deposition gas source and the gas inlet, wherein the switching manifold in a third position provides a fluid connection between the passivation gas source and the gas inlet; and wherein the switching manifold prevents the gas inlet from being in fluid connection with at least two of the chemical vapor deposition gas source, the passivation gas source, and the inhibitor gas source at a same time; and

a controller controllably connected to the switching manifold.

18. The apparatus, as recited in claim 17, further comprising:

a substrate support within the process chamber; and

a showerhead within the process chamber in fluid connection with the gas inlet.

19. The apparatus, as recited in claim 18, wherein the showerhead is disposed above the substrate support and wherein the showerhead is grounded.

20. The apparatus, as recited in claim 19, further comprising:

a low-frequency RF source electrically connected to the substrate support, wherein the low-frequency RF source provides an RF signal with a frequency in a range of 100 kHz to 1 MHz to the substrate support; and

a high-frequency RF source electrically connected to the substrate support,

wherein the high-frequency RF source provides an RF signal with a frequency in a range of 10 MHz to 100 MHz to the substrate support.

21. The apparatus, as recited in claim 20, wherein the controller comprises:

at least one processor; and

computer readable media, comprising:

computer code for providing a plurality of cycles, wherein each cycle comprises:

providing an inhibitor deposition, comprising placing the switching manifold in the first position;

providing a chemical vapor deposition comprising placing the switching manifold in the second position; and

providing a passivation comprising placing the switching manifold in a third position.

22. The apparatus, as recited in claim 21, wherein the controller is controllably connected to the high-frequency RF source and the low-frequency RF source, wherein the computer readable media, further comprises:

computer code for providing a first high-frequency excitation power when the switching manifold is placed in the first position;

computer code for providing a first low-frequency bias power when the switching manifold is placed in the first position;

computer code for providing a second high-frequency excitation power when the switching manifold is placed in the second position;

computer code for providing a second low-frequency bias power when the switching manifold is placed in the second position; and

computer code for providing a third high-frequency excitation power when the switching manifold is placed in the third position; and

computer code for providing a third low-frequency bias power when the switching manifold is placed in the third position.

23. The apparatus, as rcited in claim 1, wherein the inhibitor gas source provides an inhibitor gas for forming an inhibitor layer, wherein the inhibitor layer inhibits the deposition of an atomic layer deposition, and wherein the passivation gas source provides a passivation gas for removing the inhibitor layer.

24. The apparatus, as recited in claim 23, wherein the precursor gas source provides a precursor gas and the reactant gas source provides a reactant gas, wherein the precursor gas and reactant gas provide the atomic layer deposition.

25. The apparatus, as recited in claim 1, wherein the inhibitor gas source provides an inhibitor gas comprising at least one of iodine, chlorine, nitrogen trifluoride (NF_3), Sulfonyl halides, diols, diamines, acetylene or ethylene, carbon monoxide (CO), carbon dioxide (CO_2), pyridine, piperidine, pyrrole, pyrimidine, imidazole, and benzene.

26. The apparatus, as recited in claim 2, further comprising a high-frequency RF source electrically connected to the substrate support, wherein the high-frequency RF source provides an RF signal with a frequency in a range of 10 MHz to 100 MHz to the substrate support.

27. The method, as recited in claim 12, further comprising providing a passivation gas to tune the selectively depositing the inhibitor layer.

28. The method, as recited in claim 12, wherein the selectively depositing an inhibitor layer comprises providing an inhibitor gas comprising at least one of iodine, chlorine, nitrogen trifluoride (NF_3), Sulfonyl halides, diols, diamines, acetylene or ethylene, carbon monoxide (CO), carbon dioxide (CO_2), pyridine, piperidine, pyrrole, pyrimidine, imidazole, and benzene.

29. The apparatus, as recited in claim 13, wherein at step a a first bias is provided that causes the inhibitor layer to be deposited to a first depth into features and wherein when step a is repeated a second bias is created that causes the inhibitor layer to be deposited to a second depth into the features, wherein the first bias is greater than the second bias and wherein the first depth is greater than the second depth.

30. The method, as recited in claim 14, wherein the providing the passivation process comprises providing a passivation gas comprising at least one of O_2, H_2 and a noble gas.

31. The apparatus, as recited in claim 14, wherein at step a a first bias is provided that causes the inhibitor layer to be deposited to a first depth into features and wherein when step a is repeated a second bias is created that causes the inhibitor layer to be deposited to a second depth into the features, wherein the first bias is greater than the second bias and wherein the first depth is greater than the second depth.

32. The apparatus, as recited in claim 17, wherein the inhibitor gas source provides an inhibitor gas for forming an inhibitor layer, wherein the inhibitor layer inhibits the deposition of an atomic layer deposition, and wherein the passivation gas source provides a passivation gas for removing the inhibitor layer.

33. The apparatus, as recited in claim 32, wherein at step a a first bias is provided that causes the inhibitor layer to be deposited to a first depth into features and wherein when step a is repeated a second bias is created that causes the inhibitor layer to be deposited to a second depth into the features, wherein the first bias is greater than the second bias and wherein the first depth is greater than the second depth.

34. The apparatus, as recited in claim 18, further comprising a high-frequency RF source electrically connected to the substrate support, wherein the high-frequency RF source provides an RF signal with a frequency in a range of 10 MHz to 100 MHz to the substrate support.

35. An apparatus, comprising:

a process chamber;

a precursor gas source;

a reactant gas source;

an inhibitor gas source;

a passivation gas source;

a gas inlet, in fluid connection with the process chamber; and

a switching manifold, wherein the switching manifold in a first position provides a fluid connection between the inhibitor gas source and the gas inlet, wherein the switching manifold in a second position provides a fluid connection between the precursor gas source and the gas inlet, wherein the switching manifold in a third position provides a fluid connection between the reactant gas source and the gas inlet, wherein the switching manifold in a fourth position provides a fluid connection between the passivation gas source and the gas inlet; and wherein the switching manifold prevents the gas inlet from being in fluid connection with at least two of the precursor gas source, the reactant gas source, the passivation gas source, and the inhibitor gas source at a same time.