CLAIMS

1. A method for etching using atomic layer etching in a plasma processing chamber of a plasma processing system, said plasma processing chamber having at least one plasma generating source and at least a gas source for providing a process gas into an interior region of said plasma processing chamber, comprising providing a plurality of cycles, wherein each cycle comprises:

flowing a first gas comprising a reactant gas and an inert gas into said processing chamber;

providing a first RF signal to form the first gas into a first plasma;

stopping the flow of the first gas into the processing chamber;

flowing a second gas into the processing chamber, wherein the second gas consists essentially of the inert gas;

providing a second RF signal different from the first RF signal to form the second gas into a second plasma; and

stopping the flow of the second gas into said processing chamber.

2. The method, as recited in claim 1, further comprising stabilizing the first plasma formed from the first gas.

3. The method, as recited in claim 2, wherein each cycle further comprises flowing a third gas into said processing chamber and stopping the flow of the third gas into said processing chamber.

4. The method, as recited in claim 3, wherein the third gas has a reactant gas to inert gas ratio that is different from the ratio of reactant gas to inert gas for the first gas and the second gas.

5. The method, as recited in claim 4, wherein the flowing the second gas is provided after the stopping the flow of the first gas.

6. The method, as recited in claim 5, wherein the second RF signal has an RF signal of a different frequency than the first RF signal, and wherein the frequency of the first RF signal and the frequency of the second RF signal are predetermined.

7. The method, as recited in claim 5, wherein the first gas has a different pressure than the second gas.

8. The method, as recited in claim 7, wherein the steps of stopping the flow of the first gas and the flowing of the second gas, comprise stopping the flow of the reactant gas while maintaining the flow of the inert gas.

9. The method, as recited in claim 1, wherein each cycle further comprises flowing a third gas into said processing chamber and stopping the flow of the third gas into said processing chamber.

10. The method, as recited in claim 9, wherein the third gas has a reactant gas to inert gas ratio that is different from the ratio of reactant gas to inert gas for the first gas and the second gas.

11. The method, as recited in claim 1, wherein the flowing the second gas is provided after the stopping the flow of the first gas.

12. The method, as recited in claim 1, wherein the second RF signal has an RF signal of a different frequency than the first RF signal, and wherein the frequency of the first RF signal and the frequency of the second RF signal are predetermined.

13. The method, as recited in claim 1, wherein the first gas has a different pressure than the second gas.

14. The method, as recited in claim 1, wherein the steps of stopping the flow of the first gas and the flowing of the second gas, comprise stopping the flow of the reactant gas while maintaining the flow of the inert gas.

15. The method, as recited in claim 1, wherein the first gas is formed by mixing a flow of the reactant gas with a flow of the inert gas.

16. The method, as recited in claim 15, wherein the flow of the reactant gas and the flow of the inert gas are mixed prior to flowing into the gas chamber, such that the resulting mixture is flowed into the gas chamber.

17. The method as recited in claim 15, wherein the second gas is formed by stopping the flow of the reactant gas without stopping the flow of the inert gas.

18. The method, as recited in claim 17, further comprising the step of increasing the flow of the inert gas to compensate at least partially for the pressure stop caused by stopping the flow of the reactant gas.

19. The method, as recited in claim 1, wherein a ratio of the amount of inert gas to reactant gas in the first gas is at least 1:9.

20. The method, as recited in claim 1, wherein the ratio of the amount of inert gas to reactant gas in the first gas is at least 3:7.