CLAIMS

1. A method for etching a substrate in a plasma processing chamber having at least a primary plasma generating region and a secondary plasma generating region separated from said primary plasma generating region by a semi-barrier structure, comprising:

providing a primary feed gas into said primary plasma generating region, wherein the primary feed gas is provided to said primary plasma generating region from outside the plasma processing chamber;

providing a secondary feed gas into said secondary plasma generating region, said secondary feed gas being different from said primary feed gas;

generating a primary plasma from said primary feed gas;

generating a secondary plasma from said secondary feed gas;

etching said substrate using at least said primary plasma and neutral species from said secondary plasma, said neutral species migrating from said secondary plasma generating region to said primary plasma generating region across said semi-barrier structure, wherein said semi-barrier structure provides a barrier to the transfer of charged particles and plasma from the primary plasma generating region to the secondary plasma generating region.

2. The method of claim 1 wherein said etching is a dielectric etch.

3. The method of claim 1 wherein a pressure in said secondary plasma generating region is greater than a pressure in said primary plasma generating region.

4 The method of claim 1 wherein said secondary feed gas is a non-polymer forming gas.

5. The method of claim 1 further comprising setting input parameters for said secondary plasma generating region to emphasize dissociation of said secondary feed gas, wherein said secondary feed gas includes H_2.

6. The method of claim 5 wherein said primary feed gas includes at least one of CF_4, C_xF_y, and CH_xF_y where x and y are integer values.

7. The method of claim 1 further comprising setting input parameters for said secondary plasma generating region to emphasize dissociation of said secondary feed gas, wherein said secondary feed gas includes at least one of O_2, N_2 and NF_3.

8. The method of claim 7 wherein said primary feed gas includes at least one of argon and a fluorocarbon-containing gas.

9. The method of claim 1 further comprising setting input parameters for said secondary plasma generating region to emphasize dissociation of said secondary feed gas, wherein said secondary feed gas includes at least one of argon and N_2.

10. The method of claim 9 wherein said primary feed gas includes at least one of argon, O_2, and a fluorocarbon-containing gas.

11. The method of claim 1 further comprising setting input parameters for said secondary plasma generating region to emphasize dissociation of said secondary feed gas, wherein said secondary feed gas includes N_2.

12. The method of claim 9 wherein said primary feed gas includes CO_2.

13. The method of claim 1 further comprising setting input parameters for said secondary plasma generating region to emphasize dissociation of said secondary feed gas, wherein said secondary feed gas includes H_2 and wherein said primary feed gas includes N_2.

14. A method for etching a substrate in a plasma processing chamber having at least a primary plasma generating region and a secondary plasma generating region separated from said primary plasma generating region by a semi-barrier structure, comprising:

providing a primary feed gas into said primary plasma generating region;

providing a secondary feed gas into said secondary plasma generating region, said secondary feed gas being different from said primary feed gas;

generating a primary plasma from said primary feed gas;

generating a secondary plasma from said secondary feed gas;

etching said substrate using at least said primary plasma and neutral species from said secondary plasma, said neutral species migrating from said secondary plasma generating region to said primary plasma generating region across said semi-barrier structure;

thereafter turning off a power source to said primary plasma generating region, thereby inhibiting formation of said primary plasma;

providing another secondary feed gas into said secondary plasma generating region to generate another secondary plasma;

thereafter performing downstream plasma processing on said substrate using species from said another secondary plasma after said species from said another secondary plasma migrates across said barrier structure.

15. The method of claim 14 wherein said etching represents a dielectric etch.

16. The method of claim 15 wherein said another secondary feed gas includes H_2.

17. The method of claim 14 further comprising setting input parameters for said secondary plasma generating region to emphasize dissociation of at least one of said secondary feed gas and said another secondary feed gas.

18. The method of claim 14 wherein said downstream plasma processing represents deflourination.

19. A method for etching a substrate in a plasma processing chamber having at least a primary plasma generating region and a secondary plasma generating region separated from said primary plasma generating region by a semi-barrier structure, comprising:

providing a primary feed gas into said primary plasma generating region, wherein the primary feed gas is provided to said primary plasma generating region from outside the plasma processing chamber;

providing a secondary feed gas into said secondary plasma generating region, said secondary feed gas being different from said primary feed gas;

generating a primary plasma from said primary feed gas, ~~said generating~~ said primary plasma employing a capacitively coupling mechanism;

generating a secondary plasma from said secondary feed gas; and

etching said substrate using at least said primary plasma and neutral species from said secondary plasma, said neutral species migrating from said secondary plasma generating region to said primary plasma generating region across said semi-barrier structure, said semi-barrier structure providing a barrier to the transfer of charged particles and plasma from the primary plasma generating region to the secondary plasma generating region.

20. The method of claim 19 wherein said generating said secondary plasma ~~employing~~ employs a capacitively coupling mechanism.

21. The method of claim 19 wherein said semi-barrier structure includes a set of holes, each hole in said set of holes having a high aspect ratio configured to inhibit the formation of a plasma in said each hole.

22. The method of claim 1, wherein said neutral species migrating from said secondary plasma generating region to said primary plasma generating region across said semi-barrier structure are uniformly distributed over said substrate.

23. The method of claim 1, wherein an array of holes in the semi-barrier structure is uniformly distributed over said substrate.