CLAIMS

1. A method for etching a layer on a substrate in a semiconductor processing chamber, comprising:

introducing a first gas into said chamber, said first gas being an etchant gas suitable for etching said layer;

allowing said first gas to be present in said chamber for a period of time sufficient to cause adsorption of at least some of said first gas into said layer;

substantially replacing said first gas in said chamber with an inert gas;

generating metastables by forming a plasma from said inert gas;

allowing the metastables to traverse a separating plate structure while migrating from said plasma to said layer, the separating plate structure having a plurality of holes configured to substantially prevent migration of plasma charged species to said layer; and

etching said layer with said metastables;

wherein said separating plate structure comprises of at least two plates that are arranged parallel to the substrate and that are electrically insulated from one another, said two plates having different voltage potentials during said etching.

2. The method of claim 1 wherein said metastables also traverse a collimator plate while migrating from said plasma to said layer, wherein said collimator plate is disposed between said substrate and said separating plate structure.

3. The method of claim 1 further comprising moving at least one of said separating plate structure and said substrate relative to one another during said etching with said metastables.

4. The method of claim 1 wherein said etchant gas contains at least a halogen and said layer contains Si.

5. The method of claim 1 wherein said period of time is between about 0.05 second to about 180 seconds.

6. The method of claim 1 wherein said generating said metastables is performed after at least about 80% of said first gas in said chamber is replaced with said inert gas.

7. A substrate processing system having a substrate processing chamber for etching a layer on a substrate, comprising:

a chuck upon which said substrate is disposed during said etching;

a separating plate structure separating said chamber into a plasma generating region and a substrate processing region;

a plasma source for generating a plasma in said plasma generating region; and

logic for:

introducing a first gas into said chamber, said first gas being an etchant gas suitable for etching said layer,

allowing said first gas to be present in said chamber for a period of time sufficient to cause adsorption of at least some of said first gas into said layer,

substantially replacing said first gas in said chamber with an inert gas,

generating metastables by forming the plasma in said plasma generating region from said inert gas,

allowing the metastables to traverse the separating plate structure while migrating from said plasma to said layer, the separating plate structure having a plurality of holes configured to substantially prevent migration of plasma charged species to said layer; and

etching said layer with said metastables:

wherein said separating plate structure comprises of at least two plates that are arranged parallel to said substrate and that are electrically insulated from one another, said two plates having different voltage potentials during said etching.

8. The substrate processing system of claim 7 further comprising a collimator plate, wherein said metastables also traverse said collimator plate while migrating

from said plasma to said layer, wherein said collimator plate is disposed between said substrate and said separating plate structure.

9. The substrate processing system of claim 7 further comprising actuating arrangement for moving at least one of said separating plate structure and said substrate relative to one another during said etching with said metastables.

10. The substrate processing system of claim 7 wherein said etchant gas contains at least a halogen and said layer contains Si.

11. The substrate processing system of claim 7 wherein said period of time is between about 0.05 second to about 180 seconds.

12. The substrate processing system of claim 7 wherein said generating said metastables is performed after at least about 90% of said first gas in said chamber is replaced with said inert gas.

13. A substrate processing system having a substrate processing chamber for etching a layer on a substrate, said substrate processing chamber having a plasma generating region and a substrate processing region, said plasma generating region being separated from said substrate processing region by a separating plate structure, comprising:

a plasma source for generating a plasma in said plasma generating region; and

logic for:

introducing a first gas into said substrate processing region of said chamber, said first gas being an etchant gas suitable for etching said layer,

allowing said first gas to be present in said substrate processing region of said chamber for a period of time sufficient to cause adsorption of at least some of said first gas into said layer while maintaining a pressure of said inert gas in said plasma generating

region is greater than a pressure of said etchant gas in said substrate processing region,

replacing at least 80% of said first gas in said substrate processing region of said chamber with said inert gas after said period of time expires,

generating the plasma in said plasma generating region of said chamber to generate metastables from said inert gas,

allowing the metastables to traverse the separating plate structure while migrating from said plasma to said layer, the separating plate structure having a plurality of holes configured to substantially prevent migration of plasma charged species to said layer; and

etching said layer with said metastables while maintaining a pressure in said substrate processing region below 10 mTorr;

wherein said separating plate structure comprises of at least two plates that are arranged parallel to said substrate and that are electrically insulated from one another, said two plates having different voltage potentials during said etching.

14. The substrate processing system of claim 13 wherein said metastables also traverse a collimator plate while migrating from said plasma to said layer, wherein said collimator plate is disposed between said substrate and said separating plate structure.

15. The substrate processing system of claim 13 wherein said separating plate structure is configured for preventing migration of at least 60% of plasma charged species generated in said plasma generating region from reaching said layer.