

Claims:

1. A method of etching a film on a bevel edge of a substrate in a plasma etching chamber, comprising:

providing the substrate on a substrate support in the plasma etching chamber, the plasma etching chamber having a top edge electrode and a bottom edge electrode disposed to surround the substrate support;

positioning a gas delivery plate in the plasma processing chamber at a distance of less than about 0.6 mm from the substrate support;

flowing an etching process gas through a plurality of edge gas feeds disposed along a periphery of the gas delivery plate, the periphery of the gas deliver plate being oriented above the substrate support and the bevel edge of the substrate, the flowing further directed to a space between the top edge electrode and bottom edge electrode;

flowing a tuning gas through a center gas feed of the gas delivery plate, the tuning gas directed over a center region of the substrate so as to flow away from the center region and toward the bevel edge of the substrate and mix with the etching process gas; and

applying RF power to one of the top or bottom edge electrodes, the applied power acting to strike a plasma to etch the film of the bevel edge of the substrate;

wherein the flown etching process gas through the plurality of edge gas feeds includes NF_3 and CO_2 , and the tuning gas includes at least one of nitrogen (N_2), argon (Ar), and helium (He) flown from the center gas feed.

2. The method of claim 1, further comprising, arranging a distance between the top and bottom edge electrodes to be less than about 1.5 cm.

3. The method of claim 1, wherein the tuning gas is provided with flow rate of between about 300 sccm and about 750 sccm.

4. The method of claim 1, wherein the tuning gas is provided as a mixture of two or more of N_2 , Ar, and He, setting the mixture provides for tuning an etching profile at the bevel edge of substrate.

5. The method of claim 1, wherein the film is one of a dielectric film, or a metal film, or a photoresist film, or a semiconductor film, or a combination thereof.

6. A method of etching a film on a bevel edge of a substrate in a plasma etching chamber, comprising:

providing the substrate on a substrate support in the plasma etching chamber, the plasma etching chamber having a top edge electrode and a bottom edge electrode disposed to surround the substrate support;

positioning a gas delivery plate in the plasma processing chamber at a distance of less than about 0.6 mm from the substrate support;

flowing an etching process gas through a plurality of edge gas feeds disposed along a periphery of the gas delivery plate, the periphery of the gas deliver plate being oriented above the substrate support and the bevel edge of the substrate, the flowing further directed to a space between the top edge electrode and bottom edge electrode;

flowing a tuning gas through a center gas feed of the gas delivery plate, the tuning gas directed over a center region of the substrate so as to flow away from the center region and toward the bevel edge of the substrate and mix with the etching process gas; and

applying RF power to one of the top or bottom edge electrodes, the applied power acting to strike a plasma to etch the film of the bevel edge of the substrate;

wherein the film is a dielectric material and the etching process gas includes NF_3 and CO_2 , and the tuning gas includes at least one of nitrogen (N_2), argon (Ar), and helium (He).

7. The method of claim 6, wherein the film is one of a dielectric film, or a metal film, or a photoresist film, or a semiconductor film, or a combination thereof.

8. A method of etching a film on a bevel edge of a substrate in a plasma etching chamber, comprising:

providing the substrate on a substrate support in the plasma etching chamber, the plasma etching chamber having a top edge electrode and a bottom edge electrode disposed to surround the substrate support;

positioning a gas delivery plate in the plasma processing chamber at a distance of less than about 0.6 mm from the substrate support;

flowing an etching process gas through a plurality of edge gas feeds disposed along a periphery of the gas delivery plate, the periphery of the gas deliver plate being oriented above the substrate support and the bevel edge of the substrate, the flowing further directed to a space between the top edge electrode and bottom edge electrode;

flowing a tuning gas through a center gas feed of the gas delivery plate, the tuning gas directed over a center region of the substrate so as to flow away from the center region and toward the bevel edge of the substrate and mix with the etching process gas; and

applying RF power to one of the top or bottom edge electrodes, the applied power acting to strike a plasma to etch the film of the bevel edge of the substrate, wherein,

the etching process gas provided from the edge gas feeds includes NF_3 and CO_2 , and

adjusting a flow rate of CO_2 .

9. The method of claim 8, further including N_2 as an additional non-reactive gas supplied from the center feed.

10. The method of claim 8, wherein the film is one of a dielectric film, or a metal film, or a photoresist film, or a semiconductor film, or a combination thereof.

11. The method of claim 8, wherein adjusting the flow rate of CO_2 up increases etch rate in the bevel edge closer to an edge of the substrate.

12. The method of claim 11, wherein the flow rate of CO_2 is adjusted between 200 sccm to 500 sccm.