CLAIMS

1. A processing method comprising:

forming a plasma of a silicon-containing precursor, wherein the plasma of the silicon-containing precursor is formed at a first power level from a plasma power source;

depositing a film on a semiconductor substrate with plasma effluents of the silicon-containing precursor, wherein the film comprises amorphous silicon, wherein the semiconductor substrate is housed in a processing region of a semiconductor processing chamber, wherein the semiconductor substrate defines a feature within the semiconductor substrate, wherein the processing region is at least partially defined between a faceplate and a substrate support on which the semiconductor substrate is seated, and wherein a bias power is applied to the substrate support from a bias power source;

forming a plasma of a hydrogen-containing precursor within the processing region of the semiconductor processing chamber, wherein the plasma of the hydrogen-containing precursor is formed at a second power level from the plasma power source, and wherein a bias power is applied to the substrate support from the bias power source at a third power level greater than the second power level; and

etching the film from a sidewall of the feature within the semiconductor substrate with plasma effluents of the hydrogen-containing precursor.

2. The processing method of claim 1, wherein the feature within the semiconductor substrate is characterized by an aspect ratio of greater than or about 5:1, and wherein the feature is characterized by a width across the feature of less than or about 10 nm.

3. The processing method of claim 1, wherein the bias power source is operated in a pulsing mode at a pulsing frequency of less than or about 1 kHz during both the depositing and the etching.

4. The processing method of claim 3, wherein the plasma power source is operated in a continuous wave mode while the bias power source is operated in the pulsing mode during the etching.

5. The processing method of claim 3, wherein the bias power source is operated at a duty cycle of less than or about 50% during both the depositing and the etching.

6. The processing method of claim 1, wherein the bias power source is engaged subsequent to engagement of the plasma power source.

7. The processing method of claim 1, further comprising:

densifying the film during depositing, during etching, or both, wherein the densifying comprises reducing a hydrogen content of the film to less than or about 30 at.%.

8. The processing method of claim 1, further comprising:

subsequent to the etching, forming a plasma of a conversion precursor; and

converting the film to a modified film.

9. The processing method of claim 8, wherein the conversion precursor comprises a nitrogen-containing precursor, an oxygen-containing precursor, or a carbon-containing precursor.

10. The processing method of claim 8, wherein the method is repeated in a second cycle.

11. A processing method comprising:

forming a plasma of a silicon-containing precursor and a hydrogen-containing precursor, wherein the plasma of the silicon-containing precursor is formed at a first power level from a plasma power source;

depositing a film on a semiconductor substrate with plasma effluents of the silicon-containing precursor, wherein the semiconductor substrate is housed in a processing region of a semiconductor processing chamber, wherein the semiconductor substrate defines a feature within the semiconductor substrate, wherein a bias power is applied to a substrate support from a bias power source, wherein the film comprises amorphous silicon, and wherein plasma effluents of the hydrogen-containing precursor densify the film along a bottom and a top of the feature;

forming a plasma of a hydrogen-containing precursor within the processing region of the semiconductor processing chamber, wherein the plasma of the hydrogen-containing precursor is formed at a second power level from the plasma power source, and wherein a bias power is applied from the bias power source to the plasma of the hydrogen-containing precursor at a third power level; and

etching the film from a sidewall of the feature defined within the semiconductor substrate with plasma effluents of the hydrogen-containing precursor.

12. The processing method of claim 11, wherein the plasma power source providing the second power level is operated continuously while the bias power source is operated in a pulsing mode at a frequency of less than or about 1 kHz during the etching.

13. The processing method of claim 12, wherein the bias power source is operated at a duty cycle of less than or about 25% during each of the depositing and the etching.

14. The processing method of claim 11, wherein the etching fully removes the film from the sidewall of the feature above a base fill of the feature.

15. The processing method of claim 11, further comprising:

subsequent to the etching, forming a plasma of a conversion precursor; and

converting the film to a modified film.

16. The processing method of claim 15, wherein the conversion precursor comprises a nitrogen-containing precursor, an oxygen-containing precursor, or a carbon-containing precursor.

17. The processing method of claim 16, wherein the modified film comprises silicon nitride, silicon oxide, or silicon carbide.

18. A processing method comprising:

forming a plasma of a silicon-containing precursor utilizing a pulsed source power and a pulsed bias power;

depositing a film on a semiconductor substrate with plasma effluents of the silicon-containing precursor, wherein the semiconductor substrate is housed in a processing region of a semiconductor processing chamber, wherein the semiconductor substrate defines a feature within the semiconductor substrate, and wherein the film comprises amorphous silicon;

forming a plasma of a hydrogen-containing precursor within the processing region of the semiconductor processing chamber utilizing the pulsed source power and the pulsed bias power;

etching the film from a sidewall of the feature defined within the semiconductor substrate with plasma effluents of the hydrogen-containing precursor;

forming a plasma of a conversion precursor within the processing region of the semiconductor processing chamber; and

converting the film to a modified film.

19. The processing method of claim 18, wherein the modified film comprises silicon and one or more of nitrogen, oxygen, or carbon.

20. The processing method of claim 18, wherein the depositing, etching, and converting are performed in the same processing region of the semiconductor processing chamber.