CLAIMS

1. A method of fabricating a semiconductor substrate, the method comprising:

(a) vertical etching a feature having sidewalls and a depth into one or more layers formed on the semiconductor substrate; and

(b) depositing an amorphous carbon liner onto the sidewalls of the feature.

2. The method of claim 1, further comprising iterating (a), wherein with each iteration of (a), the depth of the feature is vertical etched deeper into the one or more layers, while the amorphous carbon liner resists lateral etching of the sidewalls of the feature.

3. The method of claim 2, further comprising iterating (b), wherein with each iteration of (b), the deposited amorphous carbon liner on the sidewalls of the feature is replenished.

4. A tool for fabricating a semiconductor substrate, the tool including a controller arranged to control in a processing chamber a deposition of an amorphous carbon liner onto sidewalls of a feature having a depth vertically etched into one or more layers formed on the semiconductor substrate.

5. The tool of claim 4, wherein the controller is further arranged to control in a processing chamber two or more iterations of the deposition to replenish the amorphous carbon liner following one or more etch iterations to deepen the depth of the feature vertically etched into the one or more layers formed on the semiconductor substrate.

6. The tool of claim 4, wherein the controller is further configured to control operation of the tool to optionally perform one or more iterations of the deposition of the amorphous carbon liner onto the sidewalls of the etched feature following one or more vertical etches to deepen the feature,

wherein the one or more vertical etches are performed in a separate substrate processing tool.

7. A method for fabricating a semiconductor substrate, the method comprising:

(i) depositing an amorphous carbon material forming a liner onto sidewalls of a feature vertically etched into one or more layers on a semiconductor substrate; and

(ii) at least partially simultaneous etching, during the deposition of the amorphous carbon material, excess deposits of the amorphous carbon material

~~depositing in a hole defining the feature and upper regions of the sidewalls of the feature.~~

~~8. The method of claim 7, further comprising controlling the at least partial simultaneous deposition and etching so that the amorphous carbon material forming the liner is more uniform in thickness from a bottom of the vertically etched feature to the upper regions of the sidewalls of the feature, wherein the more uniformity in thickness is relative to a lack of uniformity of the thickness of the liner had the etch not been performed.~~

~~9. The method of claim 7, further comprising controlling the at least partial simultaneous deposition and etch so that "pinch off" of excess amorphous carbon material in an opening defining the feature is either delayed or prevented from occurring by the at least partially simultaneous etch during the deposition, wherein pinch off is defined as a complete or partial blockage of the opening.~~

1~~0~~. A method of fabricating a semiconductor substrate, the method comprising:

(a) vertically etching a feature having an opening, sidewalls and a depth into one or more layers formed on the semiconductor substrate;

(b) depositing a liner material onto the sidewalls of the feature; and

(c) performing an etch of a carbon mask used to define the opening of the feature, the etch:

(i) removing excess deposits of the liner material that has collected in the opening of the feature defined by the carbon mask; and

(ii) shaping the carbon mask in the vicinity of the opening of the feature.

~~11~~2. The method of claim 1~~0~~, further comprising iterating (a), (b) and (c) two or more times until the feature has reached a desired depth into the one or more layers formed on the semiconductor substrate.

~~12~~3. The method of claim 1~~0~~, further comprising performing (b) and (c) in a same chamber of a substrate processing tool.

~~13~~4. A substrate processing tool, comprising:

a processing chamber;

a substrate holder for holding a substrate within the processing chamber;

a controller for controlling operation of the substrate processing tool during processing of the substrate, the controller arranged to control the substrate processing tool to:

(a) deposit a carbon liner on sidewalls of a feature (i) etched into the substrate and (ii) defined by an opening in a carbon mask; and

(b) etch the carbon mask to (iii) shape the carbon mask and (iv) remove from the opening incidental material deposited for the carbon liner.

~~14~~5. The substrate processing tool of claim ~~13~~4, wherein the etch of the carbon mask is performed to shape the carbon mask so that it is tapered from wide to narrow toward the feature.

~~15~~6. The substrate processing tool of claim ~~13~~4, wherein the controller is further configured to control an etching environment within the processing chamber so that the carbon mask and the opening are etched, while the carbon liner on the sidewalls of the feature are substantially not etched.

~~16. A method for fabricating a semiconductor substrate, comprising:~~

~~fabricating a vertical feature into one or more layers formed on a substrate, the vertical feature having an opening, sidewalls and a depth; and~~

~~depositing amorphous carbon onto the side walls of the vertical feature and within the opening, the amorphous carbon deposited in the opening forming an amorphous carbon plug in the opening of the vertical feature.~~

~~17. The method of claim 16, further comprising depositing the amorphous carbon on the sidewalls of the vertical feature so that the amorphous carbon is thinner near the depth of the vertical feature and thicker near the opening of the vertical feature.~~

~~18. The method of claim 16, further comprising depositing additional amorphous carbon over the amorphous carbon plug formed in the opening of the vertical feature and on surface area of the one or more layers surrounding the vertical feature.~~

~~19. A method performed within a substrate processing chamber, the method comprising:~~

~~fabricating a vertical feature formed on a substrate in the processing chamber, the vertical feature having an opening, side walls and a predetermined depth; and~~

depositing amorphous carbon material on the substrate in the processing chamber, the amorphous carbon material deposited on the side walls of the feature and forming a plug within the opening of the vertical feature.

20. The method of claim 19, wherein fabricating the vertical feature further comprises (a) vertically etching the feature, (b) depositing an amorphous carbon layer on the sidewalls of the feature and (c) iterating (a) and optionally (b) one or more times until the vertical feature has reached the predetermined depth, wherein the deposition of the amorphous carbon layer during each iteration of (b) mitigates horizontal etching of the feature during a subsequent iteration of (a).