Claims

1. A method for forming a semiconductor structure, the method comprising:

forming a plurality of openings in a substrate, wherein the plurality of openings extend from a surface of the substrate into the substrate, wherein each of the plurality of openings is at least partially defined by a side wall and comprises a portion closer to the surface of the substrate and another portion further away from the surface of the substrate, and wherein a diameter or lateral dimension of at least one of the plurality of openings increases with distance from the surface of the substrate such that the portion closer to the surface of the substrate of said at least one of the plurality of openings is narrower than the other portion further away from the surface of the substrate of said at least one of the plurality of openings; and

annealing the substrate after forming the plurality of openings, thereby forming a buried cavity and a membrane over the buried cavity, the buried cavity having a height greater than 3 μm and greater than a thickness of the membrane;

wherein the diameter or lateral dimension of said at least one of the plurality of openings increases monotonically with distance from the surface of the substrate.

2. The method of claim 1,

wherein each of the plurality of openings comprises a bottom surface such that the side wall extends between the surface of the substrate and the bottom surface.

3. The method of claim 2,

wherein the bottom surface of each of the plurality of openings and a cross-sectional area of each of the plurality of openings at the surface of the substrate are of a circular, hexagonal or square shape.

4. The method of claim 2,

wherein the bottom surface has a size at least 1.5 times greater than a size of the opening at the surface of the substrate.

5. The method of claim 1,

wherein the side wall defining said at least one of the plurality of openings forms an angle in a range of greater than 90° to smaller than 120° with respect to the surface of the substrate.

6. The method of claim 1,

wherein a diameter or lateral dimension of one or more remaining openings of the plurality of openings increases with distance from the surface of the substrate.

7. The method of claim 1,

wherein each of the plurality of openings is substantially of a frustum shape.

8. The method of claim 1,

wherein an aspect ratio of a depth of each of the plurality of openings relative to a diameter or lateral dimension of each of the plurality of openings at the surface of the substrate is selected from a range of greater than 13 to smaller than 25.

9. The method of claim 1,

wherein a group of three neighboring openings of the plurality of openings are arranged so as to form an equilateral triangle.

10. The method of claim 1,

wherein a group of four neighboring openings of the plurality of openings are arranged so as to form a square or diamond.

11. The method of claim 1,

wherein the plurality of openings are equally spaced apart.

12. The method of claim 1,

wherein annealing the substrate comprises annealing such that atoms from the substrate migrate to form the membrane.

13. The method of claim 1,

wherein the thickness of the membrane formed is dependent on a depth of the plurality of openings, a diameter or lateral dimension of the plurality of openings, an angle between the surface of the substrate and side walls of the plurality of openings, and a spacing between neighboring openings of the plurality of openings.

14. The method of claim 1,

wherein the height of the buried cavity formed is dependent on a depth of the plurality of openings, a diameter or lateral dimension of the plurality of openings, an angle between the surface of the substrate and the side walls of the plurality of openings, and a spacing between neighboring openings of the plurality of openings.

15. The method of claim 1,

wherein the height of the buried cavity is greater than half of a depth of the plurality of openings.

16. The method of claim 1,

wherein the plurality of openings are formed such that the plurality of openings merge together to form a cavity.

17. The method of claim 1,

wherein a spacing between neighboring openings is equal to or greater than a

diameter or lateral dimension of each of the plurality of openings at the surface of the substrate.

18. The method of claim 1,

wherein the semiconductor structure is a silicon-on-nothing (SON) structure.

19. The method of claim 1,

wherein a portion of the surface of the substrate at least partially defining the membrane is recessed from a remaining portion of the surface of the substrate.

20. A semiconductor structure comprising:

a substrate having a buried cavity and a membrane over the buried cavity;

wherein the buried cavity has a height greater than 3 μm and greater than a thickness of the membrane;

wherein forming the semiconductor structure comprises:

forming a plurality of openings in the substrate, wherein the plurality of openings extend from a surface of the substrate into the substrate, wherein each of the plurality of openings is at least partially defined by a side wall and comprises a portion closer to the surface of the substrate and another portion further away from the surface of the substrate, and wherein a diameter or lateral dimension of at least one of the plurality of openings increases with distance from the surface of the substrate such that the portion closer to the surface of the substrate of said at least one of the plurality of openings is narrower than the other portion further away from the surface of the substrate of said at least one of the plurality of openings; and

annealing the substrate after forming the plurality of openings, thereby forming the buried cavity and the membrane over the buried cavity;

wherein the diameter or lateral dimension of said at least one of the plurality of openings increases monotonically with distance from the surface of the substrate.