WHAT IS CLAIMED IS:

1. A filtration membrane suitable for filtering blood in vivo, the filtration membrane comprising:

a membrane section comprising:

a plurality of nanopores, wherein the plurality of nanopores have at least one lateral dimension in the range of 1 nm to 1000 nm;

a planar first surface;

a ribbed second surface, wherein the planar first surface is opposite the ribbed second surface, the ribbed second surface comprising ribs of a first height and ribs of a second height which is higher than the first height, wherein the ribs of the second height range in height from 20 μm to 100 μm and in thickness from 1 μm to 20 μm;

the ribs of the first height defining a plurality of first windows arranged in a grid pattern, the first windows comprising the plurality of nanopores;

the ribs of the second height defining a plurality of second windows arranged in a grid pattern, each of the plurality of second windows comprising the plurality of first windows; and

a support section forming a third window comprising the plurality of second windows, wherein the support section is attached to the ribbed second surface of the membrane section at a periphery of the membrane section and has a third height higher than the ribs of the second height,

wherein the surface area of the second surface of the membrane enclosed by the third window is in the range of 0.1 mm^2 to 10 mm^2.

2. The filtration device of claim 1, wherein the membrane section is formed from polysilicon, silicon, silicon nitride, silicon carbide, graphene, or diamond, or a combination thereof.

3. The filtration device of claim 1 or 2, wherein the support section comprises a silicon wafer.

4. The filtration device of any one of claims 1-3, wherein the plurality of nanopores have a depth in the range of 10 nm to 1000 nm.

5. The filtration device of any one of claims 1-3, wherein the plurality of nanopores have a depth in the range of 10 nm to 800 nm.

6. The filtration device of any one of claims 1-3, wherein the plurality of nanopores have a depth in the range of 100 nm to 800 nm or 500 nm to 800 nm.

7. The filtration device of any one of claims 1-6, wherein the surface area of the second surface of the membrane enclosed by the third window is in the range of 1 mm^2 to 10 mm^2, 2 mm^2 to 8 mm^2 or 3 mm^2 to 6 mm^2.

8. The filtration device of claim 1, wherein the third window is substantially rectangular in shape.

9. The filtration device of claim 8, wherein the third window has a length of 2000 μm to 5000 μm and a width of 500μm to 1000 μm.

10. The filtration device of claim 8, wherein the third window has a length of 4000 μm to 5000 μm and a width of 1000 μm.

11. The filtration device of any one of claims 1-10, wherein the third height is in the range of 200 μm to 500 μmor 300 μm to 500.

12. The filtration device of any one of claims 1-10, wherein the support section has a thickness of 20 μm to 50 μm or 30 μm to 50 μm.

13. The filtration device of any one of claims 1-12, wherein the ribs of the second height range in height from 20 μm to 80 μm, 20 μm to 50 μm or 30 μm to 50 μm.

14. The filtration device of any one of claims 1-13, wherein the ribs of the second height range in thickness from 5 μm to 20 μm or 5 μm to 15 μm.

15. The filtration device of any one of claims 1-13, wherein the ribs of the first height range in height from 2 μm to 10 μm, 3 μm to 8 μm, or 3 μm to 6 μm.

16. The filtration device of any one of claims 1-15, wherein the ribs of the first height range in thickness from 0.5 μm to 5 μm or 1 μm to 2.5 μm.

17. The filtration device of any one of claims 1-16, wherein the plurality of second windows comprise 50 to 100 second windows.

18. The filtration device of any one of claims 1-17, wherein the plurality of first windows comprise 20 to 50 first windows.

19. The filtration device of any one of claims 1-18, wherein the plurality of nanopores are slit shaped nanopores.

20. The filtration device of claim 19, wherein the slit shaped nanopores have a length of up to 3 μm and a width of up to 0.1 μm or a length of up to 2 μm and a width of up to 50 nm or a length of 1μm to 3 μm and a width of 10 nm to 100 nm.

21. The filtration device of any one of claims 1-20, wherein the nanopores are not present in regions of the membrane section that extend to form ribs and/or are covered by the support section.

22. The filtration device of any one of claims 1-21, wherein the membrane section and support section are connected via an intermediate layer.

23. The filtration device of any one of claims 1-22, comprising a plurality of the filtration units arranged in a side-by-side configuration.

24. A method for generating a biocompatible filtration membrane suitable for filtering blood in vivo, the method comprising:

depositing a first mask in a first pattern on a first surface of a support substrate,

wherein the first pattern exposes areas on the first surface which areas define outlines of a plurality of first rectangles arranged in a grid pattern and a plurality of second rectangles arranged in a grid pattern, wherein the each of the plurality of second rectangles comprise the plurality of first rectangles;

depositing a second mask on the first mask such that the second mask covers the exposed areas on the first surface which areas define outlines of the first rectangular windows and does not cover the exposed areas on the first surface which areas define outlines of the second rectangular windows thereby allowing etching of the first surface to create grooves in the support substrate corresponding to the outlines of the second rectangular windows;

etching the first surface to create the grooves, the grooves having a depth and a thickness;

removing the second mask, wherein the removing the second mask exposes areas on the first surface defining outlines of the plurality of first rectangles;

etching the first surface to increase the depth of the grooves of the plurality of the second rectangles and to create the grooves in the support substrate corresponding to the outlines of the plurality of the first rectangles such that the depth of the grooves for the second rectangles is more than that of the first rectangles;

removing the first mask;

depositing an intermediate layer over the support substrate;

depositing a membrane material to fill the grooves of the first and second rectangles created in the support substrate to create a membrane comprising a planar first surface and a non-planar second surface opposite the first surface, the non-planar second surface comprising a plurality of ribs having a first height corresponding to the depth of the grooves for the first rectangles and a plurality of ribs having a second height corresponding to the depth of the grooves for the second rectangles, wherein the second height is higher than the first height;

creating a pattern of fine grooves in regions of the membrane;

depositing a sacrificial layer on the membrane;

filling the fine grooves with additional membrane material;

removing excess additional membrane material not deposited in the fine grooves;

removing sacrificial layer from the membrane;

removing the intermediate layer and forming a cavity in the second surface of the support structure, wherein the second surface is opposite the first surface to provide:

a plurality of nanopores in the membrane, wherein the plurality of nanopores have at least one lateral dimension in the range of 1 nm to 1000 nm,

a plurality of first windows defined by the plurality of ribs having the first height,

a plurality of second windows defined by the plurality of ribs having the second height, wherein the ribs having the second height range in height from 20 μm to 100 μm and in thickness from 1 μm to 20 μm, wherein each of the plurality of second windows comprise the plurality of first windows, and

a third window having a third height defined by the support structure and formed by the walls of the cavity, wherein the third height is higher than the second height and wherein the third window comprises the plurality of second windows.

25. The method of claim 24, wherein the plurality of nanopores are not located in regions of the membrane that comprise the ribs.

26. The method of claim 24 or 25, wherein the plurality of nanopores are not located in regions of the membrane that are in contact with the support structure.

27. The method of any one of claims 24-26, wherein depositing the first mask and/or the second mask comprises chemical vapor deposition (CVD).

28. The method of any one of claims 24-26, wherein depositing the first mask and/or second mask comprises growing the mask by thermal oxidation.

29. The method of any one of claims 24-28, wherein the membrane is formed from polysilicon, silicon, silicon nitride, silicon carbide, graphene or diamond, or a combination thereof.

30. The method of any one of claims 24-29, wherein the support substrate comprises a silicon wafer.

31. The method of any one of claims 24-30, wherein the plurality of nanopores have a depth in the range of 10 nm to 1000 nm.

32. The method of any one of claims 24-30, wherein the plurality of nanopores have a depth in the range of 10 nm to 800 nm.

33. The method of any one of claims 24-30, wherein the plurality of nanopores have a depth in the range of 100 nm to 800 nm or 500 nm to 800 nm.

34. The method of any one of claims 24-33, wherein the surface area of the backside of the membrane enclosed by the third window is in the range of 1 mm^2 to 10 mm^2, 2 mm^2 to 8 mm^2 or 3 mm^2 to 6 mm^2.

35. The method of any one of claims 24-34, wherein the third window is substantially rectangular in shape.

36. The method of any one of claims 24-35, wherein the third window has a length of 2000 μm to 5000 μm and a width of 500 μm to 1000 μm.

37. The method of any one of claims 24-35, wherein the third window has a length of 4000 μm to 5000 μm and a width of 1000 μm.

38. The method of any one of claims 24-37, wherein the third height is in the range of 200 μm to 500 μm or 300 μm to 500 μm.

39. The method of any one of claims 24-38, wherein the support substrate has a thickness of 20 μm to 50 μm or 30 μm to 50 μm.

40. The method of any one of claims 24-39, wherein the ribs of the second height range in height from 20 μm to 80 μm, 20 μm to 50 μm or 30 μm to 50 μm.

41. The method of any one of claims 24-40, wherein the ribs of the second height range in thickness from 5 μm to 20 μm or 5 μm to 15 μm.

42. The method of any one of claims 24-41, wherein the ribs of the first height range in height from 2 μm to 10 μm, 3 μm to 8 μm, or 3 μm to 6 μm.

43. The method of any one of claims 24-41, wherein the ribs of the first height range in thickness from 0.5 μm to 5 μm or 1 μm to 2.5 μm.

44. The method of any one of claims 24-43, wherein the plurality of second windows comprise 50 to 100 second windows.

45. The method of any one of claims 24-44, wherein the plurality of first windows comprise 20 to 50 first windows.

46. The method of any one of claims 24-45, wherein the plurality of nanopores are slit shaped nanopores.

47. The method of claim 46, wherein the slit shaped nanopores have a length of up to 3 μm and a width of up to 0.1 μm or a length of up to 2 μm and a width of up to 50 nm or a length of 1μm to 3 μm and a width of 10 nm to 100 nm.

48. The method of any one of claims 24-47, wherein the membrane and support substrate are connected via the intermediate layer.