What is claimed is:

1. A microfabricated filtration device comprising:

a planar membrane section comprising a plurality of pores, each pore having a width of less than about 100 nm;

an additional layer of material coupled with the planar membrane section; and

a support section coupled with the additional layer of material along a first surface of the support section, wherein the support section defines a cavity within a second surface of the support section opposite the first surface of the support section, wherein the cavity provides access to a plurality of recesses defined within the support section and the additional layer of material, wherein the plurality of recesses provide access to the plurality of pores, and wherein the plurality of recesses are separated from one another by dividers comprising portions of the support section and additional layer of material coupled with the planar membrane.

2. The microfabricated filtration device of claim 1, wherein the dividers comprise a thickness of between about 10 μm and about 100 μm.

3. The microfabricated filtration device of claim 2, wherein the dividers comprise a thickness of between about 20 μm and about 50 μm.

4. The microfabricated filtration device of claim 1, wherein the additional layer of material comprises a dielectric material.

5. A method of using a microfabricated filtration device, the method comprising:

delivering a fluid to a filtration device, the filtration device including:

a planar membrane section comprising a plurality of pores, each pore having a width of less than about 100 nm,

an additional layer of material coupled with the planar membrane section, and

a support section coupled with the additional layer of material along a first surface of the support section, wherein the support section defines a cavity within a second surface of the support section opposite the first surface of the support

section, wherein the cavity provides access to a plurality of recesses defined within the support section and the additional layer of material, wherein the plurality of recesses provide access to the plurality of pores, and wherein the plurality of recesses are separated from one another by dividers comprising portions of the support section and additional layer of material coupled with the planar membrane;

flowing the fluid over the planar membrane section to produce a filtered fluid; and

delivering the filtered fluid from the filtration device.

6. The method of claim 5, wherein the filtration device further includes a first channel in fluid communication with the membrane section of the filtration device, and a second channel in fluid communication with the support section of the filtration device.

7. The method of claim 6, further comprising:

flowing the first fluid through the first channel in a first direction of flow;

flowing a second fluid through the second channel in a direction of flow that is counter-current to the first direction of flow;

transporting solutes across the membrane section between the first fluid and the second fluid.

8. The method of claim 7, further comprising:

pumping the first and second fluid through the filtration device to maintain equal pressure across the membrane section of the filtration device.

9. The method of claim 8, further comprising:

incorporating an additional material into the first fluid prior to delivering the fluid to the filtration device.

10. The microfabricated filtration device of claims 1 or 6, wherein the pores are characterized by a rectangular shape, having a width of less than 10 nm.

11. The microfabricated filtration device of claims 1 or 6, wherein the membrane comprises polysilicon.

12. The microfabricated filtration device of claims 1 or 6, wherein the recesses are characterized by a width between dividers of 60 μm and a height of 120 μm.

Claims

1. A microfabricated filtration device comprising:
a planar membrane section comprising a plurality of slit-shaped pores, each pore having a width of less than about 100 nm; an additional layer of material coupled with the planar membrane section; and a support section coupled with the additional layer of material along a first surface of the support section, wherein the support section defines a cavity within a second surface of the support section opposite the first surface of the support section, wherein the cavity provides access to a plurality of recesses defined within the support section and the additional layer of material, wherein the plurality of recesses provide access to the plurality of pores, and wherein the plurality of recesses are separated from one another by dividers comprising portions of the support section and additional layer of material coupled with the planar membrane, wherein the cavity comprises a wall that extends towards the plurality of recesses, terminates at a distance from the additional layer and forms a divider that is continuous with the wall.

2. The microfabricated filtration device of claim 1, wherein the dividers comprise a height of between about 10 μm and about 100 μm.

3. The microfabricated filtration device of claim 2, wherein the dividers comprise a height of between about 20 μm and about 50 μm.

4. The microfabricated filtration device of claim 1, wherein the additional layer of material comprises a dielectric material.

5. A method of using a microfabricated filtration device, the method comprising:
delivering a fluid to a filtration device, the filtration device including:
a planar membrane section comprising a plurality of slit-shaped pores, each pore having a width of less than about 100 nm, an additional layer of material coupled with the planar membrane section, and a support section coupled with the additional layer of material along a first surface of the support section, wherein the support section defines a cavity within a second surface of the support section opposite the first surface of the support section, wherein the cavity provides access to a plurality of recesses defined within the support section and the additional layer of material, wherein the plurality of recesses provide access to the plurality of pores, and wherein the plurality of recesses are separated from one another by dividers comprising portions of the support section and additional layer of material coupled with the planar membrane, wherein the cavity comprises a wall that extends towards the plurality of recesses, terminates at a distance from the additional layer and forms a divider that is continuous with the wall; flowing the fluid over the planar membrane section to produce a filtered fluid; and delivering the filtered fluid from the filtration device.

6. The method of claim 5, wherein the filtration device further includes a first channel in fluid communication with the membrane section of the filtration device, and a second channel in fluid communication with the support section of the filtration device.

7. The method of claim 6, further comprising: flowing the first fluid through the first channel in a first direction of flow; flowing a second fluid through the second channel in a direction of flow that is counter-current to the first direction of flow;
transporting solutes across the membrane section between the first fluid and the second fluid.

8. The method of claim 7, further comprising: pumping the first and second fluid through the filtration device to maintain equal pressure across the membrane section of the filtration device.

9. The method of claim 8, further comprising: incorporating an additional material into the first fluid prior to delivering the fluid to the filtration device.

10. The microfabricated filtration device of claims 1 or 5, wherein the pores have a width of less than 10 nm.

11. The microfabricated filtration device of claims 1 or 5, wherein the membrane comprises polysilicon.

12. The microfabricated filtration device of claims 1 or 5, wherein the recesses are characterized by a width between dividers of 60 μm and a length of 120 μm.