CLAIM(S):

1. A microfiltration membrane comprising

(a) an asymmetric polymeric layer,

(b) an isometric polymeric layer, and

(c) an interface polymeric layer between the asymmetric layer and the isometric layer, the interface layer having a first portion contacting the asymmetric layer and a second portion contacting the isometric layer;

wherein,

(i) the asymmetric layer has a region contacting the first portion of the interface layer, the region including cells having a first pore diameter;

(ii) the isometric layer has a region contacting the second portion of the interface layer, the region including cells having a second pore diameter;

the first pore diameter being larger than the second pore diameter; and the first portion of the interface layer comprises cells having the first pore diameter, and the second portion of the interface layer comprises cells having the second pore diameter.

2. The membrane of claim 1, wherein the asymmetric layer has an asymmetry of about 2 or more.

3. A microfiltration membrane comprising

(a) a first asymmetric polymeric layer, the first asymmetric polymeric layer having a first asymmetry ratio,

(b) a second asymmetric polymeric layer, the second asymmetric polymeric layer having a second asymmetry ratio, wherein the second asymmetry ratio is greater than the first asymmetry ratio; and

(c) an interface polymeric layer between the first asymmetric layer and the second asymmetric layer, the interface layer having a first portion contacting the first asymmetric layer and a second portion contacting the second asymmetric layer;

wherein,

(i) the first asymmetric layer has a region contacting the first portion of the interface layer, the region including cells having a first pore diameter;

(ii) the second asymmetric layer has a region contacting the second portion of the interface layer, the region including cells having a second pore diameter;

the first pore diameter being larger than the second pore diameter; and the first portion of the interface layer comprises cells having the first pore diameter, and the second portion of the interface layer comprises cells having the second pore diameter.

4. The microfiltration membrane of claim 3, wherein the first asymmetric polymeric layer has an asymmetry ratio in the range of from about 0.5 to about 1.5.

5. The microfiltration membrane of claim 3 or 4, wherein the second asymmetric polymeric layer has an asymmetry ratio of about 2 or more.

6. The membrane of any one of claims 1-5, comprising a pleated membrane.

7. A method of processing a fluid, comprising passing the fluid into the membrane of any one of claims 1, 2, or 6, in the direction from the asymmetric layer toward the isometric layer.

8. A method of processing a fluid, comprising passing the fluid into the membrane of any one of claims 3-6, in the direction from the second asymmetric layer toward the first asymmetric layer.

9. The method of claim 7 or 8, comprising passing the fluid through the membrane.

10. A method of making a microfiltration membrane having an asymmetric layer, an isometric layer, and an interface layer, the interface layer having a first

portion contacting the asymmetric layer and a second portion contacting the isometric layer, comprising:

(a) preparing a first solution comprising a first polymer and a solvent for the first polymer;

(b) preparing a second solution comprising a second polymer and a solvent for the second polymer;

(c) casting the first solution onto a first surface of a support;

(d) after about 2 seconds, casting the second solution on the first solution and forming a pre-membrane;

(e) exposing the pre-membrane to circulating air; and,

(f) effecting phase separation of the first solution and the second solution in a nonsolvent liquid.

11. A method of making a microfiltration membrane having a first asymmetric layer having a first asymmetry ratio, a second asymmetric layer having a second asymmetry ratio that is greater than the first asymmetry ratio, and an interface layer, the interface layer having a first portion contacting the first asymmetric layer and a second portion contacting the second asymmetric layer, comprising:

(a) preparing a first solution comprising a first polymer and a solvent for the first polymer;

(b) preparing a second solution comprising a second polymer and a solvent for the second polymer;

(c) casting the first solution onto a first surface of a support;

(d) after about 2 seconds, casting the second solution on the first solution and forming a pre-membrane; and,

(e) effecting phase separation of the first solution and the second solution in a nonsolvent liquid.

12. The method of claim 10 or 11, wherein at least one solution comprises a polysulfone.

13. The method of any one of claims 10-12, wherein casting the first solution comprises casting the first solution through first preset gap provided by a first slot die or a first casting knife, and casting the second solution comprises casting the second solution through a second preset gap provided by a second slot die or a second casting knife.

CLAIM(S):

1. A microfiltration membrane comprising

(a) an asymmetric polymeric layer,

(b) an isometric polymeric layer, and

(c) an interface polymeric layer between the asymmetric layer and the isometric layer, the interface layer having a first portion contacting the asymmetric layer and a second portion contacting the isometric layer;

wherein the membrane has a total thickness; and,

(i) the asymmetric layer has a region contacting the first portion of the interface layer, the region including cells having a first pore diameter;

(ii) the isometric layer has a region contacting the second portion of the interface layer, the region including cells having a second pore diameter;

the first pore diameter being larger than the second pore diameter; and

the first portion of the interface layer comprises cells having the first pore diameter, and the second portion of the interface layer comprises cells having the second pore diameter; and,

wherein the interface layer has a thickness in the range of from 15% to 33% of the total membrane thickness.

2. The membrane of claim 1, wherein the asymmetric layer has an asymmetry ratio of about 2 or more.

3. A microfiltration membrane comprising

(a) a first asymmetric polymeric layer, the first asymmetric polymeric layer having a first asymmetry ratio,

(b) a second asymmetric polymeric layer, the second asymmetric polymeric layer having a second asymmetry ratio, wherein the second asymmetry ratio is greater than the first asymmetry ratio; and

(c) an interface polymeric layer between the first asymmetric layer and the second asymmetric layer, the interface layer having a first portion contacting the first asymmetric layer and a second portion contacting the second asymmetric layer;

wherein the membrane has a total thickness; and,

(i) the first asymmetric layer has a region contacting the first portion of the interface layer, the region including cells having a first pore diameter;

(ii) the second asymmetric layer has a region contacting the second portion of the interface layer, the region including cells having a second pore diameter;

the first pore diameter being larger than the second pore diameter; and the first portion of the interface layer comprises cells having the first pore diameter, and the second portion of the interface layer comprises cells having the second pore diameter; and,

wherein the first asymmetric layer and the interface layer together have a thickness in the range of from 8% to 15% of the total membrane thickness.

4. The microfiltration membrane of claim 3, wherein the first asymmetric polymeric layer has an asymmetry ratio in the range of from about 0.5 to about 1.5.

5. The microfiltration membrane of claim 3 or 4, wherein the second asymmetric polymeric layer has an asymmetry ratio of about 2 or more.

6. The membrane of any one of claims 1-5, comprising a pleated membrane.

7. A method of processing a fluid, comprising passing the fluid into the membrane of any one of claims 1, 2, or 6, in the direction from the asymmetric layer toward the isometric layer.

8. A method of processing a fluid, comprising passing the fluid into the membrane of any one of claims 3-6, in the direction from the second asymmetric layer toward the first asymmetric layer.

9. The method of claim 7 or 8, comprising passing the fluid through the membrane.

10. A method of making a microfiltration membrane having an asymmetric layer, an isometric layer, and an interface layer, the interface layer having a first portion contacting the asymmetric layer and a second portion contacting the isometric layer, comprising:

(a) preparing a first solution comprising a first polymer and a solvent for the first polymer;

(b) preparing a second solution comprising a second polymer and a solvent for the second polymer;

(c) casting the first solution onto a first surface of a support using a first air gap;

(d) after about 2 seconds, casting the second solution on the first solution using a second air gap and forming a pre-membrane;

(e) exposing the pre-membrane to circulating air; and,

(f) effecting phase separation of the first solution and the second solution in a nonsolvent liquid.

11. A method of making a microfiltration membrane having a first asymmetric layer having a first asymmetry ratio, a second asymmetric layer having a second asymmetry ratio that is greater than the first asymmetry ratio, and an interface layer, the interface layer having a first portion contacting the first asymmetric layer and a second portion contacting the second asymmetric layer, comprising:

(a) preparing a first solution comprising a first polymer and a solvent for the first polymer;

(b) preparing a second solution comprising a second polymer and a solvent for the second polymer;

(c) casting the first solution onto a first surface of a support using a first air gap;

(d) after about 2 seconds, casting the second solution on the first solution using a second air gap and forming a pre-membrane; and,

(e) effecting phase separation of the first solution and the second solution in a nonsolvent liquid.

12. The method of claim 10 or 11, wherein at least one solution comprises a polysulfone.

13. The method of any one of claims 10-12, wherein the first air gap is provided by a first slot die or a first casting knife, and the second air gap is provided by a second slot die or a second casting knife.