

- 35 -

Claims

1. A method of fabricating a composite membrane, comprising:
 - a) contacting a perfluorinated polymer solution with a surface of a polymer layer;
 - 5 and
 - b) drying the perfluorinated polymer solution to form a perfluorinated polymer layer physisorbed on the surface of the polymer layer;wherein the perfluorinated polymer solution comprises a perfluorinated polymer and a C₅-C₁₈ perfluorinated solvent; and
- 10 wherein the perfluorinated polymer solution is dried at a relative humidity at less than 20%.
2. The method according to claim 1, wherein the polymer layer is selected from polyolefin, polyester ether ketone (PEEK), polyethylene terephthalate (PET), Nylon,
- 15 polyacrylonitrile (PAN) and their copolymers thereof.
3. A method of fabricating a composite membrane, comprising:
 - a) contacting a perfluorinated polymer solution with a surface of a polyolefin layer;
 - and
 - 20 b) drying the perfluorinated polymer solution to form a perfluorinated polymer layer physisorbed on the surface of the polyolefin layer;wherein the perfluorinated polymer solution comprises a perfluorinated polymer and a C₅-C₁₈ perfluorinated solvent; and
- 25 wherein the perfluorinated polymer solution is dried a relative humidity at less than 20%.
4. The method according to any one of claims 1 to 3, wherein the relative humidity is 0%.
- 30 5. The method according to any of claims 1 to 4, wherein the perfluorinated polymer solution is dried at an ambient temperature.
6. The method according to any one of claims 1 to 5, wherein the C₅-C₁₈ perfluorinated solvent is a perfluorinated polyether solvent.
- 35

- 36 -

7. The method according to any one of claims 1 to 6, wherein C₅-C₁₈ perfluorinated solvent has a boiling point of less than 110 °C.
8. The method according to any one of claims 1 to 7, wherein the perfluorinated
5 polymer in the perfluorinated polymer solution has a concentration of about 0.001 wt/wt% to about 1.5 wt/wt%.
9. The method according to any one of claims 1 to 8, wherein the perfluorinated polymer in the perfluorinated polymer solution is selected from polytetrafluoroethylene
10 (PTFE), fluorinated ethylene propylene copolymer (FEP), perfluoroalkoxy alkane (PFA), ethylene tetrafluoroethylene (ETFE), or a copolymer thereof.
10. The method according to any one of claims 1 to 9, wherein the perfluorinated polymer is selected from poly[4,5-difluoro-2,2-bis(trifluoromethyl)-1,3-dioxole-co-
15 tetrafluoroethylene] (PTFE AF 2400 or PTFE AF 1600) and poly(tetrafluoroethylene-co-2,2,4-trifluoro-5-trifluoromethoxy-1,3-dioxole) (Hyflon AD40 or Hyflon AD60) or a combination thereof.
11. The method according to any one of claims 1 to 10, wherein the perfluorinated
20 polymer solution is contacted on the surface of the polyolefin layer for at least 5 sec.
12. The method according to any one of claims 1 to 11, wherein the step of contacting perfluorinated polymer solution (step a) includes removing excess perfluorinated polymer solution.
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13. The method according to any one of claims 1 to 12, wherein the perfluorinated polymer solution is dried on the surface of the polymer layer or polyolefin layer for at least 10 sec.
- 30 14. The method according to any one of claims 1 to 13, further comprises a step before (a) of wetting the polymer layer or polyolefin layer with a solvent having a boiling point of more than 90 °C.
15. The method of claim 14, wherein the solvent is n-butanol.
35

- 37 -

16. The method according to any one of claims 1 to 15, further comprises a step prior to (a) of anhydrously drying the polymer layer or polyolefin layer and perfluorinated polymer solution.

5 17. A composite membrane, comprising:

a) a polymer layer; and

b) a perfluorinated polymer layer physisorbed on a surface of the polymer layer; wherein the perfluorinated polymer layer has a surface morphology with less than 10% of the surface comprising micro-structures; and

10 wherein the perfluorinated polymer layer has a thickness of about 5 nm to about 500 nm.

18. A composite membrane, comprising:

a) a polyolefin layer; and

15 b) a perfluorinated polymer layer physisorbed on a surface of the polyolefin layer; wherein the perfluorinated polymer layer has a surface morphology with less than 10% of the surface comprising micro-structures; and wherein the perfluorinated polymer layer has a thickness of about 50 nm to about 300 nm.

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19. The composite membrane according to claims 17 or 18, wherein the perfluorinated polymer layer has a surface morphology with no micro-structures.

25 20. The composite membrane according to claims 17 to 19, wherein the perfluorinated polymer in the perfluorinated polymer layer is selected from polytetrafluoroethylene (PTFE), fluorinated ethylene propylene copolymer (FEP), perfluoroalkoxy alkane (PFA), ethylene tetrafluoroethylene (ETFE), or a copolymer thereof.

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21. The composite membrane according to any one of claims 17 to 20, wherein the micro-structures are holes.

22. The composite membrane according to any one of claims 17 to 21, wherein the
35 micro-structures are less than 1 μm in diameter.

- 38 -

23. The composite membrane according to any one of claims 17 to 22, wherein the polymer in the polymer layer is selected from polyethylene or polypropylene.
- 5 24. The composite membrane according to any one of claims 17 to 23, wherein the polymer layer has a thickness of about 1 μm to about 10000 μm .
25. The composite membrane according to any one of claims 17 to 24, wherein the polymer layer is wetted with a solvent having a boiling point of more than 90 °C.
- 10 26. The composite membrane according to any one of claims 17 to 25, having a molecular weight cut-off (MWCO) of at least 150 g/mol in acetone.
27. The composite membrane according to any one of claims 17 to 26, having a
- 15 hexane permeance of at least 8.6 L/m²-h-bar.
28. The composite membrane according to any one of claims 17 to 27, having an acetone permeance of at least 1.1 L/m²-h-bar.
- 20 29. The composite membrane according to any one of claims 17 to 28, having a solute rejection of at least 80%.
30. A method of filtrating a chemical compound from a mixture, the mixture comprising the chemical compound and a liquid, the method comprising:
- 25 a) contacting the mixture with a composite membrane according to any one of claims 17 to 28; and
- b) applying a pressure across the composite membrane.
31. A method of filtrating a mixture by pervaporation, the mixture comprising at
- 30 least two fluids, the method comprising:
- a) contacting the mixture with a composite membrane according to any one of claims 17 to 28; and
- b) applying a pressure across the composite membrane.
- 35 32. A method of filtrating a gas and vapour mixture, the method comprising:

- 39 -

- a) contacting the mixture with a composite membrane according to any one of claims 17 to 28; and
- b) applying a pressure across the composite membrane.