CLAIMS

1. A method of manufacturing a heat exchange panel, the method comprising the steps of:

providing a support structure comprising a first layer and a second layer;

applying a first material to the first layer of the support structure to form a thin, porous support layer;

applying a second material to the first material support layer to form a thin, non-porous heat transfer layer; and

releasing the heat exchange panel by releasing the first layer of the support structure from the second layer of the support structure.

2. The method of claim 1 further comprising modifying a pore structure in at least one of the support structure or the support layer.

3. The method of claim 1, wherein the step of providing a support structure comprises providing a microfiltration membrane as the support structure.

4. The method of claim 1, wherein the support structure comprises a fabric layer.

5. The method of claim 1, wherein the support structure comprises an asymmetric structure.

6. The method of claim 1, wherein the support structure is provided with a thickness of about 2 mils to about 4 mils.

7. The method of claim 1, wherein the first material is applied in a thickness of about 1 mil to about 2 mils.

8. The method of claim 1, wherein the first material is applied via phase inversion.

9. The method of claim 1, wherein the first material comprises at least one of polysulfone or polyethylene terephthalate.

10. The method of claim 1, wherein the second material is applied in a thickness of about 10 μm or less.

11. The method of claim 1, wherein the second material is applied via a thin film deposition method.

12. The method of claim 1, wherein the second material comprises at least one of polyvinylidene fluoride, polyetherethylketone, or polytetrafluoroethylene.

13. A heat exchanger comprising a plurality of heat exchange panels, the heat exchange panels comprising:

a thin support structure having a high porosity and a low tortuosity;

a first material disposed on a first side of the support structure and forming a thin, porous support layer; and

a second material disposed on the support layer and forming a thin, non-porous heat transfer layer.

14. The heat exchanger of claim 13 further comprising a housing, wherein each of the plurality of heat exchange panels are stacked within the housing to form a plate and frame type heat exchanger.

15. The heat exchanger of claim 13 further comprising a cylindrical housing, wherein each of the plurality of heat exchange panels is spirally wound to form a tubular member and the plurality of tubular members are longitudinally disposed within the cylindrical housing to form a shell and tube type heat exchanger.

16. The heat exchanger of claim 13 further comprising a housing having a first inlet and a first outlet for directing a first liquid stream through the heat exchanger on a first side of each heat exchange panel and a second inlet and a second outlet for directing a second liquid stream

through the heat exchanger on a second side of each heat exchange panel.

17. The heat exchanger of claim 13, wherein the thin support structure comprises a polymeric paper.

18. The heat exchanger of claim 13, wherein the first material comprises at least one of polysulfone or polyethylene terephthalate.

19. The heat exchanger of claim 13, wherein the second material comprises at least one of polyvinylidene fluoride, polyetherethylketone, or polytetrafluoroethylene.

20. The heat exchanger of claim 13, wherein the thin support structure comprises a bilayer substrate.

21. The heat exchanger of claim 20, wherein the bilayer substrate comprises a removable backing layer.

22. A method of manufacturing a heat exchanger, the method comprising the steps of:

providing a housing defining an interior region and having a first inlet, a first outlet, a second inlet, and a second outlet;

forming a plurality of heat exchange panels having a first side and a second side, wherein the panels comprise:

a thin support structure having a high porosity and a low tortuosity;

a first material disposed on a first side of the support structure and forming a thin, porous support layer; and

a second material disposed on the support layer and forming a thin, non-porous heat transfer layer;

disposing each of the plurality of heat exchange panels within the interior region of the housing;

fluidly coupling a first side of each of the plurality of heat exchange panels to the first

inlet and the first outlet of the housing; and

fluidly coupling a second side of each of the plurality of heat exchange panels to the second inlet and the second outlet of the housing.

CLAIMS

1. A method of manufacturing a heat exchange panel, the method comprising the steps of:

providing a support structure comprising a bilayer substrate including first and second separable layers;

applying a first material to the first layer of the bilayer substrate of the support structure to form a thin, porous support layer;

applying a second material to the first material support layer to form a thin, non-porous heat transfer layer; and

separating the heat exchange panel by releasing the second layer of the bilayer substrate from the first layer of the bilayer substrate to form the heat exchange panel.

2. The method of claim 1 further comprising modifying a pore structure in at least one of the support structure or the support layer.

3. The method of claim 1, wherein the support structure comprises a fabric layer.

4. The method of claim 1, wherein the support structure comprises an asymmetric structure.

5. The method of claim 1, wherein the support structure is provided with a thickness of about 2 mils to about 4 mils.

6. The method of claim 1, wherein the first material is applied in a thickness of about 1 mil to about 2 mils.

7. The method of claim 1, wherein the first material is applied via phase inversion.

8. The method of claim 1, wherein the first material comprises at least one of

polysulfone or polyethylene terephthalate.

9. The method of claim 1, wherein the second material is applied in a thickness of about 10 μm or less.

10. The method of claim 1, wherein the second material is applied via a thin film deposition method.

11. The method of claim 1, wherein the second material comprises at least one of polyvinylidene fluoride, polyetherethylketone, or polytetrafluoroethylene.

12. A method of manufacturing a heat exchanger, the method comprising the steps of:

providing a housing defining an interior region and having a first inlet, a first outlet, a second inlet, and a second outlet;

forming a plurality of heat exchange panels having a first side and a second side, wherein the step of forming a panel comprises:

providing a support structure comprising a bilayer substrate including first and second separable layers;

applying a first material to the first layer of the bilayer substrate of the support structure to form a thin, porous support layer;

applying a second material to the first material support layer to form a thin, non-porous heat transfer layer; and

separating the heat exchange panel by releasing the second layer of the bilayer substrate from the first layer of the bilayer substrate to form the heat exchange panel,

disposing each of the plurality of heat exchange panels within the interior region of the housing;

fluidly coupling a first side of each of the plurality of heat exchange panels to the first inlet and the first outlet of the housing; and

fluidly coupling a second side of each of the plurality of heat exchange panels to the second inlet and the second outlet of the housing.