

CLAIMS

What is claimed is:

1. A dressing for treating a tissue site with negative pressure, the dressing comprising:
 - a first layer comprising a polymer film having a plurality of fluid restrictions through the polymer film that are configured to expand in response to a pressure gradient across the polymer film;
 - a second layer coupled to the first layer, the second layer comprising a manifold;
 - and
 - a third layer coupled to the second layer opposite the first layer, the third layer comprising a polymer drape.
2. The dressing of claim 1, wherein the first layer is configured to be interposed between the manifold and the tissue site and at least partially exposed to the tissue site.
3. The dressing of claim 1 or claim 2, further comprising a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a hydrophobic gel having a plurality of apertures.
4. The dressing of claim 3, wherein the third layer and the fourth layer enclose the first layer and the second layer.
5. The dressing of claim 3, wherein the third layer and the fourth layer enclose the first layer and the second layer, and the fourth layer is adapted to contact the tissue site.
6. The dressing of claim 1 or claim 2, further comprising a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a hydrophobic gel having a plurality of apertures in registration with at least some of the plurality of fluid restrictions in the first layer.
7. The dressing of any one of claims 3-5, wherein the plurality of apertures are in registration with the fluid restrictions.

8. The dressing of any one of claims 3-5, wherein the plurality of apertures each expose at least a portion of one of the fluid restrictions.
9. The dressing of claim 1 or 2, further comprising a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a hydrophobic gel having a plurality of apertures coextensive with second layer, wherein substantially all the plurality of apertures are in registration with the fluid restrictions in the first layer.
10. The dressing of any one of claims 1-9, wherein the fourth layer is configured to be interposed between the manifold and the tissue site.
11. The dressing of any of claims 3-10, wherein the fluid restrictions have an average length that does not substantially exceed an average dimension of the apertures.
12. The dressing of any of claims 3-10, wherein the apertures limit an effective size of the fluid restrictions.
13. The dressing of any one of claims 3-10, wherein each of the apertures are sized to expose no more than two of the fluid restrictions.
14. The dressing of claim 1 or claim 2, further comprising a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a hydrophobic gel having a plurality of apertures and an area density less than 300 grams per square meter.
15. The dressing of any of claims 3-10, wherein the hydrophobic gel is a silicone gel.
16. The dressing of any of claims 1-15, wherein the polymer drape comprises a margin that extends beyond the first layer and the second layer, and an adhesive layer disposed in the margin.
17. The dressing of any of claims 1-16, wherein the manifold comprises a foam.
18. The dressing of claim 17, wherein the foam is a polymer foam.
19. The dressing of claim 17, wherein the foam is a polyurethane ether foam.
20. The dressing of claim 17, wherein the foam is reticulated.

21. The dressing of claim 17, wherein the foam is a reticulated polymer foam.
22. The dressing of claim 17, wherein the foam is a reticulated polyurethane ether foam.
23. The dressing of any one of claims 17-22, wherein the foam is reticulated and has a free volume of at least 90%.
24. The dressing of any one of claims 17-23, wherein the foam is porous and has an average pore size in a range of 400-600 microns.
25. The dressing of any one of claims 1-24, wherein the manifold has a thickness less than 7 millimeters.
26. The dressing of any of claims 1-25, wherein the manifold is hydrophobic.
27. The dressing of any of claims 1-26, wherein the polymer film is hydrophobic.
28. The dressing of claim 27, wherein the polymer film has a contact angle with water greater than 90 degrees.
29. The dressing of claim 27, wherein the polymer film is a polyethylene film.
30. The dressing of claim 27, wherein the polymer film is a polyethylene film having an area density of less than 30 grams per square meter.
31. The dressing of any of claims 1-30, wherein the fluid restrictions comprise a plurality of slots, each of the slots having a length less than 4 millimeters.
32. The dressing of any of claims 1-30, wherein the fluid restrictions comprise a plurality of slots, each of the slots having a width less than 2 millimeters.
33. The dressing of any of claims 1-30, wherein the fluid restrictions comprise a plurality of slots, each of the slots having a length less than 4 millimeters and a width less than 2 millimeters.
34. The dressing of claim 33, wherein the width is less than 1 millimeter.

35. The dressing of claim 33, wherein the length is less than 3 millimeters and the width is less than 1 millimeter.
36. The dressing of claim 33, wherein the width is at least 0.5 millimeters.
37. The dressing of claim 33, wherein the length is at least 2 millimeters.
38. The dressing of any one of claims 1-37, wherein the fluid restrictions are coextensive with the polymer film.
39. The dressing of any one of claims 1-37, wherein the fluid restrictions are coextensive with the manifold.
40. The dressing of any one of claims 1-39, wherein a tissue-facing surface of the dressing is smooth.
41. The dressing of any one of claims 1-39, wherein a tissue-facing surface of the dressing is matte.
42. The dressing of any one of claims 1-39, wherein a tissue-facing surface of the dressing is not rough.
43. The dressing of any one of claims 1-42, wherein the second layer has a rough tissue-facing surface and is configured not to be exposed to tissue when the dressing is placed on the tissue site.
44. The dressing of any one of claims 1-43 where in the fourth layer has a smooth lower surface.
45. The dressing of any one of claims 1-44, wherein the fluid restrictions are distributed across the polymer film in a uniform pattern.
46. The dressing of claim 45, wherein the uniform pattern comprises a grid of parallel rows and columns.
47. The dressing of any one of claims 1-46, wherein:
the fluid restrictions are distributed across the polymer film in parallel rows and
columns;

- the rows are spaced about 3 millimeters on center; and
the fluid restrictions in each of the rows are spaced about 3 millimeters on center.
48. The dressing of claim 47, wherein the fluid restrictions in adjacent rows are offset.
49. The dressing of any of claims 1-48, wherein the polymer film has a substantially flat surface.
50. The dressing of claims 3-49, wherein the fourth layer has a hardness of between about 5 Shore OO and about 80 Shore OO.
51. The dressing of any of claims 1-50, wherein the fluid restrictions comprise or consist essentially of elastomeric valves in the polymer film that are normally closed.
52. The dressing of claim 51, wherein the elastomeric valves are fenestrations.
53. The dressing of any of claims 1-52, wherein the first layer is coextensive with the second layer.
54. The dressing of any preceding claim, wherein the second layer is adjacent to the first layer and the third layer is adjacent to the second layer opposite the first layer.
55. The dressing of any of claims 1-54, further comprising a fluid port coupled to the third layer, the fluid port configured to be coupled to a fluid conductor.
56. The dressing of any one of the preceding claims, wherein the third layer and the fourth layer are adapted to provide a fluid tight seal.
57. A system for treating a tissue site, the system comprising:
the dressing of any of claims 1-56; and
a negative-pressure source fluidly coupled to the dressing.
58. The system of claim 57, further comprising a fluid container fluidly coupled between the dressing and the negative-pressure source.
59. A dressing for use in treating a surface wound with negative pressure, the use comprising:
applying the dressing of any of claims 1-56 to the surface wound;
sealing the dressing to epidermis adjacent to the surface wound;

- fluidly coupling the dressing to a negative-pressure source; and
applying negative pressure from the negative-pressure source to the dressing and
promoting healing and tissue granulation.
60. The use of claim 59, wherein the second layer is not substantially exposed to the tissue site during the step of applying negative pressure.
61. The use of claim 59 or claim 60, wherein the first and fourth layers are configured to be exposed to the tissue site during the step of applying negative pressure.
62. The use of any one of claims 59-61, wherein applying the dressing comprises disposing at least part of the dressing across an edge of the surface wound.
63. The use of any one of claims 59-62, wherein applying negative pressure opens the fluid restrictions in the first layer.
64. The use of claim 63, further comprising reducing negative pressure from the negative-pressure source, wherein reducing negative pressure closes the fluid restrictions in the first layer.
65. The use of any one of claims 59-63, further comprising fluidly coupling a fluid container between the dressing and the negative-pressure source, and transferring exudate from the dressing to the fluid container.
66. The use of any one of claims 59-65, further comprising applying a manifold between the dressing and the surface wound.
67. A dressing for use in promoting granulation in a surface wound, the use comprising:
applying a dressing to the surface wound, the dressing comprising a cover, a
manifold, a perforated polymer film having a substantially flat surface, and
a perforated silicone gel having a substantially flat surface;
sealing the perforated silicone gel to the surface wound and covering at least a
portion of a periwound adjacent to the surface wound;
attaching the dressing to epidermis around the perforated silicone gel;
fluidly coupling the dressing to a negative-pressure source; and
applying negative pressure from the negative-pressure source to the dressing.

68. The use of claim 67, wherein the dressing remains on the surface wound for at least 5 days.
69. The use of claim 67, wherein the dressing remains on the surface wound for at least 7 days.
70. The use of any one of claims 67-69, wherein the perforated silicone gel and the perforated polymer film substantially prevent exposure of tissue in the surface wound to the manifold and inhibit growth of tissue into the manifold.
71. The use of any one of claims 67-70, further comprising applying a wound filler between the perforated silicone gel and the surface wound.
72. The use of claim 71, wherein the wound filler is applied interior to the periwound.
73. The use of claim 71 or claim 72, wherein the wound filler is a foam.
74. The use of any one of claims 67-70, wherein the dressing substantially prevents maceration of the periwound.
75. The use of any one of claims 67-74, wherein the perforated polymer film is a perforated polyethylene film.
76. A dressing for treating a tissue site with negative pressure, the dressing comprising:
a fluid control layer comprising a plurality of imperfect valves, the plurality of imperfect valves configured to be responsive to a pressure gradient;
a manifold layer adjacent to the fluid control layer;
a cover adjacent to the manifold layer opposite the fluid control layer; and
a sealing layer adjacent to the fluid control layer opposite the manifold layer, the sealing layer comprising a plurality of apertures in registration with the plurality of imperfect valves.
77. A dressing for treating a tissue site with negative pressure, the dressing comprising:
a first layer comprising a film formed from a hydrophobic material;
a plurality of fluid passages through the film, the plurality of fluid passages configured to expand in response to a pressure gradient across the film;

a second layer coupled to the first layer, the second layer comprising a manifold formed from a hydrophobic material;
a third layer coupled to the second layer opposite the first layer, the third layer comprising a polymer drape;
a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a hydrophobic gel having an area density less than 300 grams per square meter; and
a plurality of apertures through the fourth layer fluidly coupled to at least some of the plurality of fluid passages through the film.

78. A dressing for treating a tissue site with negative pressure, the dressing comprising:
a first layer comprising a film have a flat surface texture;
a plurality of fluid restrictions through the film, the plurality of fluid restrictions configured to be responsive to a pressure gradient across the film;
a second layer coupled to the first layer, the second layer comprising a manifold;
a third layer coupled to the second layer opposite the first layer, the third layer comprising a polymer drape;
a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a gel having an area density less than 300 grams per square meter and a hardness between about 5 Shore OO and about 80 Shore OO;
and
a plurality of apertures through the fourth layer in registration with the plurality of fluid restrictions through the film.

79. An apparatus for treating a tissue site with negative pressure, the apparatus comprising:
a first layer comprising a polythene film having a surface with a height variation of less than 0.2 millimeter over 1 centimeter and a contact angle with water greater than 90 degrees;
a plurality of fluid passages through the first layer that are normally restricted and configured to expand in response to a pressure gradient across the first layer;

- a second layer coupled to the first layer, the second layer comprising a reticulated polyurethane ether foam having a free volume of at least 90% and a thickness less than 7 millimeters;
- a third layer coupled to the second layer opposite the first layer, the third layer comprising a polymer drape; and
- a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a silicone gel having an area density less than 300 grams per square meter and a hardness between about 5 Shore OO and about 80 Shore OO; and
- a plurality of apertures through the fourth layer in registration with the plurality of fluid passages in the first layer.

80. An apparatus for treating a tissue site with negative pressure, the apparatus comprising:

- a first layer comprising a polythene film;
- a plurality of slots in the first layer, each of the slots having a length in a range of 2-4 millimeters and a width in a range of 0.5-2 millimeters and configured to expand in response to a pressure gradient across the first layer;
- a second layer coupled to the first layer, the second layer comprising a manifold;
- a third layer coupled to the second layer opposite the first layer, the third layer comprising a polymer drape; and
- a fourth layer coupled to the first layer opposite the second layer, the fourth layer comprising a silicone gel; and
- a plurality of apertures through the fourth layer aligned with at least some of the plurality of slots in the first layer.

81. A dressing for treating a tissue site with negative pressure, the dressing comprising:

- a cover;
- a manifold;
- a perforated polymer film having a substantially flat surface; and
- a perforated silicone gel having a substantially flat surface;

- wherein the cover, the manifold, the perforated polymer film, and the perforated silicone gel are assembled in a stacked relationship with the cover and the perforated silicone gel enclosing the manifold and the perforated polymer film, and the perforated silicone gel is configured to contact the tissue site.
82. The dressing of claim 81, wherein at least one of the perforated polymer film and the perforated silicone gel is configured to be interposed between the manifold and the tissue site.
83. The dressing of claim 81 or claim 82, wherein:
- the substantially flat surface of the perforated polymer film has height variations not exceeding 0.2 millimeters over 1 centimeter; and
 - the substantially flat surface of the perforated silicone gel has height variations not exceeding 0.2 millimeters over 1 centimeter.
84. A dressing for treating a tissue site with negative pressure, the dressing comprising:
- a first layer comprising a manifold;
 - a second layer comprising a hydrophobic film having a plurality of elastomeric valves that are configured to open in response to a pressure gradient across the hydrophobic film;
 - a third layer coupled to the second layer opposite the first layer, the third layer comprising a hydrophobic gel having a plurality of apertures; and
 - a cover coupled to the first layer opposite the second layer.
85. The dressing of claim 84, wherein at least one of the second layer and the third layer is configured to be interposed between the manifold and the tissue site.
86. The dressing of claim 84 or claim 85, wherein the cover and the third layer enclose the first layer and the second layer.
87. The dressing of any one of claims 84-86, wherein the third layer is adapted to contact the tissue site and the cover is the top surface of the dressing.
88. The dressing of any one of claims 84-87, wherein the plurality of apertures are fluidly coupled to at least some of the plurality of elastomeric valves.

89. The dressing of any one of claims 84-88, wherein at least some of the apertures are configured to expose at least some of the second layer to the tissue site.
90. The dressing of any one of claims 84-88, wherein at least some of the apertures are configured to expose at least some of the elastomeric valves to the tissue site.
91. The dressing of any one of claims 84-89, wherein at least some portion of the second layer is exposed through the apertures in the third layer.
92. The dressing of any one of claims 84-91, wherein at least some portion of the elastomeric valves are exposed through the apertures in the third layer.
93. The use of any one of the dressings, apparatuses, or systems of claims 1-92 for at least 5 days to promote granulation with a source of negative-pressure.
94. The use of any one of the dressings, apparatuses, or systems of claims 1-92 for at least 5 days to minimize tissue in-growth with a source of negative pressure.