



- (51) International Patent Classification:
B32B 27/00 (2006.01) *B32B 27/06* (2006.01)
- (21) International Application Number:
PCT/US2017/018242
- (22) International Filing Date:
16 February 2017 (16.02.2017)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
62/304,991 8 March 2016 (08.03.2016) US
- (71) Applicant: **AVERY DENNISON CORPORATION**
[US/US]; 207 Goode Avenue, Glendale, California 91203 (US).
- (72) Inventors: **BLAND, David**; 12358 Summerwood Drive, Concord, Ohio 44077 (US). **CHEN, Wen-Li**; 45 Westfield Commons, Rochester, New York 41625 (US). **RAMSAY, Michael**; 14726 Munnberry Oval, Newbury, Ohio 44065 (US). **WANG, Shanshan**; 7777 Barnaby Lane, Mentor, Ohio 44060 (US).
- (74) Agent: **BANDY, Mark E.**; RANKIN, HILL & CLARK LLP, 38210 Glenn Avenue, Willoughby, Ohio 44094 (US).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- with amended claims (Art. 19(1))

Date of publication of the amended claims: 5 October 2017

(54) Title: FACE FILMS AND PRESSURE SENSITIVE LAMINATES FOR PRINTING

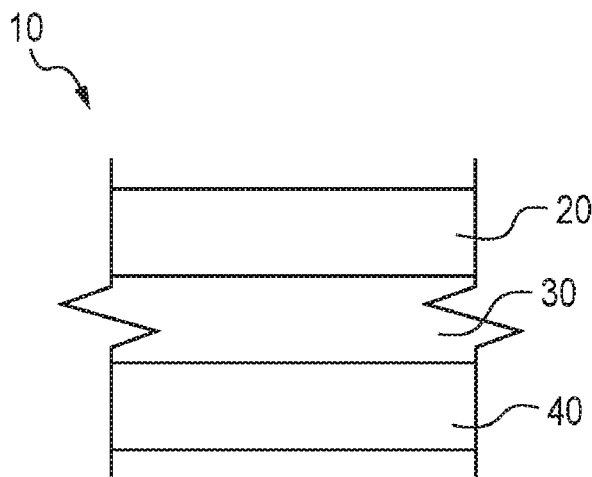


FIG. 1

(57) Abstract: Microporous structures in face films are described for improving printability of the films. Also described are laminates and pressure sensitive adhesive laminates including the microporous structured face films. Various related methods are additionally described.

AMENDED CLAIMS**received by the International Bureau on 29 August 2017 (29.08.2017)****WHAT IS CLAIMED IS:**

1. A polymeric film adapted for absorbing liquid inks from inkjet printing, the film defining a first face for receiving print, and a second oppositely directed face, the film including a microporous structure extending along at least the first face, wherein the microporous structure has a porosity within a range from 40% to 75%, the microporous structure includes a plurality of interconnected pores having a pore size distribution within a range of from 2 microns to 10 nm, the microporous structure has a thickness of at least 20 microns as measured from the first face, and the film exhibits an ink absorption rate of at least 0.01 picoliter/ μm^2 /second at a printing temperature of 40° C wherein absorption is due to a capillary flow effect provided by the microporous structure.
2. The film of claim 1 comprising at least one polyolefin.
3. The film of claim 2 wherein the film comprises at least 30% polyolefins.
4. The film of claim 3 wherein the film comprises at least 40% polyolefins.
5. The film of claim 4 wherein the comprises at least 50% polyolefins.
6. The film of any one of claims 2-5 wherein the polyolefin is selected from the group consisting of polyethylene, polypropylene, polyethylene copolymer, polypropylene copolymer, and combinations thereof.
7. The film of any one of claims 1-6 wherein the porosity is within a range from 40% to 70%.
8. The film of claim 7 wherein the porosity is within a range of from 40% to 60%.
9. The film of any one of claims 1-8 wherein the microporous structure extends through the entire thickness as measured between the first face and the second face.
10. The film of any one of claims 1-9 wherein the film includes a plurality of layers differing in chemical composition and disposed between the first face and the second face.

11. The film of claim 10 wherein the plurality of layers includes a first layer constituting the first face and a second layer constituting the second face.
12. The film of claim 11 wherein the microporous structure extends entirely through the first layer.
13. The film of claim 12 wherein the microporous structure extends at least partially through the second layer.
14. The film of claim 13 wherein the microporous structure extends entirely through the second layer.
15. The film of any one of claims 1-14 comprising at least one inorganic filler.
16. The film of claim 15 wherein the at least one inorganic filler is present within a range of from 30% to 70% by weight.
17. The film of any one of claims 1-16 further including a coating disposed on at least one of the first face and the second face, wherein the coating includes a microporous structure to thereby improve ink anchorage or surface smoothness.
18. The film of any one of claims 1-17 further including a coating disposed on at least one of the first face and the second face, wherein the coating includes a surfactant which increases surface energy of the coating to thereby increase liquid absorption.
19. The film of any one of claims 1-18 wherein the film comprises:
 - at least one polyolefin; and
 - at least one polymer incompatible with the at least one polyolefin, the at least one polymer selected from the group consisting of polystyrene, styrene copolymer, polyurethane, polyester, polyacryl resin, polymethacryl resin, polycarbonate, ionomers, and combinations thereof.
20. A laminate comprising:

a polymeric film adapted for absorbing liquid inks from inkjet printing, the film defining a first face for receiving print, and a second oppositely directed face, the film including a microporous structure extending along at least the first face, wherein the microporous structure has a porosity within a range from 40% to 75%, the microporous structure includes a plurality of interconnected pores having a pore size distribution within a range of from 2 microns to 10 nm, the microporous structure has a thickness of at least 20 microns as measured from the first face, and the film exhibits an ink absorption rate of at least 0.01 picoliter/ μm^2 /second at a printing temperature of 40° C wherein absorption is due to a capillary flow effect provided by the microporous structure;

at least one core layer disposed along the second face of the film.

21. The laminate of claim 20 wherein the film includes at least one polyolefin.
22. The laminate of claim 21 wherein the film comprises at least 30% polyolefins.
23. The laminate of claim 22 wherein the film comprises at least 40% polyolefins.
24. The laminate of claim 23 wherein the film comprises at least 50% polyolefins.
25. The laminate of any one of claims 21-24 wherein the polyolefin is selected from the group consisting of polyethylene, polypropylene, polyethylene copolymer, polypropylene copolymer, and combinations thereof.
26. The laminate of any one of claims 20-25 wherein the porosity is within a range from 40% to 70%.
27. The laminate of claim 26 wherein the porosity is within a range of from 40% to 60%.
28. The laminate of any one of claims 20-27 wherein the microporous structure extends through the entire thickness of the film as measured between the first face and the second face.

29. The laminate of any one of claims 20-28 wherein the film includes a plurality of layers differing in chemical composition and disposed between the first face and the second face.

30. The laminate of claim 29 wherein the plurality of layers includes a first layer constituting the first face and a second layer constituting the second face.

31. The laminate of claim 30 wherein the microporous structure extends entirely through the first layer.

32. The laminate of claim 31 wherein the microporous structure extends at least partially through the second layer.

33. The laminate of claim 32 wherein the microporous structure extends entirely through the second layer.

34. The laminate of any one of claims 20-33 wherein the core layer is a solid nonporous film.

35. The laminate of any one of claims 20-34 wherein the core layer is a porous film.

36. The laminate of claim 35 wherein the porous film includes a microporous structure that has a porosity within a range of from 40% to 75%.

37. The laminate of claim 35 wherein the porous film includes a microporous structure that includes a plurality of interconnected pores having a pore size distribution within a range of from 2 microns to 10 nm.

38. The laminate of any one of claims 20-37 wherein the film comprises at least one inorganic filler.

39. The laminate of claim 38 wherein the at least one inorganic filler is present within a range of from 30% to 70% by weight.

40. The laminate of any one of claims 20-39 further including a coating disposed on the first face of the film, wherein the coating includes a microporous structure to thereby improve ink anchorage or surface smoothness.

41. The laminate of any one of claims 20-40 further including a coating disposed on the first face of the film, wherein the coating includes a surfactant which increases surface energy of the coating to thereby increase liquid absorption.

42. The laminate of any one of claims 20-41 wherein the film comprises (i) at least one polyolefin, and (ii) at least one polymer selected from the group consisting of polystyrene, styrene copolymer, polyurethane, polyester, polyacryl resin, polymethacryl resin, polycarbonate, ionomers, and combinations thereof.

43. An adhesive laminate comprising:
a polymeric film adapted for absorbing liquid inks from inkjet printing, the film defining a first face for receiving print, and a second oppositely directed face, the film including a microporous structure extending along at least the first face, wherein the microporous structure has a porosity within a range from 40% to 75%, the microporous structure includes a plurality of interconnected pores having a pore size distribution within a range of from 2 microns to 10 nm, the microporous structure has a thickness of at least 20 microns as measured from the first face, and the film exhibits an ink absorption rate of at least 0.01 picoliter/ μm^2 /second at a printing temperature of 40° C wherein absorption is due to a capillary flow effect provided by the microporous structure;
a layer of adhesive disposed along the second face of the film.

44. The adhesive laminate of claim 43 wherein the adhesive is a pressure sensitive adhesive.

45. The adhesive laminate of any one of claims 43-44 further comprising:
a release liner disposed on the layer of adhesive.

46. The adhesive laminate of any one of claims 43-45 wherein the film includes at least one polyolefin.

47. The adhesive laminate of claim 46 wherein the film comprises at least 30% polyolefins.

48. The adhesive laminate of claim 47 wherein the film comprises at least 40% polyolefins.

49. The adhesive laminate of claim 48 wherein the film comprises at least 50% polyolefins.

50. The adhesive laminate of any one of claims 46-49 wherein the polyolefin is selected from the group consisting of polyethylene, polypropylene, polyethylene copolymer, polypropylene copolymer, and combinations thereof.

51. The adhesive laminate of any one of claims 43-50 wherein the porosity is within a range from 40% to 70%.

52. The adhesive laminate of claim 51 wherein the porosity is within a range of from 40% to 60%.

53. The adhesive laminate of any one of claims 43-52 wherein the microporous structure extends through the entire thickness of the film as measured between the first face and the second face.

54. The adhesive laminate of any one of claims 43-53 wherein the film includes a plurality of layers differing in chemical composition and disposed between the first face and the second face.

55. The adhesive laminate of claim 54 wherein the plurality of layers includes a first layer constituting the first face and a second layer constituting the second face.

56. The adhesive laminate of claim 55 wherein the microporous structure extends entirely through the first layer.

57. The adhesive laminate of claim 56 wherein the microporous structure extends at least partially through the second layer.

58. The adhesive laminate of claim 57 wherein the microporous structure extends entirely through the second layer.

59. The adhesive laminate of any one of claims 43-58 wherein the face film comprises at least one inorganic filler.

60. The adhesive laminate of claim 59 wherein the at least one inorganic filler is present within a range of from 30% to 70% by weight.

61. The adhesive laminate of any one of claims 43-60 wherein the film further includes a coating disposed on the first face of the film, the coating includes a microporous structure to thereby improve ink anchorage or surface smoothness.

62. The adhesive laminate of any one of claims 43-61 wherein the film further includes a coating disposed on the first face of the film, the coating includes a surfactant which increases surface energy of the coating to thereby increase liquid absorption.

63. The adhesive laminate of any one of claims 43-62 wherein the film comprises (i) at least one polyolefin, and (ii) at least one polymer selected from the group consisting of polystyrene, styrene copolymer, polyurethane, polyester, polyacryl resin, polymethacryl resin, polycarbonate, ionomers, and combinations thereof.

64. A method of forming a polymer film adapted for absorbing liquid inks from inkjet printing, the film including a microporous structure extending along at least one face of the film, the method comprising:

extruding polymer to form a film;

stretching the film to a stretch ratio within a range of from 1:1.1 to 1:10 such that the microporous structure has a porosity within a range from 40% to 75% and includes a plurality of interconnected pores having a pore size distribution within a range of from 2 microns to 10 nm whereby absorption by the film is due to a capillary flow effect provided by the microporous structure.

65. The method of claim 64 wherein stretching the film is performed inline.
66. The method of claim 64 wherein stretching the film is performed off line.
67. The method of claim 64 wherein stretching the film is performed in a single direction.
68. The method of claim 64 wherein stretching the film is performed in both a machine direction and a cross direction.
69. The method of any one of claims 64-68 wherein stretching is performed such that the stretch ratio is within a range of from 1:2 to 1:8.
70. The method of any one of claims 64-69 wherein the film after stretching includes the microporous structure having a thickness of at least 20 microns.
71. The method of any one of claims 64-70 wherein the film includes at least one polyolefin.
72. The method of claim 71 wherein the film includes at least 30% polyolefins.
73. The method of claim 72 wherein the film includes at least 40% polyolefins.
74. The method of claim 73 wherein the film includes at least 50% polyolefins.
75. The method of any one of claims 71-74 wherein the polyolefin is selected from the group consisting of polyethylene, polypropylene, polyethylene copolymer, polypropylene copolymer, and combinations thereof.
76. The method of any one of claims 64-75 wherein the porosity is within a range from 40% to 70%.
77. The method of claim 76 wherein the porosity is within a range of from 40% to 60%.

78. The method of any one of claims 64-77 wherein the film includes at least one inorganic filler.

79. The method of claim 78 wherein the at least one inorganic filler is present within a range of from 30% to 70% by weight.

80. The method of any one of claims 64-79 wherein the film comprises at least one polyolefin and at least one polymer incompatible with the at least one polyolefin, the at least one polymer selected from the group consisting of polystyrene, styrene copolymer, polyurethane, polyester, polyacryl resin, polymethacryl resin, polycarbonate, ionomers, and combinations thereof.