

CLAIMS

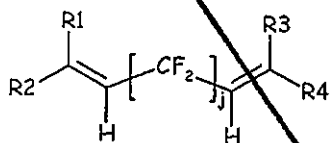
What is claimed is:

1. A fluorocarbon liquid composition comprising a fluorocarbon liquid medium containing a fluorinated ionomer dissolved or dispersed therein, at least 90% by weight of the fluorinated ionomer consisting in particles of size lower than 200 nm, the fluorinated ionomer comprising:

fluorinated monomer units containing ethylenic groups and functional groups transformable into hydrophilic groups, chosen from the groups consisting of $-\text{SO}_2\text{F}$, $-\text{COOR}$, $-\text{COF}$ and combinations of these, wherein R is a C_1 to C_{20} alkyl radical or a C_6 to C_{20} aryl radical;

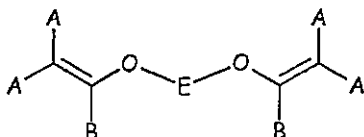
monomeric units deriving from a bis-olefin, chosen among the formulae (OF-1), (OF-2), (OF-3) where:

(OF-1)



wherein j is an integer between 2 and 10 and R1, R2, R3, R4, equal or different from each other, are H, F or C_1 to C_5 alkyl or (per)fluoroalkyl group;

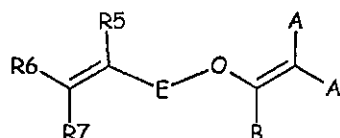
(OF-2)



wherein each of A, equal or different from each other and at each occurrence, is independently selected from F, Cl, and H; each of B, equal or different from each other and at each occurrence, is independently selected from F, Cl, H and ORB,

wherein RB is a branched or straight chain alkyl radical which can be partially, or completely fluorinated or chlorinated; E is a divalent group having 2 to 10 carbon atom, optionally fluorinated, which may be inserted with ether linkages;

(OF-3)



wherein E, A and B have the same meaning as above defined; R5, R6, R7, equal or different from each other, are H, F or C1-5 alkyl or (per)fluoroalkyl group; and

iodine and/or bromine atoms.

2. The liquid composition of claim 1, wherein the ionomer has an equivalent weight of between 380 g/eq and 620 g/eq.
3. The liquid composition of claim 1, wherein the bis-olefin has the formula:



wherein: $m=2-10$, R_1 , R_2 , R_5 , R_6 , are equal to or different from each other and are H or C_1 - C_5 alkyl groups.

4. The liquid composition of claim 1, wherein the iodine and/or bromine atoms are in a terminal position of the ionomer primary chains, said iodine and/or bromine atoms coming from a fluorocarbon chain transfer agent of formula:



where X_1 and X_2 are chosen from the group consisting of I, Br, and combinations of these.

5. The liquid composition of claim 4, wherein the content of the iodine and/or bromine atoms is between 0.1% and 5% by weight based on the ionomer.
6. The liquid composition of claim 1, wherein the fluorocarbon liquid medium comprises a perfluoropolyether or consists of a mixture of perfluoropolyethers.
7. The liquid composition of claim 6, wherein the perfluoropolyethers comprised have the general formula $F_3C-O-[CF_2-CF(CF_3)-O]_n-[CF_2-O]_m-CF_3$ wherein m and n are integers, being $n > 0$ and $m \geq 0$, said perfluoropolyethers each having molecular weight between 300 amu and 600 amu and a boiling point between 20°C and 150°C.
8. The liquid composition of claim 7 wherein the liquid composition contains mixtures of perfluoropolyethers having the general formula $F_3C-O-[CF_2-CF(CF_3)-O]_n-[CF_2-O]_m-CF_3$, said mixtures having boiling points comprised between 55°C and 135°C and a ratio between the indexes m and n below 0.05.
9. The liquid composition of claim 7 wherein the liquid composition contains mixtures of perfluoropolyethers having the general formula $F_3C-O-[CF_2-CF(CF_3)-O]_n-[CF_2-O]_m-CF_3$, each perfluoropolyether having molecular weight between 400 and 600 amu, said mixture having a boiling point comprised between 80°C and 100°C and a ratio between the indexes m and n below 0.05.
10. The liquid composition of claim 1, wherein the fluorocarbon liquid medium comprises a hydrogenated fluoropolyether.
11. The liquid composition of claim 1, wherein the fluorocarbon liquid medium consists of a mixture of hydrogenated fluoropolyethers.
12. The liquid composition according to claims 10 or 11 wherein the hydrogenated fluoropolyethers have the general formula $R^*-O-R_f'-R^{*'}$ wherein:
 $-R^*$ and $R^{*'}$, equal or different from each other, are independently chosen between $-C_mF_{2m+1}$ and $-C_nF_{2n+1}H_h$ groups, with m, n being integers from 1 to 3, h being integer $\geq$

1, chosen so that $h \leq 2n+1$, with the proviso that at least one of R^* and R^{**} is a $-C_nF_{2n+1}-$ _hH_h group, as defined above;

R_f' is chosen among the followings structures (1), (2), and (3) where:

structure (1) is $-(CF_2O)_a-(CF_2CF_2O)_b-(CF_2-(CF_2)_{z'}-CF_2O)_c$, with a, b and c being integers up to 10, and z' being an integer equal to 1 or 2, $a \geq 0$, $b \geq 0$, $c \geq 0$ and $a+b > 0$;

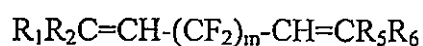
structure (2) is $-(C_3F_6O)_c-(C_2F_4O)_b-(CFXO)_t$, with X being, at each occurrence, independently selected among -F and -CF₃; b, c' and t being integers up to 10, $c' > 0$, $b \geq 0$, $t \geq 0$; and

structure (3) is $-(C_3F_6O)_c-(CFXO)_t$, with X being, at each occurrence, independently selected among -F and -CF₃; c' and t being integers up to 10, $c' > 0$, $t \geq 0$.

13. The liquid composition of claim 12 where R_f' is selected from among structures (1) and (2).
14. The liquid composition of claim 1, wherein the fluorocarbon liquid medium comprises the methoxy nonafluorobutane isomers $(CF_3)_2CFCF_2-O-CH_3$ and/or $CF_3CF_2CF_2CF_2-O-CH_3$.
15. The liquid composition of claim 1, wherein the fluorinated ionomer comprises: monomeric units comprising tetrafluoroethylene;

fluorinated monomeric units containing ethylenic groups and functional groups transformable into hydrophilic groups, said hydrophilic groups chosen from the groups consisting of $-SO_2F$, $-COOR$, $-COF$ and combinations of these wherein R is a C₁ to C₂₀ alkyl radical or a C₆ to C₂₀ aryl radical;

monomeric units deriving from a bis-olefin of formula:



wherein: $m=2-10$, R_1 , R_2 , R_5 , R_6 , are equal to or different from each other and are H or C_1-C_5 alkyl groups; and

iodine and or bromine atoms in a terminal position of the primary chains, said iodine and/or bromine atoms coming from a fluorocarbon chain transfer agent of formula:



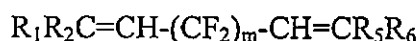
where X_1 and X_2 are chosen from the group consisting of I, Br, and combinations of these.

16. The liquid composition of claim 15, wherein the fluorinated monomeric units containing ethylenic groups and functional groups transformable into hydrophilic groups have formula:



17. The liquid composition of claim 1, wherein the liquid composition additionally comprises a crosslinking agent and a radical initiator.

18. The liquid composition of claim 17, wherein the crosslinking agent is a bis-olefin of formula:



wherein: $m=2-10$, R_1 , R_2 , R_5 , R_6 , are equal to or different from each other and are H or C_1-C_5 alkyl groups.

19. The liquid composition of claim 17, wherein the radical initiator is an organic dialkyl peroxide.
20. The liquid composition of claim 17 wherein the radical initiator is 2,5-di(t-butylperoxy)-2,5-dimethylhexane.

21. The liquid composition of claim 1, wherein at least 95% by weight of the fluorinated ionomer consists in particles of size lower than 200 nm.
22. The liquid composition of claim 1, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 200 nm.
23. The liquid composition of claim 22, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 125 nm.
24. The liquid composition of claim 22, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 40 nm.
25. The liquid composition of claim 22, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 15 nm.
26. A fluorocarbon liquid composition comprising a fluorocarbon liquid medium containing a crosslinkable fluorinated ionomer dissolved or dispersed therein, at least 90% by weight of the crosslinkable fluorinated ionomer consisting in particles of size lower than 200 nm.
27. The liquid composition of claim 26, wherein the liquid composition additionally comprises a crosslinking agent and a radical initiator.
28. A microporous membrane composite comprising:

a microporous membrane support comprising a coating on the surfaces and pores of said microporous membrane support, said coating comprises amorphous ionomer with acid hydrophilic groups, the microporous membrane composite is non-dewetting after autoclave treatment in water, said microporous membrane composite is wet with methanol and water containing solutions, and said microporous membrane composite has a flow loss of 82% or less compared to the microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa.

29. An article comprising:

a methanol and water solution wettable microporous membrane composite that is non-dewetting following autoclave treatment in water, said microporous membrane composite comprises a microporous membrane support with a surface area of $10 \text{ m}^2/\text{g}$ or more that has a coating on surfaces and pores of the microporous membrane support, said coating comprises an ionomer with hydrophilic groups where the ionomer is crosslinked, the microporous membrane composite has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol for the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, and where the pore size of the microporous membrane support is 0.45 microns or less.

30. An article comprising:

a microporous membrane composite comprising a microporous membrane support that has a rated pore size of 0.2 microns or less and an amount of a coating comprising an amorphous crosslinked fluorinated ionomer on the surfaces and pores of said microporous membrane support whereby the microporous membrane composite is non-dewetting following water autoclave, and said microporous membrane composite is wettable with a solution containing methanol in an amount of less than 80wt % methanol in water; said microporous membrane composite has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol for the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, said crosslinked fluorinated ionomer comprises crosslinker groups that are without hydrophilic groups.

31. The article of claim 30 where the fluorinated ionomer is crosslinked with a crosslinker comprising bis-olefins.

32. The article of claim 30 where the ionomers have an equivalent weight of between 380 g/eq and 620 g/eq.

33. The article of claim 30 where the microporous membrane composite has an ion exchange capacity of 95 nanomoles/cm² or more.
34. The article of claim 30 where the microporous membrane support is a multilayer membrane.
35. The article of claim 30 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value is within $\pm 9\%$ of a mean densitometer value determined by said densitometer of said methylene blue dye stained microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
36. The article of claim 30 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value does not differ at the 95% confidence limit by a Student-t test from a mean densitometer value determined by said densitometer of said methylene blue dye stained sample of said microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
37. The article of claim 30 where the microporous membrane composite has a water permeability of greater than (1000 liter/atm*hr*m²),
38. An article comprising:
- a methanol and water solution wettable microporous membrane composite comprising a microporous membrane support and an amount of a coating comprising an amorphous crosslinked fluorinated ionomer on surfaces and pores of said microporous membrane support, the microporous membrane composite is non-dewetting following water autoclave and said microporous

membrane composite has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol for the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, and where the pore size of the microporous membrane support is 0.45 microns or less, said crosslinked fluorinated ionomer comprises:

monomeric units derived from tetrafluoroethylene;

fluorinated ionomer units derived from fluorinated monomer units comprising fluorinated ethylenic groups and functional groups transformable into hydrophilic groups, said functional groups transformable into hydrophilic groups chosen from the groups consisting of $-\text{SO}_2\text{F}$, $-\text{COOR}$, $-\text{COF}$ and combinations of these wherein R is a C_1 to C_{20} alkyl radical or a C_6 to C_{20} aryl radical; and

monomeric crosslink units derived from a bis-olefin of formula:

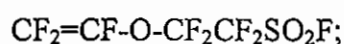


wherein: $m=2-10$, R_1 , R_2 , R_5 , R_6 , are equal to or different from each other and are H or C_1 – C_5 alkyl groups.

39. The article of claim 38 where the amount of said coating is 25% by weight to 30% by weight of said microporous membrane composite

40. The article of claim 38 where microporous membrane support is a multilayer microporous membrane.

41. The article of claim 38 where fluorinated ionomer units are derived from a fluorinated monomer unit of formula:



42. The article of claim 38 where the microporous membrane composite has a surface area of $10 \text{ m}^2/\text{g}$ or more and an ion exchange capacity of 95 nanomoles/square centimeter or more.
43. The article of claim 38 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value is within $\pm 9\%$ of a mean densitometer value determined by said densitometer of said methylene blue dye stained microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70°C and 80°C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
44. The article of claim 38 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value does not differ at the 95% confidence limit by a Student-t test from a mean densitometer value determined by said densitometer of said methylene blue dye stained sample of said microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70°C and 80°C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
45. The article of claim 38 where said fluorinated ionomers contains between 0.01% by weight and 5% by weight of said bis-olefin.
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46. The article of claim 38 where the coating comprises ionomers that have equivalent weights between 460 g/eq to 600 g/eq .
47. A porous membrane composite comprising: a microporous membrane support with pores 0.1 micron or smaller and a surface area of $10 \text{ meter}^2/\text{gram}$,

said microporous membrane composite has an ion exchange capacity of 95 nanomoles/ cm^2 or greater and is non-dewetting and has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in

isopropyl alcohol of the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, a weight percentage of the crosslinked amorphous ionomer on the microporous support is between 25 wt percent and 30 wt percent; and

said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value is within $\pm 9\%$ of a mean densitometer value determined by said densitometer of said methylene blue dye stained microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.

48. The fluorocarbon liquid composition of claim 1, wherein j is an integer between 4 and 8.
49. The fluorocarbon liquid composition of claim 1, wherein E is a $-(CF_2)_m$ -group, with m being an integer from 3 to 5.
50. The fluorocarbon liquid composition of claim 1, wherein E is $F_2C=CF-O-(CF_2)_5-O-CF=CF_2$.
51. The fluorocarbon liquid composition of claim 12, wherein a, b and c of structure (1) are integers up to 50.
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52. The fluorocarbon liquid composition of claim 12, wherein each of a and b are > 0 and b/a is comprised between 0.1 and 10 in structure (1).
53. The fluorocarbon liquid composition of claim 12, wherein b and $t > 0$, c'/b is comprised between 0.2 and 5.0, and $(c'+b)/t$ is comprised between 5 and 50 in structure (2).
54. The fluorocarbon liquid composition of claim 12, wherein $t > 0$ and c'/t is comprised between 5 and 50 in structure (3).

55. The microporous membrane composite of claim 28, wherein the microporous membrane composite is multilayered.
56. The microporous membrane composite of claim 28, wherein at least 90% by weight of the ionomer consists in particles of size lower than 200 nm.
57. The article of claim 29, wherein the methanol and water solution wettable microporous membrane composite is multilayered.
58. The article of claim 29, wherein at least 90% by weight of the ionomer consists in particles of size lower than 200 nm.
59. The article of claim 30, wherein at least 90% by weight of the fluorinated ionomer consists in particles of size lower than 200 nm.
60. The article of claim 38, wherein at least 90% by weight of the fluorinated ionomer consists in particles of size lower than 200 nm.
61. The porous membrane composite of claim 47, wherein at least 90% by weight of the ionomer consists in particles of size lower than 200 nm.
62. The porous membrane composite of claim 47, wherein the microporous membrane composite is multilayered.

CLAIMS

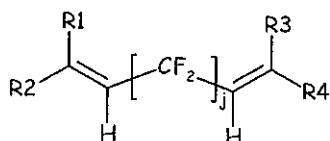
What is claimed is:

1. A fluorocarbon liquid composition comprising a fluorocarbon liquid medium containing a fluorinated ionomer dissolved or dispersed therein, at least 90% by weight of the fluorinated ionomer consisting in particles of size lower than 200 nm, the fluorinated ionomer comprising:

fluorinated monomer units containing ethylenic groups and functional groups transformable into hydrophilic groups, chosen from the groups consisting of $-\text{SO}_2\text{F}$, $-\text{COOR}$, $-\text{COF}$ and combinations of these, wherein R is a C_1 to C_{20} alkyl radical or a C_6 to C_{20} aryl radical;

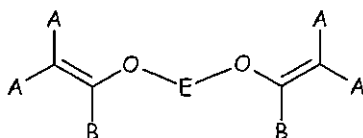
monomeric units deriving from a bis-olefin, chosen among the formulae (OF-1), (OF-2), (OF-3) where:

(OF-1)



wherein j is an integer between 2 and 10 and R1, R2, R3, R4, equal or different from each other, are H, F or C_1 to C_5 alkyl or (per)fluoroalkyl group;

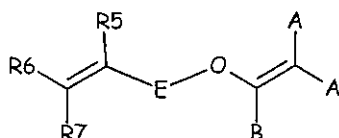
(OF-2)



wherein each of A, equal or different from each other and at each occurrence, is independently selected from F, Cl, and H; each of B, equal or different from each other and at each occurrence, is independently selected from F, Cl, H and ORB, wherein RB is a branched or straight chain alkyl radical which can be partially, or

completely fluorinated or chlorinated; E is a divalent group having 2 to 10 carbon atom, optionally fluorinated, which may be inserted with ether linkages;

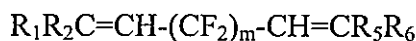
(OF-3)



wherein E, A and B have the same meaning as above defined; R5, R6, R7, equal or different from each other, are H, F or C1-5 alkyl or (per)fluoroalkyl group; and

iodine and/or bromine atoms.

2. The liquid composition of claim 1, wherein the ionomer has an equivalent weight of between 380 g/eq and 620 g/eq.
3. The liquid composition of claim 1, wherein the bis-olefin has the formula:



wherein: $m=2-10$, R_1 , R_2 , R_5 , R_6 , are equal to or different from each other and are H or C_1 – C_5 alkyl groups.

4. The liquid composition of claim 1, wherein the iodine and/or bromine atoms are in a terminal position of the ionomer primary chains, said iodine and/or bromine atoms coming from a fluorocarbon chain transfer agent of formula:



where X_1 and X_2 are chosen from the group consisting of I, Br, and combinations of these.

5. The liquid composition of claim 4, wherein the content of the iodine and/or bromine atoms is between 0.1% and 5% by weight based on the ionomer.

6. The liquid composition of claim 1, wherein the fluorocarbon liquid medium comprises a perfluoropolyether or consists of a mixture of perfluoropolyethers.
7. The liquid composition of claim 6, wherein the perfluoropolyethers comprised have the general formula $F_3C-O-[CF_2-CF(CF_3)-O]_n-[CF_2-O]_m-CF_3$ wherein m and n are integers, being $n > 0$ and $m \geq 0$, said perfluoropolyethers each having molecular weight between 300 amu and 600 amu and a boiling point between 20°C and 150°C.
8. The liquid composition of claim 7 wherein the liquid composition contains mixtures of perfluoropolyethers having the general formula $F_3C-O-[CF_2-CF(CF_3)-O]_n-[CF_2-O]_m-CF_3$, said mixtures having boiling points comprised between 55°C and 135°C and a ratio between the indexes m and n below 0.05.
9. The liquid composition of claim 7 wherein the liquid composition contains mixtures of perfluoropolyethers having the general formula $F_3C-O-[CF_2-CF(CF_3)-O]_n-[CF_2-O]_m-CF_3$, each perfluoropolyether having molecular weight between 400 and 600 amu, said mixture having a boiling point comprised between 80°C and 100°C and a ratio between the indexes m and n below 0.05.
10. The liquid composition of claim 1, wherein the fluorocarbon liquid medium comprises a hydrogenated fluoropolyether.
11. The liquid composition of claim 1, wherein the fluorocarbon liquid medium consists of a mixture of hydrogenated fluoropolyethers.
12. The liquid composition according to claims 10 or 11 wherein the hydrogenated fluoropolyethers have the general formula $R^*-O-R_f'-R^{*'}$ wherein:
 - R^* and $R^{*'}$, equal or different from each other, are independently chosen between $-C_mF_{2m+1}$ and $-C_nF_{2n+1}-H_h$ groups, with m, n being integers from 1 to 3, h being integer ≥ 1 , chosen so that $h \leq 2n+1$, with the proviso that at least one of R^* and $R^{*'}$ is a $-C_nF_{2n+1}-H_h$ group, as defined above;

R_f' is chosen among the followings structures (1), (2), and (3) where:

structure (1) is $-(CF_2O)_a-(CF_2CF_2O)_b-(CF_2-(CF_2)_{z'}-CF_2O)_c$, with a, b and c being integers up to 50, and z' being an integer equal to 1 or 2, $a \geq 0$, $b \geq 0$, $c \geq 0$ and $a+b > 0$;

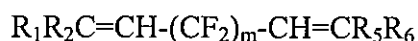
structure (2) is $-(C_3F_6O)_c'-(C_2F_4O)_b-(CFXO)_t$, with X being, at each occurrence, independently selected among -F and -CF₃; b, c' and t being integers up to 10, $c' > 0$, $b \geq 0$, $t \geq 0$; and

structure (3) is $-(C_3F_6O)_c'-(CFXO)_t$, with X being, at each occurrence, independently selected among -F and -CF₃; c' and t being integers up to 10, $c' > 0$, $t \geq 0$.

13. The liquid composition of claim 12 where R_f' is selected from among structures (1) and (2).
14. The liquid composition of claim 1, wherein the fluorocarbon liquid medium comprises the methoxy nonafluorobutane isomers (CF₃)₂CFCF₂-O-CH₃ and/or CF₃CF₂CF₂CF₂-O-CH₃.
15. The liquid composition of claim 1, wherein the fluorinated ionomer comprises:
monomeric units comprising tetrafluoroethylene;

fluorinated monomeric units containing ethylenic groups and functional groups transformable into hydrophilic groups, said hydrophilic groups chosen from the groups consisting of -SO₂F, -COOR, -COF and combinations of these wherein R is a C₁ to C₂₀ alkyl radical or a C₆ to C₂₀ aryl radical;

monomeric units deriving from a bis-olefin of formula:



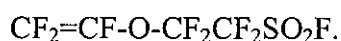
wherein: $m=2-10$, R₁, R₂, R₅, R₆, are equal to or different from each other and are H or C₁-C₅ alkyl groups; and

iodine and or bromine atoms in a terminal position of the primary chains, said iodine and/or bromine atoms coming from a fluorocarbon chain transfer agent of formula:



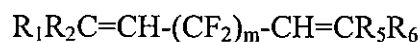
where X_1 and X_2 are chosen from the group consisting of I, Br, and combinations of these.

16. The liquid composition of claim 15, wherein the fluorinated monomeric units containing ethylenic groups and functional groups transformable into hydrophilic groups have formula:



17. The liquid composition of claim 1, wherein the liquid composition additionally comprises a crosslinking agent and a radical initiator.

18. The liquid composition of claim 17, wherein the crosslinking agent is a bis-olefin of formula:



wherein: $m=2-10$, R_1 , R_2 , R_5 , R_6 , are equal to or different from each other and are H or C_1-C_5 alkyl groups.

19. The liquid composition of claim 17, wherein the radical initiator is an organic dialkyl peroxide.

20. The liquid composition of claim 17 wherein the radical initiator is 2,5-di(t-butylperoxy)-2,5-dimethylhexane.

21. The liquid composition of claim 1, wherein at least 95% by weight of the fluorinated ionomer consists in particles of size lower than 200 nm.

22. The liquid composition of claim 1, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 200 nm.
23. The liquid composition of claim 22, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 125 nm.
24. The liquid composition of claim 22, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 40 nm.
25. The liquid composition of claim 22, wherein at least 99% by weight of the fluorinated ionomer consists in particles of size lower than 15 nm.
26. A fluorocarbon liquid composition comprising a fluorocarbon liquid medium containing a crosslinkable fluorinated ionomer dissolved or dispersed therein, at least 90% by weight of the crosslinkable fluorinated ionomer consisting in particles of size lower than 200 nm.
27. The liquid composition of claim 26, wherein the liquid composition additionally comprises a crosslinking agent and a radical initiator.
28. A microporous membrane composite comprising:
- a microporous membrane support comprising a coating on the surfaces and pores of said microporous membrane support, said coating comprises amorphous ionomer with acid hydrophilic groups, the microporous membrane composite is non-dewetting after autoclave treatment in water, said microporous membrane composite is wet with methanol and water containing solutions, and said microporous membrane composite has a flow loss of 82% or less compared to the microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa;
- wherein the microporous membrane is prepared by using the fluorocarbon liquid composition of Claim 1.

29. An article comprising:

a methanol and water solution wettable microporous membrane composite that is non-dewetting following autoclave treatment in water, said microporous membrane composite comprises a microporous membrane support with a surface area of 10 m²/g or more that has a coating on surfaces and pores of the microporous membrane support, said coating comprises an ionomer with hydrophilic groups where the ionomer is crosslinked, the microporous membrane composite has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol for the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, and where the pore size of the microporous membrane support is 0.45 microns or less;

wherein the article is prepared by using the fluorocarbon liquid composition of Claim 1.

30. An article comprising:

a microporous membrane composite comprising a microporous membrane support that has a rated pore size of 0.2 microns or less and an amount of a coating comprising an amorphous crosslinked fluorinated ionomer on the surfaces and pores of said microporous membrane support whereby the microporous membrane composite is non-dewetting following water autoclave, and said microporous membrane composite is wettable with a solution containing methanol in an amount of less than 80wt % methanol in water; said microporous membrane composite has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol for the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, said crosslinked fluorinated ionomer comprises crosslinker groups that are without hydrophilic groups;

wherein the article is prepared by using the fluorocarbon liquid composition of Claim 1.

31. The article of claim 30 where the fluorinated ionomer is crosslinked with a crosslinker comprising bis-olefins.
32. The article of claim 30 where the ionomers have an equivalent weight of between 380 g/eq and 620 g/eq.
33. The article of claim 30 where the microporous membrane composite has an ion exchange capacity of 95 nanomoles/cm² or more.
34. The article of claim 30 where the microporous membrane support is a multilayer membrane.
35. The article of claim 30 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value is within $\pm 9\%$ of a mean densitometer value determined by said densitometer of said methylene blue dye stained microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
36. The article of claim 30 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value does not differ at the 95% confidence limit by a Student-t test from a mean densitometer value determined by said densitometer of said methylene blue dye stained sample of said microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
37. The article of claim 30 where the microporous membrane composite has a water permeability of greater than (1000 liter/atm*hr*m²),
38. An article comprising:

a methanol and water solution wettable microporous membrane composite comprising a microporous membrane support and an amount of a coating comprising an amorphous crosslinked fluorinated ionomer prepared using the fluorocarbon liquid composition of Claim 1 on surfaces and pores of said microporous membrane support, the microporous membrane composite is non-dewetting following water autoclave and said microporous membrane composite has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol for the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, and where the pore size of the microporous membrane support is 0.45 microns or less.

39. The article of claim 38 where the amount of said coating is 25% by weight to 30% by weight of said microporous membrane composite.
40. The article of claim 38 where microporous membrane support is a multilayer microporous membrane.
41. The article of claim 38 where fluorinated ionomer units are derived from a fluorinated monomer unit of formula:



42. The article of claim 38 where the microporous membrane composite has a surface area of 10 m²/g or more and an ion exchange capacity of 95 nanomoles/square centimeter or more.
43. The article of claim 38 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value is within $\pm 9\%$ of a mean densitometer value determined by said densitometer of said methylene blue dye stained microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.

44. The article of claim 38 where said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value does not differ at the 95% confidence limit by a Student-t test from a mean densitometer value determined by said densitometer of said methylene blue dye stained sample of said microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite.
45. The article of claim 38 where said fluorinated ionomers contains between 0.01% by weight and 5% by weight of said bis-olefin.
46. The article of claim 38 where the coating comprises ionomers that have equivalent weights between 460 g/eq to 600 g/eq.
47. A porous membrane composite comprising: a microporous membrane support with pores 0.1 micron or smaller and a surface area of 10 meter²/gram,

said microporous membrane composite has an ion exchange capacity of 95 nanomoles/cm² or greater and is non-dewetting and has a flow loss on average in isopropyl alcohol that is 82% or less compared to a flow loss on average in isopropyl alcohol of the uncoated microporous membrane support when measured using 500 milliliters of isopropyl alcohol at a pressure of 97,905 Pa, a weight percentage of the crosslinked amorphous ionomer on the microporous support is between 25 wt percent and 30 wt percent; and

said microporous membrane composite has a mean densitometer value determined by densitometer readings of a methylene blue dye stained sample of said microporous membrane composite, said mean densitometer value is within ±9% of a mean densitometer value determined by said densitometer of said methylene blue dye stained microporous membrane composite after 4 or more hours flow through contact with isopropyl alcohol containing 5000 ppm fluorosurfactant at a temperature of between 70 °C and 80 °C at a flow rate of

at least 80 ml/min through a 47 millimeter diameter sample of said methylene blue dye stained microporous membrane composite;

wherein the article is prepared by using the fluorocarbon liquid composition of Claim 1.

48. The fluorocarbon liquid composition of claim 1, wherein j is an integer between 4 and 8.
49. The fluorocarbon liquid composition of claim 1, wherein E is a $-(CF_2)_m-$ group, with m being an integer from 3 to 5.
50. The fluorocarbon liquid composition of claim 1, wherein the bis-olefin of OF-2 type is $F_2C=CF-O-(CF_2)_5-O-CF=CF_2$.
51. The fluorocarbon liquid composition of claim 12, wherein a, b and c of structure (1) are integers up to 10.
52. The fluorocarbon liquid composition of claim 12, wherein each of a and b are > 0 and b/a is comprised between 0.1 and 10 in structure (1).
53. The fluorocarbon liquid composition of claim 12, wherein b and $t > 0$, c'/b is comprised between 0.2 and 5.0, and $(c'+b)/t$ is comprised between 5 and 50 in structure (2).
54. The fluorocarbon liquid composition of claim 12, wherein $t > 0$ and c'/t is comprised between 5 and 50 in structure (3).
55. The microporous membrane composite of claim 28, wherein the microporous membrane composite is multilayered.
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56. The article of claim 29, wherein the methanol and water solution wettable microporous membrane composite is multilayered.
57. The porous membrane composite of claim 47, wherein the microporous membrane composite is multilayered.