APPENDIX A. CLAIMS (CLEAN VERSION)

1. A filtration chamber comprising a microfabricated filter enclosed in a housing, wherein the filtration chamber comprises an antechamber and a post-filtration subchamber, and the fluid flow path in the antechamber is substantially opposite to or substantially antiparallel to the fluid flow path in the post-filtration subchamber.

2. The filtration chamber of claim 1, wherein each of the antechamber and the post-filtration subchamber has an inflow port and/or an outflow port.

3. The filtration chamber of claim 2, wherein the antechamber comprises at least two inflow ports.

4. The filtration chamber of claim 3, wherein the antechamber comprises a suprafilter thereby creating a suprachamber.

5. The filtration chamber of claim 4, wherein the suprafilter, between the antechamber and the suprachamber, is sufficiently rigid to maintain its flatness under slow flow conditions.

6. The filtration chamber according to claim 4 or 5, wherein the suprafilter comprises holes or slots with openings smaller than about 5 microns.

7. The filtration chamber according to any one of claims 2-6, wherein the inflow port and outflow port may be used interchangeably.

8. The filtration chamber according to any one of claims 1-7, wherein the microfabricated filter comprises one or more tapered slots.

9. The filtration chamber of claim 8, wherein the microfabricated filter comprises from about 100 to 5,000,000 tapered slots.

10. The filtration chamber according to any one of claims 1-9, wherein the thickness of the microfabricated filter is from about 20 to about 200 microns.

11. The filtration chamber of claim 10, wherein the thickness of the microfabricated filter is from about 40 to about 70 microns.

12. The filtration chamber according to any one of claims 8-11, wherein the tapered slots are from approximately 20 microns to 200 microns in length and from about 2 microns to about 16 microns in width, and the tapering of said slots is from about 0 degree to about 10 degrees, and wherein the variation in slot size of said tapered slots is less than about 20%.

13. The filtration chamber according to any one of claims 8-11, wherein the size of the tapered slots varies by more than 20%.

14. The filtration chamber of claim 13, wherein the size of the tapered slots varies by more than 50%.

15. The filtration chamber of claim 14, wherein the size of the tapered slots varies by more than 100%.

16. The filtration chamber according to any one of claims 13-15, wherein the size of the tapered slots varies along the fluid flow path in the antechamber.

17. The filtration chamber according to any one of claims 2-16, wherein the post-filtration subchamber comprises at least two outflow ports.

18. The filtration chamber of claim 17, wherein the at least two outflow ports are arranged along the fluid flow path in the antechamber.

19. The filtration chamber according to any one of claims 1-18, comprising two or more electrodes.

20. The filtration chamber of claim 19, wherein the electrodes are placed on opposite sides of the microfabricated filter.

21. The filtration chamber according to claim 19 or 20, wherein the electrodes are placed on the housing of the filtration chamber.

22. The filtration chamber according to any one of claims 19-21, wherein the electrodes are placed in the antechamber and/or the post-filtration subchamber.

23. The filtration chamber according to any one of claims 19-21, wherein the electrodes are incorporated or placed into one or more of the ports or connections that interact with the antechamber and/or the post-filtration subchamber.

24. The filtration chamber according to any one of claims 1-23, wherein the filtration chamber comprises at least one acoustic element.

25. The filtration chamber according to any one of claims 1-24, wherein the outflow port of the antechamber is connected to a collection chamber or collection well.

26. The filtration chamber according to any one of claims 1-25, wherein the housing comprises a top part and a bottom part, and the top part and the bottom part engage or bond together to form the filtration chamber.

27. The filtration chamber according to any one of claims 1-26, wherein the filtration chamber has a length of about 1 mm to about 10 cm, a width of about 1 mm to about 3 cm, and a depth of about 0.02 mm to about 20 mm.

28. The filtration chamber of claim 27, wherein the filtration chamber has a length of about 10 mm to about 50 mm, a width of about 5 mm to about 20 mm, and a depth of about 0.05 mm to about 2.5 mm.

29. The filtration chamber of claim 28, wherein the filtration chamber has a length of about 30 mm, a width of about 6 mm, and a depth of about 1 mm.

30. The filtration chamber according to any one of claims 1-29, wherein the housing has a length of about 38 mm, a width of about 12 mm, and a depth of about 20 mm as outer dimensions.

31. The filtration chamber according to any one of claims 27-30, wherein its antechamber has a length of about 1 mm to about 10 cm, a width of about 1 mm to about 3 cm, and a depth of about 0.01 mm to about 10 mm.

32. The filtration chamber of claim 31, wherein its antechamber has a length of about 10 mm to about 50 mm, a width of about 5 mm to about 20 mm, and a depth of about 0.01 mm to about 1 mm.

33. The filtration chamber of claim 32, wherein its antechamber has a length of about 30 mm, a width of about 6 mm, and a depth of about 0.1-0.4 mm.

34. The filtration chamber according to any one of claims 31-33, wherein the volume of the antechamber is about 0.01 μL to about 5 mL.

35. The filtration chamber of claim 34, wherein the volume of the antechamber is about 1 μL to about 100 μL.

36. The filtration chamber of claim 35, wherein the volume of the antechamber is about 40 to 80 μL.

37. The filtration chamber according to any one of claims 27-36, wherein the post-filtration subchamber has a length of about 1 mm to about 10 cm, a width of about 1 mm to about 3 cm, and a depth of about 0.01 mm to about 1 cm .

38. The filtration chamber of claim 37, wherein the post-filtration subchamber has a length of about 10 mm to about 50 mm, a width of about 5 mm to about 20 mm, and a depth of about 0.2 mm to about 1.5 mm.

39. The filtration chamber of claim 38, wherein the post-filtration subchamber has a length of about 30 mm, a width of about 6.4 mm, and a depth of about 0.6-1 mm.

40. A filtration chamber comprising a microfabricated filter enclosed in a housing, wherein the surface of said filter and/or the inner surface of said housing are modified by vapor deposition, sublimation, vapor-phase surface reaction, or particle sputtering to produce a uniform coating.

41. The filtration chamber of claim 40, wherein the filtration chamber comprises an antechamber and a post-filtration subchamber.

42. The filtration chamber of claim 41, wherein the antechamber comprises a suprafilter thereby creating a suprachamber.

43. The filtration chamber of claim 42, wherein the surface of the suprafilter is modified by vapor deposition, sublimation, vapor-phase surface reaction, or particle sputtering to produce a uniform coating.

44. The filtration chamber according to any one of claims 40-43, wherein the modification is by physical vapor deposition.

45. The filtration chamber according to any one of claims 40-43, wherein the modification is by plasma-enhanced chemical vapor deposition.

46. The filtration chamber according to any one of claims 40-43, wherein the vapor deposition is of a metal nitride or a metal halide.

47. The filtration chamber of claim 46, wherein the metal nitride is titanium nitride, silicon nitride, zinc nitride, indium nitride, and/or boron nitride.

48. The filtration chamber according to any one of claims 40-43, wherein the modification is by chemical vapor deposition.

49. The filtration chamber of claim 48, wherein the chemical vapor deposition is by a Parylene or derivative thereof.

50. The filtration chamber of claim 49, wherein the Parylene or derivative thereof is selected from the group consisting of Parylene, Parylene-N, Parylene-D, Parylene AF-4, Parylene SF, and Parylene HT.

51. The filtration chamber of claim 48, wherein the modification is by polytetrafluoroethylene (PTFE).

52. The filtration chamber of claim 48, wherein the modification is by Teflon-AF.

53. The filtration chamber according to claim 40 or 43, wherein the modification is by a perfluorocarbon.

54. The filtration chamber of claim 53, wherein the perfluorocarbon is 1H,1H,2H,2H-perfluorooctyltriethoxysilane, 1H,1H,2H,2H-perfluorodecyltriethoxysilane, trichloro(1H,1H,2H,2H-perfluorooctyl)silane or trichloro(octadecyl)silane and is in liquid form.

55. The filtration chamber according to any one of claims 40-54, wherein the filter and/or housing comprises silicon, silicon dioxide, glass, metal, carbon, ceramics, plastic, or a polymer.

56. The filtration chamber according to any one of claims 40-54, wherein the filter and/or housing comprises silicon nitride or boron nitride.

57. A filtration chamber comprising a microfabricated filter enclosed in a housing, wherein the surface of said filter and/or the inner surface of said housing are modified by a metal nitride, a metal halide, a Parylene or derivative thereof, a polytetrafluoroethylene (PTFE), a Teflon-AF or a perfluorocarbon.

58. The filtration chamber of claim 57, wherein the filtration chamber comprises an antechamber and a post-filtration subchamber.

59. The filtration chamber of claim 58, wherein the antechamber comprises a suprafilter thereby creating a suprachamber.

60. The filtration chamber of claim 59, wherein the surface of the suprafilter is modified by a metal nitride, a metal halide, a Parylene or derivative thereof, a polytetrafluoroethylene (PTFE), a Teflon-AF or a perfluorocarbon.

61. The filtration chamber according to any one of claims 57-60, wherein the metal nitride is titanium nitride, silicon nitride, zinc nitride, indium nitride, and/or boron nitride.

62. The filtration chamber according to any one of claims 57-60, wherein the Parylene or derivative thereof is selected from the group consisting of Parylene, Parylene-N, Parylene-D, Parylene AF-4, Parylene SF, and Parylene HT.

63. The filtration chamber according to any one of claims 57-60, wherein the perfluorocarbon is 1H,1H,2H,2H-perfluorooctyltriethoxysilane, 1H,1H,2H,2H-perfluorodecyltriethoxysilane, trichloro(1H,1H,2H,2H-perfluorooctyl)silane or trichloro(octadecyl)silane, and the perfluorocarbon covalently binds the surface.

64. The filtration chamber according to any one of claims 57-63, wherein the filter and/or housing comprises silicon, silicon dioxide, glass, metal, carbon, ceramics, plastic, or a polymer.

65. The filtration chamber according to any one of claims 57-63, wherein the filter and/or housing comprises silicon nitride or boron nitride.

66. The filtration chamber according to any one of claims 1-65, wherein the surface of the filter and/or the inner surface of said housing are modified by vapor deposition, sublimation, vapor-phase surface reaction, or particle sputtering to produce a uniform coating.

67. The filtration chamber of claim 66, wherein the vapor deposition is of a metal nitride or a metal halide.

68. The filtration chamber of claim 67, wherein the metal nitride is titanium nitride, silicon nitride, zinc nitride, indium nitride, and/or boron nitride.

69. The filtration chamber of claim 66, wherein the modification is by chemical vapor deposition.

70. The filtration chamber of claim 66, wherein the modification is by a perfluorocarbon.

71. The filtration chamber of claim 70, wherein the perfluorocarbon is 1H,1H,2H,2H-perfluorooctyltriethoxysilane, 1H,1H,2H,2H-perfluorodecyltriethoxysilane, trichloro(1H,1H,2H,2H-perfluorooctyl)silane or trichloro(octadecyl)silane and is in liquid form.

72. The filtration chamber according to any one of claims 1-71, wherein the surface of the filter and/or the inner surface of said housing are modified by a metal nitride, a metal halide, a Parylene, a polytetrafluoroethylene (PTFE), a Teflon-AF or a perfluorocarbon.

73. The filtration chamber of claim 72, wherein the metal nitride is titanium nitride, silicon nitride, zinc nitride, indium nitride, and/or boron nitride.

74. The filtration chamber of claim 72, wherein the perfluorocarbon is 1H,1H,2H,2H-perfluorooctyltriethoxysilane, 1H,1H,2H,2H-perfluorodecyltriethoxysilane, trichloro(1H,1H,2H,2H-perfluorooctyl)silane or trichloro(octadecyl)silane, and the perfluorocarbon covalently binds the surface.

75. A filtration chamber according to any one of claims 1-74, comprising at least two microfabricated filters.

76. The filtration chamber of claim 75, wherein the at least two microfabricated filters are arranged in tandem.

77. A filtration chamber comprising at least two filtration chambers according to any one of claims 1-76 arranged in tandem.

78. The filtration chamber of claim 77, wherein the antechambers of the at least two filtration chambers are in fluid connection.

79. The filtration chamber of claim 78, wherein the at least two filtration chambers share one microfabricated filter and/or suprafilter.

80. The filtration chamber according to claim 77 or 78, wherein the slots of the filters within each filtration chamber are of different widths, and the filtration chambers are arranged in order of increasing slot widths.

81. A cartridge comprising the filtration chamber according to any one of claims 1-80.

82. The cartridge of claim 81, comprising at least two filtration chambers.

83. The cartridge of claim 82, comprising eight filtration chambers.

84. An automated filtration unit for separating a target component in a fluid sample, comprising the filtration chamber according to any one of claims 1-80.

85. The automated filtration unit of claim 84, further comprising a control algorithm for controlling the fluid flow in the filtration chamber.

86. The automated filtration unit according to claim 84 or 85, comprising at least two filtration chambers.

87. The automated filtration unit according to claim 86, wherein the at least two filtration chambers are arranged in tandem, and the filtration chambers comprise filters of increasing slot width.

88. The automated filtration unit according to claim 86 or 87, wherein the filters contain slot widths of increasing size along the fluidic path.

89. The automated filtration unit of claim 88, comprising a suprachamber.

90. The automated filtration unit according to any one of claims 84-89, wherein the post-filtration subchamber comprises multiple partitions each comprising an outflow port.

91. The automated filtration of claim 90, wherein the outflow port from each partition of the post-filtration chamber is aligned with individual wells of a multi-well plate.

92. The automated filtration of claim 91, wherein the wells are spaced about every 1-100 mm.

93. The automated filtration of claim 91, wherein the wells are spaced about every 2.25 mm.

94. The automated filtration of claim 91, wherein the wells are spaced about every 4.5 mm.

95. The automated filtration of claim 91, wherein the wells are spaced about every 9 or 18 mm.

96. The automated filtration unit according to any one of claims 84-95, comprising eight filtration chambers.

97. The automated filtration unit according to any one of claims 84-96, comprising a means for effecting fluid flow in the filtration chamber.

98. The automated filtration unit of claim 97, wherein the means for effecting fluid flow is a fluidic pump.

99. The automated filtration unit according to any one of claims 84-98, comprising a means for collecting the separated target component.

100. An automated system for separating and analyzing a target component in a fluid sample, comprising the automated filtration unit according to any one of claims 84-98 and an analysis apparatus connected to the filtration unit.

101. The automated system of claim 100, wherein the analysis apparatus is a cell sorting device or a flow cytometer.

102. A method for separating a target component in a fluid sample, comprising:

a) dispensing the fluid sample into the filtration chamber according to any one of claims 1-80; and

b) providing a fluid flow of the fluid sample through the filtration chamber, wherein the target component of the fluid sample is retained by or passes through the filter.

103. The method of claim 102, comprising providing a fluid flow of the fluid sample through the antechamber of the filtration chamber and a fluid flow of a solution through the post-filtration subchamber of the filtration chamber, and optionally a fluid flow of a solution through the suprachamber of the filtration chamber.

104. The method according to claim 102 or 103, wherein the fluid sample is separated based on the size, shape, deformability, binding affinity and/or binding specificity of the components.

105. The method according to claim 103 or 104, wherein the fluid sample is dispensed through the inflow port of the antechamber.

106. The method according to any one of claims 103-105, wherein the solution is introduced to the inflow port of the post-filtration subchamber.

107. The method according to any one of claims 103-105, wherein the solution is introduced to the inflow port of the supra-filtration chamber.

108. The method according to any one of claims 102-107, wherein the fluid sample is manipulated by a physical force effected via a structure that is external to the filter and/or a structure that is built-in on the filter.

109. The method of claim 108, wherein the physical force is selected from the group consisting of a dielectrophoretic force, a traveling-wave dielectrophoretic force, a magnetic force, an acoustic force, an electrostatic force, a mechanical force, an optical radiation force and a thermal convection force.

110. The method of claim 109, wherein the dielectrophoretic force or the traveling-wave dielectrophoretic force is effected via an electrical field produced by an electrode.

111. The method of claim 109, wherein the acoustic force is effected via a standing-wave acoustic field or a traveling-wave acoustic field.

112. The method of claim 109, wherein the acoustic force is effected via an acoustic field produced by piezoelectric material.

113. The method of claim 109, wherein the acoustic force is effected via a voice coil or audio speaker.

114. The method of claim 109, wherein the electrostatic force is effected via a direct current (DC) electric field.

115. The method of claim 109, wherein the optical radiation force is effected via laser tweezers.

116. The method according to any one of claims 102-115, wherein the fluid sample is blood, effusion, urine, bone marrow sample, ascitic fluid, pelvic wash fluid, pleural fluid, spinal fluid, lymph, serum, mucus, sputum, saliva, semen, ocular fluid, extract of nasal, throat or genital swab, cell suspension from digested tissue, extract of fecal material, cultured cells of either mixed types and/or mixed sizes, or cells that contain contaminants or unbound reactants that need to be removed.

117. The method of claim 116, wherein the fluid sample is a blood sample and the component being removed is a plasma, a platelet and/or a red blood cell (RBC).

118. The method of claim 116, wherein the fluid sample are cells that contain contaminants or unbound reactants that need to be removed, and the reactant is a labeling reagent for the cells.

119. The method of claim 116, wherein the fluid sample is a blood sample and the target component is a nucleated cell, e.g., a non-hematopoietic cell, a subpopulation of blood cells, a fetal red blood cell, a stem cell, or a cancerous cell.

120. The method of claim 116, wherein the fluid sample is an effusion or a urine sample and the target component is a nucleated cell, *e.g.*, a cancerous cell or a non-hematopoietic cell.

121. A method of separating a target component in a fluid sample using the automated filtration unit according to any one of claims 84-99, comprising:

a) dispensing the fluid sample into the filtration chamber; and

b) providing a fluid flow of the fluid sample through the filtration chamber, wherein the target component of the fluid sample is retained by or flows through the filter.

122. The method of claim 121, wherein the fluid sample is separated based on the size, shape, deformability, binding affinity and/or binding specificity of the components.

123. The method according to claim 121 or 122, wherein the fluid sample in the antechamber flows substantially antiparallel to the solution in the post-filtration subchamber.

124. The method according to any one of claims 121-123, wherein the filter rate is about 0-5 mL/min.

125. The method of claim 124, wherein the filter rate is about 10-500 μL/min.

126. The method of claim 125, wherein the filter rate is about 80-140 μL/min.

127. The method according to any one of claims 124-126, wherein the feed rate is about 1-10 times the filter rate.

128. The method according to any one of claims 102-127, further comprising:

c) rinsing the retained components of the fluid sample with an additional sample-free rinsing reagent.

129. The method of claim 128, wherein during the rinsing step the feed rate is less than or equal to the filter rate.

130. The method according to claim 128 or 129, wherein a rinsing reagent is introduced to the post-filtration subchamber.

131. The method according to claim 128 or 129, wherein the rinsing reagent is introduced to the antechamber and/or the suprachamber.

132. The method according to any one of claims 102-131, further comprising:

d) providing a labeling reagent to bind to the target component.

133. The method of claim 132, wherein the labeling reagent is an antibody.

134. The method according to claim 132 or 133, wherein the labeling reagent is added to the collection chamber.

135. The method according to claim 132 or 133, wherein the labeling reagent is added to the antechamber and/or the suprachamber.

136. The method according to any one of claims 132-135, wherein during the labeling step the fluid flow in the post-filtration subchamber is stopped.

137. The method according to any one of claims 132-136, further comprising:

e) removing the unbound labeling reagent.

138. The method according to any one of claims 102-137, further comprising:

f) recovering the target component in the collection chamber.

139. The method of claim 138, wherein during the recovering step the feed rate is about 5-20 mL/min.

140. The method according to claim 138 or 139, wherein during the recovering step the outflow rate equals the inflow rate in the post-filtration subchamber.

141. The method according to any one of claims 138-140, wherein during the recovering step the outflow is paused for about 50 ms.

142. The method according to any one of claims 121-141, wherein the fluid sample is a blood sample, which comprises removing at least one type of undesirable component using a specific binding member.

143. The method of claim 142, wherein the at least one undesirable component are white blood cells (WBCs).

144. The method of claim 143, wherein the specific binding member selectively binds to WBCs and is coupled to a solid support.

145. The method of claim 144, wherein the specific binding member is an antibody or an antibody fragment that selectively binds to WBCs.

146. The method of claim 145, wherein the specific binding member is an antibody that selectively binds to CD3, CD11b, CD14, CD17, CD31, CD45, CD50, CD53, CD63, CD69, CD81, CD84, CD102 or CD166.

147. The method of claim 146, wherein the specific binding member is an antibody that selectively binds to CD35 and/or CD50.

148. The method according to any one of claims 142-147, further comprising contacting the blood sample with a secondary specific binding member.

149. The method of claim 148, wherein said secondary specific binding member is an antibody that selectively binds to CD31, CD36, CD41, CD42 (a, b or c), CD51, or CD51/61.

150. A method of enriching and analyzing a target component in a fluid sample using the automated system according to claim 100 or 101, comprising,

a) dispensing the fluid sample into the filtration chamber;

b) providing a fluid flow of the fluid sample through the antechamber of the filtration chamber and a fluid flow of a solution through the post-filtration subchamber of the filtration chamber, wherein the target component of the fluid sample is retained in the antechamber and non-target components flow through the filter into the post-filtration subchamber;

c) labeling the target component; and

d) analyzing the labeled target component using the analysis apparatus.

151. The method of claim 150, comprising providing fluid flow into the suprachamber.

152. The method according to claim 150 or 151, wherein the target component is a cell or cellular organelle.

153. The method of claim 152, wherein the cell is a nucleated cell.

154. The method of claim 152, wherein the cell is a rare cell.

CLAIMS

The claims defining the invention are as follows.

1. A filtration chamber comprising a microfabricated filter enclosed in a housing, wherein the filtration chamber comprises an antechamber and a post-filtration subchamber, and the fluid flow path in the antechamber is substantially opposite to or substantially antiparallel to the fluid flow path in the post-filtration subchamber.

2. The filtration chamber of claim 1, wherein each of the antechamber and the post-filtration subchamber has an inflow port and/or an outflow port.

3. The filtration chamber of claim 2, wherein the antechamber comprises at least two inflow ports.

4. The filtration chamber of claim 3, wherein the antechamber comprises a suprafilter thereby creating a suprachamber.

5. The filtration chamber of claim 4, wherein the suprafilter, between the antechamber and the suprachamber, is sufficiently rigid to maintain its flatness under slow flow conditions; and/or wherein the suprafilter comprises holes or slots with openings smaller than about 5 microns.

6. The filtration chamber according to any one of claims 2-5, wherein the inflow port and outflow port may be used interchangeably.

7. The filtration chamber according to any one of claims 1-6, wherein the microfabricated filter comprises one or more tapered slots, or from about 100 to about 5,000,000 tapered slots.

8. The filtration chamber according to any one of claims 1-7, wherein the thickness of the microfabricated filter is from about 20 to about 200 microns, or from about 40 to about 70 microns.

9. The filtration chamber according to claim 7 or 8, wherein the tapered slots are from approximately 20 microns to 200 microns in length and from about 2 microns to about 16 microns in width, and the tapering of said slots is from about 0 degree to about 10 degrees, and wherein the variation in slot size of said tapered slot is less than about 20%, or

wherein the size of the tapered slots varies by more than 20%, more than 50%, or more than 100%.

10. The filtration chamber according to claim 9, wherein the size of the tapered slots varies along the fluid flow path in the antechamber.

11. The filtration chamber according to any one of claims 2-10, wherein the post-filtration subchamber comprises at least two outflow ports arranged along the fluid flow path in the antechamber.

12. The filtration chamber according to any one of claims 2-11, wherein the outflow port of the antechamber is connected to a collection chamber or collection well.

13. The filtration chamber according to any one of claims 1-12, wherein the surface of said filter, said suprafilter, and/or the inner surface of said housing are modified by vapor deposition, sublimation, vapor-phase surface reaction, or particle sputtering to produce a uniform coating.

14. The filtration chamber according to claim 13, wherein the modification is by physical vapor deposition, by plasma-enhanced chemical vapor deposition, or by chemical vapor deposition.

15. The filtration chamber according to claim 13 or 14, wherein:

the vapor deposition is of a metal nitride or a metal halide;

the vapor deposition is of titanium nitride, silicon nitride, zinc nitride, indium nitride, and/or boron nitride;

the chemical vapor deposition is by a Parylene or derivative thereof, by polytetrafluoroethylene (PTFE), by Teflon-AF, or by a perfluorocarbon;

the chemical vapor deposition is by a Parylene or derivative thereof selected from the group consisting of Parylene, Parylene-N, Parylene-D, Parylene AF-4, Parylene SF, and Parylene HT; and/or

the chemical vapor deposition is by a perfluorocarbon selected from the group consisting of 1H,1H,2H,2H-perfluorooctyltriethoxysilane, 1H,1H,2H,2H-perfluorodecyltriethoxysilane, trichloro(1H,1H,2H,2H-perfluorooctyl)silane, and trichloro(octadecyl)silane.

16. The filtration chamber according to any one of claims 13-15, wherein the filter and/or housing comprises silicon, silicon dioxide, glass, metal, carbon, ceramics,

plastic, or a polymer, or wherein the filter and/or housing comprises silicon nitride or boron nitride.

17. A filtration chamber according to any one of claims 1-16, comprising at least two microfabricated filters optionally arranged in tandem.

18. A filtration chamber comprising at least two filtration chambers according to any one of claims 1-17 arranged in tandem.

19. The filtration chamber of claim 18, wherein the antechambers of the at least two filtration chambers are in fluid connection, or wherein the at least two filtration chambers share one microfabricated filter and/or suprafilter; and/or

wherein the slots of the filters within each filtration chamber are of different widths, and the filtration chambers are arranged in order of increasing slot widths along the fluidic path.

20. A cartridge or an automated filtration unit for separating a target component in a fluid sample, comprising the filtration chamber according to any one of claims 1-19.

21. The automated filtration unit according to claim 20, wherein the post-filtration subchamber comprises multiple partitions each comprising an outflow port, optionally wherein the outflow port from each partition of the post-filtration chamber is aligned with individual wells of a multi-well plate.

22. The automated filtration unit according to claim 20 or 21, comprising a means for effecting fluid flow in the filtration chamber, and/or a means for collecting the separated target component.

23. An automated system for separating and analyzing a target component in a fluid sample, comprising the automated filtration unit according to any one of claims 20-22 and an analysis apparatus connected to the filtration unit, optionally wherein the analysis apparatus comprises a cell sorting device or a flow cytometer.

24. A method for separating a target component in a fluid sample, comprising:

a) dispensing the fluid sample into the filtration chamber according to any one of claims 1-19; and

b) providing a fluid flow of the fluid sample through the filtration chamber, wherein the target component of the fluid sample is retained by or passes through the filter.

25. The method of claim 24, wherein:

the method comprises providing a fluid flow of the fluid sample through the antechamber of the filtration chamber and a fluid flow of a solution through the post-filtration subchamber of the filtration chamber, and optionally a fluid flow of a solution through the suprachamber of the filtration chamber; and/or

the fluid sample is separated based on the size, shape, deformability, binding affinity and/or binding specificity of the components.

26. The method according to claim 25, wherein:

the fluid sample is dispensed through the inflow port of the antechamber; wherein the solution is introduced to the inflow port of the post-filtration subchamber; or wherein the solution is introduced to the inflow port of the supra-filtration chamber; and/or

the fluid sample is manipulated by a physical force effected via a structure that is external to the filter and/or a structure that is built-in on the filter.

27. The method of claim 26, wherein the physical force is selected from the group consisting of a dielectrophoretic force, a traveling-wave dielectrophoretic force, a magnetic force, an acoustic force, an electrostatic force, a mechanical force, an optical radiation force and a thermal convection force.

28. The method of claim 27, wherein:

the dielectrophoretic force or the traveling-wave dielectrophoretic force is effected via an electrical field produced by an electrode;

the acoustic force is effected via a standing-wave acoustic field or a traveling-wave acoustic field, via an acoustic field produced by a piezoelectric material, or via a voice coil or audio speaker;

the electrostatic force is effected via a direct current (DC) electric field; and/or

the optical radiation force is effected via laser tweezers.

29. The method according to any one of claims 24-28, wherein the fluid sample is blood, effusion, urine, bone marrow sample, ascitic fluid, pelvic wash fluid, pleural fluid, spinal fluid, lymph, serum, mucus, sputum, saliva, semen, ocular fluid, extract of nasal, throat or genital swab, cell suspension from digested tissue, extract of

fecal material, cultured cells of either mixed types and/or mixed sizes, or cells that contain contaminants or unbound reactants that need to be removed.

30. The method of claim 29, wherein the fluid sample is selected from the group consisting of:

a blood sample and the component being removed is a plasma, a platelet and/or a red blood cell (RBC);

cells that contain contaminants or unbound reactants that need to be removed, and the reactant is a labeling reagent for the cells;

a blood sample and the target component is a nucleated cell, *e.g.*, a non-hematopoietic cell, a subpopulation of blood cells, a fetal red blood cell, a stem cell, or a cancerous cell; and

an effusion or a urine sample and the target component is a nucleated cell, *e.g.*, a cancerous cell or a non-hematopoietic cell.

31. A method of separating a target component in a fluid sample using the automated filtration unit according to any one of claims 20-22, comprising:

a) dispensing the fluid sample into the filtration chamber; and

b) providing a fluid flow of the fluid sample through the filtration chamber, wherein the target component of the fluid sample is retained by or flows through the filter,

wherein optionally the filter rate is about 0-5 mL/min, about 10-500 μL/min, or about 80-140 μL/min, or wherein the feed rate is about 1-10 times the filter rate.

32. The method according to any one of claims 24-31, further comprising:

c) rinsing the retained components of the fluid sample with an additional sample-free rinsing reagent,

optionally wherein during the rinsing step the feed rate is less than or equal to the filter rate, and/or optionally wherein a rinsing reagent is introduced to the post-filtration subchamber, or to the antechamber and/or the suprachamber.

33. The method according to claim 32, further comprising:

d) providing a labeling reagent to bind to the target component,

optionally wherein the labeling reagent is an antibody; optionally wherein the labeling reagent is added to the collection chamber, or to the antechamber and/or the

suprachamber; and/or optionally wherein during the labeling step the fluid flow in the post-filtration subchamber is stopped.

34. The method according to claim 33, further comprising:

e) removing the unbound labeling reagent; and/or

f) recovering the target component in the collection chamber.

35. The method of claim 34, wherein during the recovering step the feed rate is about 5-20 mL/min; wherein during the recovering step the outflow rate equals the inflow rate in the post-filtration subchamber; and/or wherein during the recovering step the outflow is paused for about 50 ms.

36. The method according to any one of claims 31-35, wherein the fluid sample is a blood sample, which comprises removing at least one type of undesirable component using a specific binding member.

37. The method of claim 36, wherein the at least one undesirable component are white blood cells (WBCs), and/or wherein the specific binding member is coupled to a solid support.

38. The method of claim 37, wherein the specific binding member is selected from the group consisting of:

an antibody or an antibody fragment that selectively binds to WBCs;

an antibody that selectively binds to CD3, CD11b, CD14, CD17, CD31, CD45, CD50, CD53, CD63, CD69, CD81, CD84, CD102, or CD166; and

an antibody that selectively binds to CD35 and/or CD50.

39. The method according to any one of claims 36-38, further comprising contacting the blood sample with a secondary specific binding member, optionally wherein said secondary specific binding member is an antibody that selectively binds to CD31, CD36, CD41, CD42 (a, b or c), CD51, or CD51/61.

40. A method of enriching and analyzing a target component in a fluid sample using the automated system according to claim 23, comprising:

a) dispensing the fluid sample into the filtration chamber;

b) providing a fluid flow of the fluid sample through the antechamber of the filtration chamber and a fluid flow of a solution through the post-filtration subchamber of the filtration chamber, wherein the target component of the fluid sample is retained in the

antechamber and non-target components flow through the filter into the post-filtration subchamber;

c) labeling the target component; and

d) analyzing the labeled target component using the analysis apparatus,

optionally wherein the target component is a cell or cellular organelle, a nucleated cell, or a rare cell.