

최신 미국특허 등록 목록

■ System for nitrifying and de-nitrifying wastewater

- Patent number : WO 2007/120934 (2007)
- Inventors : R.W. Dimassimo, S.-N. Hong, Z. Hong and L. Wood
- Applicant : I. Kruger Incorporated, USA
- Abstract : This patent provides details of a system for nitrifying and de-nitrifying wastewater. A system is provided that includes first and second reactors (A & B), each of which operate to nitrify or de-nitrify the wastewater that they contain. Downstream from the first and second reactors is a membrane reactor (C) that operates under aerobic conditions, and includes one or more submersed membranes for separating solids. Extending between the membrane reactor and each of the first and second reactors is a return line with appropriate controls for permitting activated sludge to be returned to one of the reactors at a time. To nitrify and de-nitrify wastewater, an influent stream is alternately directed to the anoxic reactors, which are alternately operated under aerobic and anoxic conditions. To reduce or minimise the dissolved oxygen return from the membrane reactor to the first and second reactors, the flow of return activated sludge is controlled such that it is generally returned to the reactor that is operating under aerobic conditions. The accompanying figure illustrates the system described. An influent line (12) leads to the two reactors (A & B). By using a valve, or other conventional flow control means, wastewater influent passing through the influent line can be alternately directed through feed lines (12A) or (12B) to each of the reactors. The aerobic membrane reactor (C) is disposed such that wastewater or mixed liquor in either reactor A or B can be directed into reactor C. The mixed liquor chan-

nelled to the aerobic reactor is directed through the immersed membrane filter (14) which effectively separates the wastewater into a permeate and activated sludge. In the case of the system shown in the diagram, permeate is pumped from the membrane filter and from reactor C through effluent line (26) that includes a check valve (28).

■ Fouling-resistant membranes

- Patent number : WO 2007/120631 (2007)
- Inventors : A.M. Mayes and A. Asatekin
- Applicant : Massachusetts Institute of Technology, USA
- Abstract : This patent generally covers amphiphilic graft copolymers based on polyacrylonitrile (PAN) which can be used to make membranes for liquid filtration. In one aspect, the invention provides systems and methods for preparing high-flux, fouling-resistant nanofiltration membranes whose pore size can be readily tuned. In some cases, micro-phase separation of a graft copolymer, composed of a backbone comprising PAN and hydrophilic side-chains, is used. In others, nano-channels of 'tunable' width are formed, which may give the membrane permselective properties and/or anti-fouling characteristics. In addition, a copolymer may be used as an additive in the immersion precipitation casting of ultrafiltration or microfiltration membranes. In certain instances, the additive can be isolated in the membrane's exterior and/or pore surfaces, for example, because of favourable interactions between the hydrophilic side chains and the surrounding environment, which may create a surface that resists fouling by biological molecules.

■ Polytetrafluoroethylene porous membrane

- **Patent number** : WO 2007/119508 (2007)
- **Inventors** : M. Suzuki and Y. Uchida
- **Applicant** : Nitto Denko Corporation, Japan
- **Abstract** : A process has been developed for producing a polytetrafluoroethylene (PTFE) porous membrane which exhibits both a high collection efficiency and a low pressure loss, though it has a mean pore diameter larger than that of conventional PTFE porous membranes, and also a greater thickness. The process described involves stretching an unbaked PTFE sheet 5-fold to 30-fold in a prescribed direction at a temperature of the melting point of the material or above, and further stretching the resulting sheet 5-fold to 40-fold in a direction different from the above prescribed direction and at a temperature lower than the melting point indicated earlier. The sheet is then heated to a temperature above melting point.

■ Blood/air mass exchange apparatus

- **Patent number** : WO 2007/119073 (2007)
- **Inventors** : W.R. Johns
- **Applicant** : Haemair Limited, UK
- **Abstract** : The subject of this patent is an apparatus designed for use in blood/air mass exchange. It comprises a number of conduits for defining a blood flow from an inlet, and a plurality of conduits for defining an air flow from an inlet. The air-flow and blood-flow conduits are at least partially composed of a gas-permeable membrane material. The conduits are arranged relative to each other in such a way as to enable the transfer of oxygen from the air flow to the blood flow, and transfer of carbon dioxide from the blood flow to the air flow through the membrane material. The apparatus additionally comprises at least one sensor for sensing patient respiratory demand, and a way of governing the rate of blood/air mass exchange through the separate control of the levels of carbon dioxide and oxygen in the air flow.

■ Composite membrane

- **Patent number** : WO 2007/118902 (2007)
- **Inventors** : J. Caro, H. Wang, M. Noack, P. Kölsch, F. Kapteijn, N. Kanellopoulos and J. Nolan
- **Applicant** : Leibniz-Universität Hannover, Germany
- **Abstract** : This invention relates to composite ceramic membranes for use in chemical processes such as the separation of molecules – sometimes referred to as molecular sieving – preferably in combination with the chemical conversion of molecules, selected from a composition of different molecules (for example, selective partial or full oxidation). The composite membrane offers a combination of molecular sieving and oxygen transport. This makes it suitable for the selective oxidation of hydrocarbons from a feed comprising a mixture of hydrocarbons. The membrane described by this patent comprises a first layer, containing an oxygen transporting material (for example, perovskite) and, in association with the first layer, a second layer that contains a molecular sieve (for instance, a zeolite).

■ Heat exchange devices and materials using gas-permeable membranes

- **Patent number** : WO 2007/124386 (2007)
- **Inventors** : I. Touzov
- **Abstract** : The invention described by this patent eliminates the impact of hydrodynamic resistance of wicking materials while preserving high efficiency of capillary suction achievable by very narrow capillaries in the design of heat transporting devices, such as a heat pipe. It uses microporous or nano-porous membranes in place of traditional wicks, placed across (normal to the vector of speed) the transport direction of the liquid. Elimination of the resistance is achieved by positioning the membrane on the surface of the liquid that forms an interface between the liquid and the vapour – allowing vapour to condense on the liquid surface, creating extensive capillary pressure.

■ Header for module of hollow-fibre membranes

- Patent number : WO 2007/127768 (2007)
- Inventors : R. Szabo, G. Bakos, A. Palinkas and S.K. Pedersen
- Applicant : Zenon Technology Partnership, USA
- Abstract : This specification may relate to methods of potting hollow-fibre membranes, to methods of making headers for modules of hollow-fibre membranes, to potted hollow-fibre membranes or to headers or modules of potted hollow-fibre membranes. Hollow-fibre membranes are potted by injecting a liquid material into a substantially closed cavity (44) containing the fibres. The cavity may be formed in part by the interaction of a mould, a permeate pan (52) and a layer of an adhesive that has been pre-applied to a bundle of the membranes.

■ Reverse osmosis membrane with a branched poly(alkylene oxide) modified anti-fouling surface

- Patent number : WO 2007/127605 (2007)
- Inventors : J.Q. Niu and W.E. Mickols
- Applicant : Dow Global Technologies Incorporated, USA
- Abstract : In this invention, composite membranes that exhibit long-term resistance to bio-fouling comprise a porous support and a cross-linked polyamide, discriminating layer having an external surface. The discriminating layer comprising a branched poly(alkylene oxide) (PAO) polymer attached to its external surface. The branched PAO polymer typically has the structure of a molecular comb or brush, and is made by polymerisation of a PAO macro-monomer of the following formula (I): $RO-[(CHR')_{n-0}]_m - V$ in which R is hydrogen or a Q-2O aliphatic or aromatic group; V is any group containing a polymerisable site; each R' is independently hydrogen or a short chain alkyl group, n is an integer of 1-6; and m is an integer of 1 to about 200. The -end group can be either polymerised or copolymerised

■ Embolic protection filtering devices

- Patent number : WO 2007/109526 (2007)
- Inventors : B.R. White
- Applicant : Boston Scientific Scimed Incorporated, USA
- Abstract : This patent covers embolic protection filtering devices and methods for making and using them. An example of a filtering device, described by this patent, includes a filter wire and a filter coupled to the filter wire. The filter can include a filter loop (16) and a filter membrane (22) coupled to the filter loop. A number of tubular members (32) also may be coupled to the filter membrane. This allows a filter-retaining shaft (34) to extend through tubular member (32) that holds the filter (16) in a collapsed configuration.

■ Device for measuring permeate flow of membrane elements

- Patent number : WO 2007/108977 (2007)
- Inventors : M. Wilf, R. Franks, C. Bartels and N. Ikeyama
- Applicant : Hydranautics, USA
- Abstract : The subject of this patent is a system that includes integrated sensors for measuring the permeate flow and permeate conductivity of individual membrane elements (163) in a reverse osmosis (RO) unit while it is in operation. These integrated sensors are small, which enables them to be inserted into the permeate tube (172) of connected membrane elements (163) while the RO unit is operating.

■ Method of producing a hollow membrane

- Patent number : WO 2007/107542 (2007)
- Inventors : S. Ermolaev, N. Jitariouk and A. Le Moel
- Applicant : Commissariat à l'Énergie Atomique, France
- Abstract : The production of hollow membranes (10) in which two support layers (12a,

12b) are arranged one above the other and supported by a plurality of capillary tubes (14), has been optimised. The assembly is formed from an organic polymer. In particular, since the material forming the assembly is polymerised (in a number of polymerisation steps (61)), the membrane has a structure close to that of organic systems, and forms capillary ducts (14) for the flow of a first fluid. The space between the capillary tubes (14) and the support layers (12) forms an internal cavity (16) for the flow of a second fluid. The membranes (10) produced in this way can be assembled as fluid treatment modules with intermediate porous plates.

■ Membrane for olefin/paraffin separation

- Patent number : WO 2007/111521 (2007)
- Inventors : A.D. Magalhães Mendes, J.C. Godinho De Faria Dos Santos and A.P. Grilo Taveira
- Applicant : Universidade Do Porto, Portugal
- Abstract : This patent discloses a device that uses membranes which is capable of separating olefins from paraffins. The device considered is based on an ultra-microporous ceramic membrane module (zeolite-based or silicate-based), containing a fixed carrier of copper I or silver ions 'inserted' by ion exchange, or as a monolayer of CuCl, AgNO₃, Cu- or Ag-. Olefins have higher diffusivity and affinity to the membrane than the remaining species, therefore the bi-component permeation selectivity becomes reinforced, compared with the ideal permeation selectivity. The purification of olefins by removal of dienes and/or alkynes, is accomplished with a zeolite membrane functionalised with Ag- and having a specific catalyst in its permeate side (for example, palladium nanoparticulate) for catalysing the hydrogenation of the permeating dienes and alkynes to the corresponding olefins, thus increasing the selectivity and the driving force of the separation process.

■ Method and apparatus for generating hydrogen

- Patent number : WO 2007/114859 (2007)

- Applicant/Inventor : M.S. Wilson, USA

- Abstract : The subject of this patent is a method and apparatus for generating hydrogen from a fuel that is composed of a compound - preferably methanol - that decomposes through an endothermic reaction. A catalyst can be used to decompose the methanol into hydrogen and CO. Ideally, this catalyst should have a low selectivity for reacting CO and water to form CO₂ and hydrogen. A permselective membrane, preferably cleaned by the water, is used to separate the hydrogen. The retentate has value as a fuel and is reacted or otherwise burned in order to provide heat for the decomposition reaction. Referring to the accompanying diagram, fuel (20) is introduced at pressure into decomposition reactor (30), in which is disposed a catalyst (31) to aid the decomposition of methanol. Hydrogen that is produced by the decomposition reaction permeates through the hydrogen permselective membrane separator (32) into plenum (33), which is preferably disposed within separator housing (34). This permeate hydrogen (21) is then supplied to the end-use application. Products of the decomposition reaction that did not permeate through separator - primarily comprising CO, non-permeate hydrogen, and unreacted fuel (as well as lesser by-products) - are collectively known as retentate (22). This is released from the reactor (30) and routed at pressure to an ejector. Depending on the conditions, retentate and air (23) are burned directly in a flame and/or react with a catalyst (38) preferably disposed within a burner (37). The heat generated drives the decomposition reaction on the catalyst (31) in the reactor in addition to ensuring that the permselective separator (32) is maintained at a temperature that is sufficiently high to expedite the transport of hydrogen permeate across its structure. As an option, effluent (24) from the burner may be discharged to a heat-recovery device and/or a tail-gas clean-up bed to remove the remaining traces of unburnt or unreacted gases.

■ System for treating a mixture of hydrocarbon and CO₂

- Patent number : WO 2007/117974 (2007)

- **Inventors** : T.J. Payton
 - **Applicant** : Occidental Energy Ventures Corporation, USA
 - **Abstract** : A system and method is disclosed for treating a mixture of hydrocarbon and carbon dioxide gas produced from a hydrocarbon reservoir. The system includes a gas power turbine adapted to burn the produced gas mixture of hydrocarbon and carbon dioxide gas, with oxygen as an oxidising agent, and a capture unit to collect the exhaust gas from the turbine. An inlet compressor receives exhaust gas from the capture system and compresses it before injecting it into the hydrocarbon reservoir. The system may further include a membrane system that preferentially removes carbon dioxide and hydrogen sulfide from the produced gas stream before the stream is used as fuel gas in the power turbine. The carbon dioxide and hydrogen sulfide removed by the membrane system is combined with the exhaust gas, which is then injected into a hydrocarbon reservoir.
- **Small-scale RO system with concentrate management**
 - **Patent number** : WO 2007/115988 (2007)
 - **Inventors** : R. Wolbers
 - **Applicant** : Wapura Trinkwasserreinigungs GmbH, Germany
 - **Abstract** : This invention relates to a method for operating a small-scale reverse osmosis (RO) system. The method makes use of a control unit. According to the patent, an RO module (4) is supplied with untreated water by an inlet (1), from which a partial amount, designated as a concentrate, is discharged via a concentrate outlet (9) and another partial amount, designated as a permeate, is filtered by a membrane and is discharged via a permeate outlet (21) from the RO module (4). According to the invention, an additional amount is added to a continuous concentrate flow, which is less than the amount required to operate the system in a safe manner. The additional amount is adjusted through a user-interface in accordance with the membrane performance and the degree of hardness of the untreated water.
- **Method for testing chromatography media and devices**
 - **Patent number** : WO 2007/120272 (2007)
 - **Inventors** : S. Nochumson and P. Levison
 - **Applicant** : Pall Corporation, USA
 - **Abstract** : This invention covers methods for testing the chromatography type and/or the integrity of a chromatography membrane or monolith. The patent that covers this invention provides details of relevant test procedures, but in particular it describes ways of testing the chromatography type and integrity of a chromatography device (comprising a chromatography membrane or monolith) while the membrane or monolith is sealed in a housing.
- **Ultrafiltration system for on-line analyser**
 - **Patent number** : WO 2007/119928 (2007)
 - **Applicant/Inventor** : Y. Shin, Korea
 - **Abstract** : This invention relates to a system for pretreating a test sample so that it can be analysed. The test sample contains suspended solids. In particular, it refers to an ultrafiltration (UF) system for an on-line analyser. This is used to filter suspended solids in order to stably and quantitatively analyse the test sample. The process described uses a module-type hollow-fibre membrane filter intake system (combined with the on-line analyser). According to the patent, the UF system may be useful in obtaining reliable results, using filtered water, in the foodstuffs and chemical industries and in the field of environmental science. This is achieved by continuously separating solids from the liquid test sample (containing a large amount of the solids) and optimising the test sample, in order to examine it using the on-line analyser. The systems is also designed to sense and swiftly

respond to a real-time change in process and to minimise operator intervention.

■ Hybrid membrane module

- **Patent number** : WO 2007/107992 (2007)
- **Inventors** : M. Perry
- **Applicant** : Bio Pure Technology Limited, USA
- **Abstract** : This invention covers a process for reducing the content and volume of organic matter in a wastewater stream. According to the patent, it involves contacting the stream with a nanofiltration device so as to obtain a concentrate, and a permeate as an aqueous stream containing any salts of non-precipitable metal ions which may be present. The concentrate is then brought into contact with an ultrafiltration device, and optionally also with activated carbon. This process may be part of a broader one that also removes other components from the wastewater stream. A module comprising (a) a nanofiltration device; (b) an ultrafiltration device; (c) conduit(s) adapted to convey the concentrate from nanofiltration device to the ultrafiltration device; and optionally (d) a vessel containing activated carbon, form part of this system. Also discussed is a unit for treating a wastewater stream which includes this module.

■ Ion-conductive copolymers

- **Patent number** : WO 2007/100342 (2007)
- **Inventors** : S. Cao
- **Applicant** : Polyfuel Incorporated, USA
- **Abstract** : This invention relates to ion-conductive copolymers that can be used to fabricate proton exchange membranes, catalyst coated proton exchange membranes and membrane electrode assemblies which are used in fuel cells for electronic devices, power supplies and vehicles. The ion-conductive copolymers comprise one or more ion-conducting oligomers and at least two of the following: one or more ion-conducting monomers; one or more non-ionic monomers; and one or more non-ionic oligomers.

■ Process for recovering acid

- **Patent number** : WO 2007/103314 (2007)
- **Inventors** : R.A. Strauss, T.R. Melli, J.H. Hollenbach and B.S. Minhas
- **Applicant** : Exxonmobil Research and Engineering Company, USA
- **Abstract** : This patent provides details of a cross-linked polymeric polyvinyl sulfate membrane or cross-linked copolymer polyvinyl sulfate and polyvinyl alcohol membrane, or Nafion or polytetrafluoroethylene suitable for use in an acid environment. It also explains how it can be used for recovering or reconstituting acid from a feed mixture comprising predominantly acid and water. The method described (see figure below) involves processing the mixture using a first polymeric membrane such as Nafion or polytetrafluoroethylene, to form a first retentate containing a substantially greater concentration of acid than the feed mixture, and a first permeate containing a substantially greater concentration of water than the mixture. The first polymeric membrane selectively excludes permeance of the acid over the water found in the mixture, and recovers the first retentate. The first retentate can be processed further using a second water-reduction membrane system to form a retentate stream containing a substantially greater concentration of acid than the first retentate and a second stream containing a substantially greater concentration of water than the first retentate, and recovering the acid retentate.

■ Multifunctional electrophoresis cassette

- **Patent number** : WO 2007/106832 (2007)
- **Inventors** : G. Magnant, M. Finney, T. Barbera, W. Bowers, D. Kozwich, S. Seymour, R. Nelson and C.T. Boles
- **Applicant** : Sage Science Incorporated, USA
- **Abstract** : In this patent, details of a device and method are provided for more efficiently performing electrophoresis and electro-blotting. A sandwich structure is described that includes an electrophoresis gel affixed to a blotting mem-

brane. A gel casting and/or running frame is used to hold the 'sandwich'. The patent also describes a method and composition that allows the separation of the gel and membrane after a combined electrophoresis and electro-blotting operation has been performed, so as to allow further operations to be carried out individually on the membrane, gel or both of these. A uniform electrophoretic field may be created by surrounding the sandwich structure with an insulating fluid – the insulating fluid is then swapped for a conducting fluid to allow the application of an electro-blotting field. An apparatus automatically manages fluid exchange and actuation of electrophoresis and electro-blotting electrodes. A plurality of parallel cavities may be used to hold multiple gels or gel membrane sandwiches.

■ High-flux mixed matrix membranes

- Patent number : WO 2007/106677 (2007)
- Inventors : C. Liu, S. Kulprathipanja and S.T. Wilson
- Applicant : UOP Llc, USA
- Abstract : This patent discloses a new class of high-flux mixed matrix membranes that are made by incorporating porous inorganic fillers (for example, microporous and mesoporous molecular sieves, carbon molecular sieves and porous metal-organic frameworks) into a high-flux high surface-area microporous organic polymer matrix. These microporous organic polymers are referred to as 'polymers of intrinsic microporosity' (or PIMs). These membranes are promising for a wide range of separation processes, claim the inventors, including liquid separation, such as pervaporation of phenol/water, and also gas separation used by the petrochemical and natural gas industries, such as methane/carbon dioxide, olefin/paraffin and iso/normal paraffins.

■ Membrane-based water-treatment apparatus

- Patent number : WO 2007/105851 (2007)

- Inventors : K. Kim, K. Seo and J. Kweon

- Applicant : Sungshin Engineering Company Limited, Korea

- Abstract : Disclosed is a water-treatment apparatus, which includes a fibre filter that is disposed in an integrated unit. The water that is to be treated flows into a primary filter. Also detailed is a submerged membrane module (which is disposed in the fibre filter). This acts as a secondary filter, and accepts water processed by the primary filter. Air diffusers – installed in the lower portions of the integrated water-treatment arrangement and the submerged membrane module – supply air when the fibre filter and the submerged membrane module are back-washed. The water-treatment apparatus connects the fibre filter to the submerged membrane module. This reduces operating costs substantially (compared with conventional membrane-based systems) while maintaining excellent filtration characteristics to improve the quality of the treated water. It also reduces the manufacturing costs and size of the system. The accompanying figure shows a schematic view of the water-treatment apparatus. The membrane module (3) is integrated into fibre filter (2) to create an integrated water-treatment arrangement (1). This arrangement is connected to a storage tank (21), which supplies raw water to the treatment system. Also shown is a water discharge tank (22) for storing water used to back-wash the fibre filter. Another tank (25) stores part of the water treated by the membrane module, and supplies it for washing the membrane module (3) when it is back-washed. The integrated water-treatment arrangement and membrane module are provided with (at lower portions), air diffusers. These convert air supplied by a blower into bubbles. This enables the air to be supplied to the integrated water-treatment arrangement and the membrane module when the fibre filter and the membrane module are being back-washed.

■ Removal of metal sulfide particles from a liquid stream

- Patent number : WO 2007/104769 (2007)

- **Inventors** : J.L.W.C. Den Boestert, A. Nijmeijer, W.M. Bond and H.W. Schenck
Applicant: Shell Internationale Research Maatschappij Bv, The Netherlands, and Shell Canada Limited, Canada
- **Abstract** : This invention concerns a method for removing metal sulfide particles from a liquid stream (comprising a solvent and metal sulfide particles) using a filter system (2) that is made up of at least one membrane. The method involves contacting the liquid stream with the membrane, thereby transferring metal sulfide particles from the stream onto the membrane surface - to obtain a liquid stream depleted of metal sulfide particles, and a filter system containing a membrane that has been enriched with metal sulfide particles. The patent describing this invention further provides details of an apparatus that comprises a solvent regenerator column, with at least one inlet and two outlets. In a preferred embodiment of the apparatus, the solvent regenerator column (1) metal sulfide particles are formed and a liquid stream composed of a solvent, metal sulfide particles (and optionally dissolved contaminants such as water) is withdrawn from the bottom of the solvent regenerator and led away via line-4 to a filter system (2) comprising at least one membrane. The liquid stream that is depleted of metal sulfide particles is led via line-5 to separation column (3), where separation of solvent and contaminants, such as water, takes place. Preferably, the column comprises internals to enhance separation of solvent and contaminants. It will be understood that deposition of metal sulfide particles on these internals can create problems. By using an apparatus comprising a filter system, these problems are avoided. Suitably, a solvent comprising metal carbonyls and hydrogen sulfide and/or metal sulfide is led to the solvent regenerator column (1) via line-6 and metal sulfide particles are formed in the solvent regenerator column by heating. Preferably, a liquid stream comprising a solvent (and optionally dissolved contaminants such as water and metal sulfide particles) is withdrawn from the bottom of the solvent regenerator (1) and is led elsewhere via line-7, and another stream is led via line-4 to a filter

system (2). By only leading part of the stream from the solvent regenerator to the filter system, metal sulfide removal can be done faster and is accomplished using a small unit. In the filter system, removal of metal sulfide particles takes place, resulting in a liquid stream depleted of metal sulfide particles. Preferably, a gas stream, comprising inter alia hydrogen sulfide, is led from the top of the solvent regenerator via line-8 to a hydrogen sulfide disposal unit (not shown in the figure).

■ Hollow-fibre membrane module with a fixed structure

- **Patent number** : WO 2007/104208 (2007)
- **Inventors** : L. Chen, M. Chen and Q. Chen
- **Applicant** : Shanghai Litree Purifying Equipment Company Limited, China
- **Abstract** : A hollow-fibre membrane module with a fixed structure has been developed. It is composed of a bearing shell (7); an inlet (8); a concentrated water outlet (10); a produced water outlet(s) (9); a central tube (1); and hollow-fibre membranes (6). The hollow-fibre membranes (6), central tube (1) and the bearing shell (7) are fixed together. The inlet (8) is located at one end of the hollow-fibre membranes (6), while the concentrated water outlet (10) is located at the other end. The produced water outlet(s) (9) is (are) located at one end or both ends of the central tube (1), and there are small holes drilled on the side wall of the central tube (1). The module also comprises at least one separate ring (2) for fixing in place the hollow-fibre membranes (6). A separate ring (2) is fixed on the central tube (1) and the hollow-fibre membranes (6) are arranged in parallel through this separate fixed ring (2).

■ Fluorination of a porous hydrocarbon-based polymer for use as a composite membrane

- **Patent number** : WO/2007/109106 (2007)
- **Inventors** : P.D. Kozak, C. Mah and S.J. McDermid
- **Applicant** : Ballard Material Products Incorporated, USA

- **Abstract** : This patent covers the fluorination of a porous hydrocarbon-based polymer for use as a composite membrane. In particular, the material described is designed to be used as a composite proton exchange membrane for a fuel cell. The composite membrane is formed by fluorination of the porous hydrocarbon-based polymer to yield a selectively fluorinated polymer, which is then loaded with an ionomer to yield the composite membrane.
- **Filter plate**
 - **Patent number** : WO 2007/096128 (2007)
 - **Inventors** : J. Verhaeghe, J. Hugelier, M. Van Haeke and J. Van Meenen
 - **Applicant** : NV Bekaert SA, Belgium
 - **Abstract** : A plate-like structure (100) for filtering a fluid forms the subject of this patent. It comprises a first filter membrane (110) and a second filter membrane (120). The filter membranes are substantially planar and substantially parallel. The membranes are composed of metal fibres. The filter plate also includes a reinforcement (130, 131) interposed between (and attached to) the filter membranes. This reinforcement creates at least two flow channels (132) between the filter membranes for guiding a fluid towards the edge of the filter plate.
 - **Capturing analyte transfers from gels**
 - **Patent number** : WO/2007/075325 (2007)
 - **Inventors** : M. Zhu and R.P. Moerschell
 - **Applicant** : Bio-Rad Laboratories Incorporated, USA
 - **Abstract** : In this invention, proteins and other analytes that have been separated by electrophoretic means in a gel are transferred to a membrane by conventional blotting techniques. The membrane has a composite structure, comprising an analyte-binding layer and a size-retention layer. The pore size of the size-retention layer is large enough to allow non-macromolecular ions to pass through its structure, yet not large enough to allow the passage of the analytes from the gel, nor antibodies or other macromolecules, or reagents in general, that might be used in the detection, imaging or quantification of the analytes.
 - **Synthesis of bio-diesel using alkali ion-conductive ceramic membranes**
 - **Patent number** : WO 2007/082092 (2007)
 - **Inventors** : S. Balagopal, A. Joshi and J. Pendelton
 - **Applicant** : Ceramatec Incorporated, USA
 - **Abstract** : A method and apparatus for synthesising bio-diesel (40) using alkali alkoxide (30) generated on-site using an electrochemical process is disclosed. The apparatus and method convert alkali salts of glycerine into glycerine and in doing so bring about the separation of clean glycerine (72) from bio-diesel (70). The method is enabled by the use of alkali ion-conductive ceramic membranes (16 & 42) in electrolytic cells (12 & 14).
 - **Process for producing a zeolite separation membrane**
 - **Patent number** : WO 2007/081024 (2007)
 - **Inventors** : T. Mizuno
 - **Applicant** : Bussan Nanotech Research Institute Incorporated, Japan
 - **Abstract** : A process has been developed for producing a zeolite separation membrane. The membrane is composed of a porous support containing alumina as the main component and a zeolite layer formed both on the surface of the support and in its pores. The formation of the membrane element involves bringing a porous support, with silica deposited both on its surface and in its pores, into contact with a reaction fluid containing silicon and aluminium. The reaction fluid is heated to form a zeolite separation membrane element. In the next step of the production process the zeolite membrane element is sep-

arated from the reaction fluid. According to this patent, a zeolite separation membrane can be obtained, which can separate alcohol and water satisfactorily even when the content ratio of water to alcohol is low.

■ **Device for testing the integrity of filtration membranes**

- **Patent number** : WO 2007/080260 (2007)
- **Inventors** : M. Petry
- **Applicant** : Degremont, France
- **Abstract** : The subject of this patent is a device for testing the integrity of filtration membranes. The integrity test method is applied to hollow-fibre filtration membranes of the type with an internal skin. A concentrate compartment (J) is formed by the lower part of the hollow fibres while a permeate compartment (K) is formed by the part on the outside of the hollow fibres. A pressurised gas is made to flow through the concentrate compartment (J) for draining the hollow fibres, which are open at their ends. The method starts by leaving the permeate compartment (K) open to the atmosphere, so as to allow the liquid on the surface of the membrane to migrate through its structure. The permeate compartment (K) is then isolated. Pressure in the permeate compartment (K) increases, caused by the circulation of gas in the concentrate compartment (J), and the flow of gas towards the permeate compartment is measured, and after a defined time, the pressure rise is compared with that observed when an integral membrane is used.

■ **Improved operating strategies in filtration processes**

- **Patent number** : WO 2007/079540 (2007)
- **Inventors** : F. Zha, R.W. Phelps, A. Sneddon and T. Nguyen
- **Applicant** : Siemens Water Technologies Corporation, USA
- **Abstract** : A method of running a membrane filtration system that has a number of repeated operating cycles forms the subject of this

patent. The method includes the step of varying the value of one or more operating parameters of the system associated with a particular operating cycle between and/or during one or more repetitions of the operating cycle. Membrane filtration systems operating in accordance with the method are also disclosed.

■ **Chlorine-resistant desalination membranes**

- **Patent number** : WO 2007/084759 (2007)
- **Inventors** : J.E. Mcgrath, B.H. Park and B.D. Freeman
- **Applicant** : Board of Regents, The University of Texas System, and Virginia Tech Intellectual Properties Incorporated, USA
- **Abstract** : This invention concerns a membrane and kit. It also covers a method of making a hydrophilic-hydrophobic random copolymer membrane (in that the membrane includes a hydrophilic-hydrophobic random copolymer). It includes one or more hydrophilic monomers having a sulfonated polyarylsulfone monomer, and a second monomer and one or more hydrophobic monomers having a non-sulfonated third monomer and a fourth monomer. The sulfonated polyarylsulfone monomer introduces a sulfonate into the hydrophilic-hydrophobic random copolymer prior to polymerisation.

■ **Forward osmosis system**

- **Patent number** : WO 2007/084256 (2007)
- **Inventors** : L.H. Steimel and J.C. Emerson
- **Applicant** : JohnsonDiversey Incorporated, USA
- **Abstract** : In this invention, forward osmosis is used to dispense chemicals into a process water system, such as a cooling tower, chilled water unit, boiler, or pulp and paper plant. The dispenser (10) includes a flexible pouch (14) filled with a treatment chemical (44) and an osmotic membrane (34). The dispenser is placed in the process water system. Water passing through the membrane (34) increases the internal pressure, which forces the chemical (44) into the process water system. The exposed surface area

of the osmotic membrane (34) can be altered to control the dispensing rate. The apparatus can either use the chemical treatment agent as the osmotic agent, or can be divided into two separate areas using a separate osmotic agent such as sodium chloride. The dispenser can be positioned in the process water system at a location where water flows onto the osmotic membrane only when the process water system is in operation.

■ Membrane filtration apparatus

- **Patent number** : WO 2007/083723 (2007)
- **Inventors** : H. Kubo and S.-H. Park
- **Applicant** : Toray Industries Incorporated, Japan
- **Abstract** : This patent describes a membrane filtration apparatus that operates in a stable fashion at a high percentage recovery even when it is processing raw water that has a relatively high level of turbidity. The membrane filtration apparatus comprises a dipping tank (1) with a raw water supply port in its upper part and a water discharge port in its lower part. A dipping-type hollow-fibre membrane module (2), comprising a large number of hollow-fibre membranes in a bundle, is disposed within the tank (1) so that the longitudinal direction of the fibre is oriented vertically. A diffuser tube (3) is disposed below the hollow-fibre membrane module. The position of the raw water supply port is located above the module. In the section of the dipping tank (in which the hollow-fibre membrane module has been disposed) the proportion of the sectional area of the membrane module to the sectional area within the dipping tank is 60~90%; the distance between the diffuser tube and the bottom face of the dipping tank is not less than 200 mm; and the position of the water discharge port is not less than 200 mm below the diffuser tube.

■ System for monitoring RO membranes

- **Patent number** : WO 2007/087578 (2007)

- **Inventors** : Y. Cohen and M. Uchymiak

- **Applicant** : The Regents of the University of California, USA

- **Abstract** : A system and method for monitoring a reverse osmosis (RO) membrane in an RO unit has been developed. It is capable of detecting the formation of mineral salt crystals on the surface of the membrane. The system includes an RO monitoring cell coupled to the unit so as to receive a sample taken from either the feed stream or the concentrate stream. The cell has a visually-observable RO membrane that is visible to a system which creates and collects images, and conveys image signals to a data processing unit. The signals are translated into visual images for display, and are used to correlate data in the image signal with a scaling condition on the membrane in the RO unit.

■ Method for increasing the permeability of polymer film

- **Patent number** : WO 2007/092437 (2007)

- **Inventors** : T.A. Davis and W.M. Rast

- **Applicant** : University of South Carolina, USA

- **Abstract** : Polymer membranes are disclosed that have increased permeability. The process detailed by this patent can, for instance, increase the ion permeability and/or the gas permeability of membranes. In one embodiment, a precursor polymer is subjected to energy in an amount sufficient to form damage tracks through the thickness of its structure. These (the tracks) are then oxidised to form free radical groups. The precursor polymer is then hydrolysed, causing ion groups to form that cluster along the damage tracks. In another embodiment, sulfonated tetrafluoroethylene-based copolymer ionomer membranes are formed that have increased conductivity. Other ionomer membranes that may be formed, according to the patent, include copolymers of a vinyl hydrocarbon and a vinyl carboxylic acid.

■ **Membrane structure for gas separation**

- **Patent number** : WO 2007/093443 (2007)
- **Inventors** : M. Hempel, W. Stoeters, R.-P. Peters and H. Holakovsky
- **Applicant** : Boehringer Ingelheim Microparts GmbH, Germany
- **Abstract** : A membrane structure for gas separation, a degassing device that uses this membrane, and a method for producing both the membrane and device are disclosed. A porous carrier layer is joined (flat) to a thin polymer membrane - made, in particular, from amorphous polytetrafluoroethylene. The polymer membrane is produced on or from the carrier layer. This makes it possible to create a simple and inexpensive structure, and also an effective means of gas separation. In a preferred embodiment, the polymer membrane is formed by applying a polymer solution (in the liquid state) to the carrier layer and drying it.

■ **Microporous membrane**

- **Patent number** : WO 2007/098339 (2007)
- **Inventors** : X. Wei and C. Haire
- **Applicant** : Celgard Llc, USA
- **Abstract** : A microporous membrane is made by a dry-stretch process and has substantially 'round-shaped' pores and the ratio of machine-

direction tensile strength to transverse-direction tensile strength is 0.5 to 5.0. The method of making this microporous membrane includes a number of stages. First, a polymer is extruded into a non-porous precursor. It is then stretched 'biaxially'. This includes both machine-direction and transverse-direction stretching (the transverse direction includes a simultaneous, controlled machine-direction relaxation).

■ **Composite membrane material**

- **Patent number** : WO 2007/085458 (2007)
- **Inventors** : M. Reiner
- **Applicant** : Trans-Textil GmbH, Germany
- **Abstract** : In this method for producing a composite membrane material, a layer of spreadable polymer paste (6) is applied to a release paper (1). This is followed by wet lamination of the polymer paste (6) with a microporous, vapour-permeable membrane (12) on the side of the polymer paste (6) that is facing away from the release paper (1). After the composite membrane material has dried, the release paper (1) is detached to obtain a composite membrane material without a carrier substrate. This can be laminated on textile substrates or other materials, or can be used, for example, as a membrane.