

최신 미국특허 등록 목록

■ Membrane Electrode Assemblies and Fuel-Cell Systems with Surface-Modified Electrocatalysts and Methods for Electrocatalyst Surface Modification

- 등록번호: 08574785
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- 출원인: You-Mee Kim Min-Kyu Song Young-Mi ParkSung-Guk An Ho-Jin Kweon (KR)
- 초록: The present invention relates to a membrane-electrode assembly for a fuel cell and a fuel cell system comprising the same. The membrane-electrode assembly includes an anode and a cathode facing each other and a polymer electrolyte membrane positioned therebetween. The polymer electrolyte membrane adheres to the anode through a binder disposed between the polymer electrolyte membrane and the anode, and adheres to the cathode through a binder disposed between the polymer electrolyte membrane and the cathode. The binder and the polymer electrolyte membrane can include a cation exchange resin and an inorganic additive.

■ MEMBRANE SUITABLE FOR BLOOD FILTRATION

- 등록번호: 13701321
- 발명자: Konraad Albert Louise Hector Dullaert Marko Dorschu Jun Qiu Jens Christoph Thies (NL)
- 출원인: Konraad Albert Louise Hector

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- 초록: The invention relates to a membrane construction comprising multiple layers wherein at least one of the layers is a nanoweb made of polymeric nanofibers, wherein the mean flow pore size of the nanoweb is in the range from 50 nm to 5 μ m, wherein the number average diameter of the nanofibers is in the range from 100 to 600 nm, wherein the basis weight of the nanoweb is in the range from 1 to 20 g/m², wherein the porosity of the nanoweb is in the range from 60 to 95%, wherein at least one of the layers is a support layer and wherein the nanoweb is hydrophilic.

■ MEMBRANE FILTRATION PROCESS WITH HIGH WATER RECOVERY

- 등록번호: 13254881
- 발명자: Sijing Wang Yanrong Zhu Gaorong He (CN)
- 출원인: Sijing Wang Yanrong Zhu Gaorong He (CN)
- 초록: A membrane filtration process includes pretreating an influent solution to remove suspended solids, to produce a pretreated solution. pH of the pretreated solution is adjusted to at least 8.3 or lower by injecting CO₂ into the pretreated solution, to produce a conditioned solution. Injecting CO₂ also serves to supplement bicarbonate in the conditioned solution. The conditioned solution is flowed through a membrane filtration unit, to pro-

duce a permeate solution and a retentate solution. The membrane filtration unit comprises reverse osmosis membranes or nanofiltration membranes, or both. The retentate solution is then treated to cause precipitation, to produce a supernatant solution and a reject solution. At least a portion of the supernatant solution is recirculated by combining it with the influent solution prior to the step of pretreating.

■ METHOD OF PRODUCING POLYOLEFIN MICRO-POROUS MEMBRANE AND SEPARATOR FOR LITHIUM ION BATTERY

- 등록번호: 13901883
- 발명자: Ippei Noda (JP)
- 출원인: Ippei Noda (JP)
- 초록: A method is presented for producing polyolefin microporous membranes which are superior in thermal stability and are particularly useful as a separator for a lithium ion battery. A process including a first step of melting polyolefin resin and mixing together at least melted polyolefin resin, organosiloxane particles including a polysiloxane cross-linked structure and having a spherical or golfball shape with an average particle diameter of 0.01–10 μm and a plasticizer to obtain a melted mixture, a second step of molding this mixture and biaxially stretching molded product to obtain a stretched film and a third step of extracting and removing the plasticizer from the stretched film is carried out, if a membrane having a single film layer is to be produced, to obtain this single film layer and, if a membrane having two or more laminated film layer is to be produced, to obtain the film layers on both outsides.

■ REPLACEABLE FINE MACHINING MEMBRANE, STATIONARY FINE MACHINING TOOL, AND

METHOD FOR PRODUCING A REPLACEABLE FINE MACHINING MEMBRANE

- 등록번호: 13261602
- 발명자: Roland Tuecks (DE)
- 출원인:
- 초록: The invention relates to a replaceable fine machining membrane (19) for fixing on a tool head (1), to which pressure can be applied, of a stationary fine machining tool for fine machining a workpiece surface. A fine machining means substrate (27) is integrated in the fine machining membrane (19), said fine machining membrane (19) having a crosslinked elastomer (40) and said fine machining means substrate (27) being embedded in the crosslinked elastomer (40). The invention also relates to a method for producing such a fine machining membrane (19) and to a stationary fine machining tool with a tool head (1) to which pressure can be applied and which has a removable fixing means (31) for fixing such a replaceable fine machining membrane (19). Finally, the invention relates to a method for producing the novel fine machining membrane (19). The invention allows the precise reproducible fine machining of workpiece surfaces even with highly convex or freely shaped membranes (19). Furthermore, a detaching or tearing of the fine machining means substrate (27) is prevented, and the fine machining is simplified and accelerated.

■ METHODS OF OPERATING A MEMBRANE SEPARATION DEVICE, CONTROL DEVICES FOR A MEMBRANE SEPARATION DEVICE AND DEVICES THAT OPERATE A MEMBRANE SEPARATION DEVICE

- 등록번호: 13799761
- 발명자: Andrea Pavan (IT), Jürgen Johann (DE), Marc Fink (DE)

- 출원인:
- 초록: A method of operating a membrane separation device in a continuous flow process includes in the membrane separation device, separating a supply liquid into a first partial stream and a second partial stream, wherein flow rate of the second partial stream and/or recovery rate of the second partial stream is influenced by at least one influencing variable that varies during operation, and varying the flow rate of the first partial stream to compensate for a change of the at least one influencing variable to control flow rate and/or recovery rate of the second partial stream to a preset value.

■ METHOD FOR VENTING AIR WITH A MEMBRANE

- 등록번호: 13422128
- 발명자: Brian J. Kwarta (US)
- 출원인: Brian J. Kwarta (US)
- 초록: A method for passing a liquid from a first location to a second location in which gas is selectively vented, the method includes passing the liquid from the first location; receiving the liquid in a conduit having a vent covered by a membrane for permitting gas to be vented; an inlet for receiving the liquid from the first location; and an outlet for passing the liquid to the second location; and selectively permitting and inhibiting flow of gas to the vent; wherein when the liquid in the conduit is below a predetermined threshold, a movable element is placed at a venting position that allows flow of gas to the membrane, and when the ink in the conduit is at or above the predetermined threshold, the movable element is placed at a sealing position that does not allow flow of gas to the membrane.

■ UNIVERSAL SUPPORT ARRANGEMENT FOR SEMI-MEMBRANE TANK WALLS

- 등록번호: 13847858
- 발명자: David L. Jordan (US), William E. Michaud (US)
- 출원인:
- 초록: Embodiments of the invention relate to support arrangements for semi-membrane tank walls and, more particularly, to a universal support assembly for tanks that experience thermal expansion and contraction. One embodiment of the invention may include a tank assembly having at least one tank wall, a support structure at least partially adjacent to the wall, and a link member coupling the tank to the support structure. The link member may be configured to accommodate relative movement between the tank and the support structure through rotation. The link member may be coupled to the tank wall by a ball and socket joint and coupled to the support structure with another ball and socket joint, allowing substantially unlimited in-plane movement of the tank wall relative to the support structure.

■ POLYPHENOL-TYPE POLYMER COATING OF FILTRATION MEMBRANES

- 등록번호: 13422255
- 발명자: Kristof VIZVARDI (HU), Zoltan A. FEKETE (HU)
- 출원인:
- 초록: A filtration membrane is coated with a polymer made from a compound comprising a benzenediol or a substituted phenol, such as catechol. The polymer deposition process comprises exposing the membrane to the compound in an aqueous alkaline solution. A membrane module may be immersed in the

solution. Optionally, the solution is aerated. The polymer coating is reasonably durable in aqueous environments but may be removable. In an example, a module of PVDF based outside-in hollow fiber membranes was coated with poly(catechol). The membranes had a reduced fouling rate and could be maintenance cleaned with water or a dilute oxidant solution. The polycatechol coating could be oxidized by cleaning the membrane with a hypochlorite solution and re-coated. The modified membranes may be used, for example, in water or wastewater treatment. A filtration process includes steps of oxidizing and re-applying the coating after the membrane has been in use.

■ Method for Sealing Hollow Fiber Membranes

- 등록번호: 13421326
- 발명자: Taylour Johnson (US), David Colby (US)
- 출원인: Taylour Johnson (US), David Colby (US)
- 초록: The present invention is directed to a method of sealing the free end of a hollow fiber membrane for use in a single header filtration module by dipping the end of the membrane into a low-viscosity light-curable adhesive and curing the adhesive. The invention further encompasses the resulting sealed hollow fiber membrane with a diameter that is only slightly larger than the diameter of the unsealed membrane.

■ FLUORINE-BASED POLYMER ELECTROLYTE MEMBRANE

- 등록번호: 13877726
- 발명자: Michiyo Yamane (JP), Naoto Miyake (JP)
- 출원인:
- 초록: An object of the present invention is to provide a polymer electrolyte membrane meeting power generation properties and physical dura-

bility at the same time and having high durability. A polymer electrolyte membrane comprising a microporous membrane and a fluorine-based polymer electrolyte contained in a pore of the microporous membrane, wherein pore distribution of the microporous membrane has a pore distribution with a center of distribution in a pore diameter range of 0.3 μm to 5.0 μm , and the fluorine-based polymer electrolyte composition contains a fluorine-based polymer electrolyte (component A) having an ion exchange capacity of 0.5 to 3.0 meq/g.

■ METHODS OF PREPARING A CROSSLINKED FIBER MEMBRANE

- 등록번호: 13872523
- 발명자: Shabbir Husain (PK)
- 출원인:
- 초록: Disclosed herein is a method for preparing a crosslinked hollow fiber membrane. The method involves spinning a one phase solution comprising a monoesterified polyimide polymer, acetone as a volatile solvent, a spinning solvent, a spinning non-solvent, and optionally an organic and/or inorganic additive, wherein the volatile solvent is present in an amount of greater than 25 wt.% to about 50 wt.%, based on the total weight of the solution.

■ SEPARATION MEMBRANE FOR WATER TREATMENT AND MANUFACTURING METHOD THEREOF

- 등록번호: 13647465
- 발명자: Chong Min KOO (KR), Kyung Youl BAEK (KR), Seung Sang HWANG (KR), Soon Man HONG (KR), Ho Bum PARK (KR), Ji Young JUNG (KR), Jang Woo LEE (KR), Young Hoon CHO (KR), Seung Gun YU (KR), Sang Hee PARK (KR)

- 출원인:
- 초록: The present invention relates to a separation membrane for water treatment having high water flux and membrane contamination preventing characteristics, and a manufacturing method thereof. The separation membrane for water treatment according to the present invention includes a nanofiber wherein the separation membrane has a surface electric charge. According to the present invention, a separation membrane for water treatment having high water flux and membrane contamination preventing characteristics, and a manufacturing method thereof may be implemented.

■ Direct Formate Fuel Cell Employing Formate Salt Fuel, An Anion Exchange Membrane, And Metal Catalysts

- 등록번호: 13414648
- 발명자: JOHN HAAN (US)
- 출원인:
- 초록: A direct formate fuel cell (DFFC) employs at least one formate salt as the anode fuel, either air or oxygen as the oxidant, a polymer anion exchange membrane (AEM) to separate the anode and cathode, and metal catalysts at the anode and cathode. One exemplary embodiment consists of palladium nanoparticle anode catalyst and platinum nanoparticle cathode catalyst, each applied to the alkaline AEM in the form of a thin film. Operation of the DFFC at 60°C, with 1 M KOOCH+2 M KOH as the anode fuel and electrolyte and oxygen at the cathode produces 144 mW cm⁻² of peak power density, 181 mA cm⁻² current density at 0.6 V, and an open circuit voltage of 0.931 V. This performance is competitive with alkaline direct liquid fuel cells (DLFCs) reported in the litera-

ture and demonstrates that formate fuel is a legitimate contender with alcohol fuels for alkaline DLFCs.

■ METHODS FOR IMPROVING MEMBRANE BIOREACTOR SYSTEMS

- 등록번호: 13119829
- 발명자: Sijing Wang (CN), Stephen Robert Vasconcellos (US), Jianqiu Wang (CN)
- 출원인: Sijing Wang (CN), Stephen Robert Vasconcellos (US), Jianqiu Wang (CN)
- 초록: A method of conditioning mixed liquor in a membrane bioreactor includes dispersing a treatment additive in the mixed liquor. The treatment additive includes a water soluble block copolymer. Methods for improving flux in a membrane bioreactor and clarifying wastewater are also provided.

■ Magnetically controlled permeability membranes

- 등록번호: 13800564
- 발명자: J rgen Kosel (SA), Niveen Khashab (SA), Amir Zaher (SA)
- 출원인: J rgen Kosel (SA), Niveen Khashab (SA), Amir Zaher (SA)
- 초록: A bioactive material delivery system can include a thermoresponsive polymer membrane and nanowires distributed within the thermoresponsive polymer membrane. Magnetic activation of a thermoresponsive polymer membrane can take place via altering the magnetization or dimensions of nanowires dispersed or ordered within the membrane matrix.

■ WATER DESALINATION MECHANISM

- 등록번호: 13937456
- 발명자: Uri Rapoport (IL)
- 출원인: Uri Rapoport (IL)
- 초록: A water desalination mechanism, including: a running pipe, for fresh water; a venturi arrangement, having a first venturi nozzle, a second venturi nozzle and a branch between; the first and second nozzles; a container divided by a reverse osmosis membrane into a first side and a second side and having: a first side inlet, for contaminated water; a first side outlet, for remaining salts and/or minerals; and a second side outlet, for desalinated water.

■ MEMBRANE SUPPORT MATERIAL

- 등록번호: 13996274
- 발명자: Katsumi Osaka (JP), Akihiro Okubo (JP), Daisuke Fujieda (JP)
- 출원인: Katsumi Osaka (JP), Akihiro Okubo (JP), Daisuke Fujieda (JP)
- 초록: The membrane support material is support material for adhering a membrane to a membrane attachment surface. A plurality of non-woven fiber sheets, which are three-dimensional fiber aggregates, are layered together and thermal and pressure processed to bond fibers of the non-woven fiber sheets and form a single sheet of support material. Each layer of non-woven fiber sheet 1 has a different longitudinal-to-lateral tensile strength ratio (k), which is the ratio (f_2/f_1) of the tensile strength in the lengthwise direction (f_2) to the tensile strength in the width direction (f_1), and in the thermal and pressure processed state, the support material membrane attachment surface has curvature in the lateral (width) direction with an outward protruding (convex) center region.

■ Solar-Driven Air Gap Membrane Distillation System

- 등록번호: 13858194
- 발명자: Edward Kurt Summers (US), Ryan Enright (US), John H. Lienhard (US)
- 출원인: Edward Kurt Summers (US), Ryan Enright (US), John H. Lienhard (US)
- 초록: Membrane distillation system. The system includes a solar radiation absorbing porous membrane positioned to receive solar radiation to heat the membrane. A transparent cover is spaced apart from the membrane to form a channel through which a saline feed stream flows. A condensation structure is spaced apart from an opposite side of the porous membrane forming an air gap channel there between. Means are provided for coolant flow along an outside surface of the condensation structure so that distilled water will condense on the condensation structure for collection from the air gap channel.

■ METHODS OF MEMBRANE MODIFICATION

- 등록번호: 13861818
- 발명자: Suzana NUNES (SA), Iran D. CHARRY PRADA (SA)
- 출원인: Suzana NUNES (SA), Iran D. CHARRY PRADA (SA)
- 초록: A porous membrane can include a nanoparticle.

■ GRAPHENE BASED FILTER

- 등록번호: 13835173
- 발명자: Rohit N. Karnik (US), Sean C. O' Hern (US), Michael S.H. Boutilier (US), Cameron A. Stewart (CA), Harold S. Au (US), Nicolas G. Hadjiconstantinou (US),

Tahar Laoui (SA), Muataz A. Atieh (SA)

- 출원인: Massachusetts Institute of Technology King Fahd University of Petroleum & Minerals (US), King Fahd University of Petroleum & Minerals (US)
- 초록: Two-dimensional material based filters, their method of manufacture, and their use are disclosed. The filters may include at least one active layer disposed on a porous substrate. The at least one active layer may include intrinsic and/or intentional formed pores. In some embodiments, the flow resistance of the porous substrate may be selected to limit flow through defects and intrinsic pores in the at least one active layer.

■ APPARATUS AND METHOD FOR FABRICATING ANTI-MICROBIAL AIR FILTER MEDIA AND ANTI-MICROBIAL AIR FILTER MEDIA

- 등록번호: 13686192
- 발명자: Jae Hee JUNG (KR), Gwi Nam BAE (KR), Bo Mi KWON (KR), Gi Byoung HWANG (KR)
- 출원인: Jae Hee JUNG (KR), Gwi Nam BAE (KR), Bo Mi KWON (KR), Gi Byoung HWANG (KR)
- 초록: The present disclosure relates to an antimicrobial filter medium with improved antimicrobial property and microbe capture ability wherein gaseous antimicrobial nanoparticles are uniformly coated onto the filter medium and conductive members are attached on both sides of the filter medium, and an apparatus and a method for fabricating the same.

■ ANION EXCHANGE COMPOSITE MEMBRANE

FILLED WITH CROSSLINKED POLYMER ELECTROLYTES FOR FUEL CELLS AND METHOD FOR PREPARING THE SAME

- 등록번호: 13588123
- 발명자: Young Woo Choi (KR), Mi Soon Lee (KR), Tae Hyun Yang (KR), Chang Soo Kim (KR), Young Gi Yoon (KR), Seok Hee Park (KR), Sung Dae Yim (KR), Gu Gon Park (KR), Young Jun Sohn (KR), Minjin Kim (KR), Byungchan Bae (KR)
- 출원인: Young Woo Choi (KR), Mi Soon Lee (KR), Tae Hyun Yang (KR), Chang Soo Kim (KR), Young Gi Yoon (KR), Seok Hee Park (KR), Sung Dae Yim (KR), Gu Gon Park (KR), Young Jun Sohn (KR), Minjin Kim (KR), Byungchan Bae (KR)
- 초록: An anion exchange composite membrane is filled with crosslinked polymer electrolytes for fuel cells. A method comprises, (A) preparing anion exchange electrolyte precursor solution, said anion exchange electrolyte precursor solution consisting of a electrolyte monomer of tetravalent ammonium salt having a cation, a bisacrylamide crosslinker having tertiary amine functional group, an initiator and water; (B) impregnating a porous polymer supporter into said electrolyte precursor solution; (C) forming primary anion exchange crosslink polymer electrolyte micropore filling membrane by laminating said polymer supporter and crosslinking within a film; (D) deriving quaternary ammonium of said crosslinker having tertiary amine functional group by immersing said primary anion exchange crosslink polymer electrolyte micropore filling membrane in Vinylbenzyl chloride monomer solution; and (E) preparing composite membrane filled with crosslinked polymer electrolytes by crosslink-

ing after said ammonium deriving is complete, said crosslinking being radical polymerizing vinyl group of said electrolyte micropore filling membrane.

■ METHOD FOR SEPARATING AND RECOVERING PURIFIED ALKALI METAL SALT

- 등록번호: 13991046
- 발명자: Takao Sasaki (JP), Masahide Taniguchi (JP), Hiroo Takabatake (JP), Saburo Sone (JP)
- 출원인: Takao Sasaki (JP), Masahide Taniguchi (JP), Hiroo Takabatake (JP), Saburo Sone (JP)
- 초록: The present invention relates to a method for separating and recovering a purified alkali metal salt from an aqueous alkali metal salt solution, the method including a treatment step of removing a purification-inhibiting substance from an aqueous alkali metal salt solution with a separation membrane having a glucose removal ratio and an isopropyl alcohol removal ratio simultaneously satisfying the following expressions (I) and (II) when each of a 1,000 ppm aqueous glucose solution having a temperature of 25°C. and pH of 6.5 and a 1,000 ppm aqueous isopropyl alcohol solution having a temperature of 25°C. and pH of 6.5 is permeated through the separation membrane at an operating pressure of 0.75 MPa: Glucose removal ratio $\geq 90\%$. . . (I), Glucose removal ratio-Isopropyl alcohol removal ratio $\geq 30\%$. . . (II).

■ Method of manufacturing a track membrane

- 등록번호: US 13/442,799
- 발명자: Oleg Figovsky, Elena Gotlib, Dmitry Pashin, Alexander Leykin

- 출원인: Polymate, Ltd., Nanotech Industries, Inc.
- 초록: Method of manufacturing track membranes by penetration of working substances into and through the membrane matrix of polymer material is disclosed. The matrix is placed into holder that is inserted into one end of a tubular shell, the other end of which contains a cartridge with an explosive material and a working substance in the form of a supersaturated solution of a water-soluble salt. When the explosive material is detonated, the particles of the water-soluble salt interact with the matrix in the form of a high-speed jet with the velocity of particles in the range of 3,800 to 4,200 m/sec. As a result of penetrating of the particles into and through the material of the matrix, a plurality of holes is formed in the matrix. The track membranes are produced by slicing the membrane matrix after removal of the residue of the particles by washing the pierced membrane with water.

■ Multi-channel membrane

- 등록번호: US 13/819,074
- 발명자: Christian Dahlberg, Dietmar Oechsle, Erik M ller, Werner Wietschorke
- 출원인: Mahle International Gmbh
- 초록: A multi-channel membrane, in particular for treatment of liquids, includes at least one outer membrane surface and one inner membrane surface, which forms at least two longitudinally extending inner channels, which are enclosed by the outer membrane surface. It is proposed that the outer membrane surface and the inner membrane surface each form an actively separating layer.

■ Thin film composite reverse osmosis membrane

with antifouling properties and method of preparation of the same

- 등록번호: PCT/IN2013/000222
- 발명자: Pushpito Kumar Ghosh, Suresh Kumar JEWRAJKA, Alamuru Venkata Rami Reddy, Soumya HALDAR, Sanjay Mandal, Sadhika KHULLAR
- 출원인: Council Of Scientific & Industrial Research
- 초록: The present invention relates to the preparation of novel antibiofouling Thin Film Composite (TFC) Reverse Osmosis (RO) membranes on porous polysulfone (PSf) support of thickness 30–40 micron. TFC-RO membranes were prepared by interfacial polymerization between neat m-phenylenediamine (MPD) in water and pyridine tricarboxylic acid chloride (PTC) or a mixture containing PTC and trimesoyl chloride (TMC) in mixture of hexane + dichloromethane. The best results in terms of flux, NaCl rejection and antibiofouling property were obtained with 2:3-1:1 weight ratio of PTC to TMC. The present invention also relates to the preparation of antibiofouling TFC membranes by the interfacial polymerization between mixture of melamine + MPD and TMC. The best results in terms of antibiofouling property, NaCl rejection and flux were obtained with 1 :1 weight ratio of MPD to melamine.

■ Polymer electrolyte membrane, a method for fabricating the same, and a membrane-electrode assembly including the same

- 등록번호: PCT/KR2013/002569
- 발명자: Moo Seok Lee, Yong Cheol Shin, Na Young Kim, Dong Hoon Lee
- 출원인: Kolon Industries, Inc

- 초록: The present invention relates to a polymer electrolyte membrane, a method for fabricating the same, and a membrane-electrode assembly including the same, and provides a polymer electrolyte membrane which includes a hydrocarbon series ion conductive layer, and a fluoride series ion conductive body discontinuously dispersed on the surface of the hydrocarbon series ion conductive layer. The polymer electrolyte membrane has excellent junctional property with an electrode, resulting in excellent adhesive strength, improving the performance of a fuel cell due to reduced interfacial resistance, and having excellent transfer efficiency when being joined with an electrode by using transference.

■ A vacuum air gap membrane distillation system for desalination

- 등록번호: PCT/SG2012/000115
- 발명자: James Antony PRINCE, Gurdev Singh, Tiruvannamalai Subbarayan SHANMUGASUNDARAM
- 출원인: Ngee Ann Polytechnic
- 초록: This invention relates to a vacuum air gap membrane distillation system for desalination purposes. More particularly, this invention relates to a membranedistillation system with multiple cells in which the system's flux is increased due to the temperature and pressure differential within the system. The configuration of the vacuum air gap?membrane?distillation system allows for latent heat within the system to be recycled effectively reducing the energy consumption of the system.

■ Thin film composite membrane structures

- 등록번호: PCT/US2013/031946

- 발명자: Jeffrey R. McCUTCHEON, Thomas J. Hamlin, Mark T. Meyering, Liwei Huang
- 출원인: 3M Innovative Properties Company, University Of Connecticut
- 초록: Provided are thin film composite membrane structures comprising: a selective membrane layer for ion rejection attached to a support layer, the support layer comprising a multi-zone microfiltration membrane comprising: a porous support material; and at least two

microfiltration zones, where a first zone comprises a first membrane and a second zone that is attached to the first zone and that coats at least a portion of the porous support material. Thin film composite membrane structures may be provided in reverse osmosis systems or nanofiltration systems. Also, thin film composite membrane structures may be provided in direct osmotic concentration systems, forward osmosis systems, or pressure retarded osmosis systems.