

## 최신 미국특허 등록 목록

### ■ Composition containing proton-conductive copolymer, polymer electrolyte membrane, method of producing the membrane, and fuel cell using the membrane

- 등록번호 : 7619044
- 발명자 : Lee, Won-mok(Seoul, KR), Kim, Hae-kyoung(Seoul, KR), Kim, Tae-kyoung(Seoul, KR)
- 출원인 : Samsung SDI Co., Ltd.(Suwon-si, KR)
- 초록 : A composition containing a proton-conductive copolymer, a polymer electrolyte membrane containing the composition; a method of producing the membrane; and a fuel cell employing the membrane. The composition includes: a proton-conductive copolymer comprising a first styrene repeating unit, a second styrene repeating unit, and a dimethylsiloxane repeating unit; and a cross-linked polymer obtained from a cross-linking reaction between a siloxane oligomer having an unsaturated bond and a cross-linking agent. The cross-linked polymer has the same properties as the dimethylsiloxane repeating unit of the proton-conductive copolymer.

### ■ Porous composite membrane and method for making the same

- 등록번호 : 7628917
- 발명자 : Penezina, Oksana(Needham, MA, US), Pacheco, Manuel M.(Billerica, MA, US), Tsou, Dean T.(Lexington, MA, US)
- 출원인 : Whatman, Inc.(GB)
- 초록 : The invention provides composite porous membranes comprising a porous hydrophobic substrate coated with difunctional surface-modifying molecules. The difunctional surface-

modifying molecules provide a hydrophilic surface without forming branches of interconnected polymer molecules in the pores. The invention also provides a method for making composite porous membranes, such as a composite hydrophilic membrane with reduced concentration of surface modifying molecules required to coat a hydrophobic substrate.

### ■ Solid polymer electrolyte membrane and process for producing the same, and fuel cell

- 등록번호 : 7629393
- 발명자 : Takahashi, Norifumi(Gunma, JP), Ohba, Toshio(Gunma, JP), Kawada, Nobuo(Gunma, JP)
- 출원인 : Shin-Etsu Chemical Co., Ltd.(Tokyo, JP)
- 초록 : The present invention relates to a solid polymer electrolyte membrane having both of a higher proton conductivity and a smaller methanol permeability, which can be produced by conducting a graft polymerization of a fluoro-resin thin membrane irradiated with a radiation with a monofunctional monomer and again irradiating the resulting film with a radiation, followed by conducting a graft polymerization thereof with a polyfunctional monomer; and a high-performance fuel cell comprising the solid polymer electrolyte membrane, a fuel electrode and an air electrode, said solid polymer electrolyte membrane being disposed between the fuel electrode and the air electrode.

### ■ Smart membranes for nitrate removal, water purification, and selective ion transportation

- 등록번호 : 7632406

- 발명자 : Wilson, William D.(Pleasanton, CA, US), Schaldach, Charlene M. (Pleasanton, CA, US), Bourcier, William L.(Livermore, CA, US), Paul, Phillip H.(Livermore, CA, US)
- 출원인 : Lawrence Livermore National Security, LLC(Livermore, CA, US)
- 초록 : A computer designed nanoengineered membrane for separation of dissolved species. One embodiment provides an apparatus for treatment of a fluid that includes ions comprising a microengineered porous membrane, a system for producing an electrical charge across the membrane, and a series of nanopores extending through the membrane. The nanopores have a pore size such that when the fluid contacts the membrane, the nanopores will be in a condition of double layer overlap and allow passage only of ions opposite to the electrical charge across the membrane.

#### ■ Poly(ethylene chlorotrifluoroethylene) membranes

- 등록번호 : 7632439
- 발명자 : Mullette, Daniel(Toongabbie, AU), Muller, Heinz-Joachim(Thornleigh, AU)
- 출원인 : Siemens Water Technologies Corp. (Lowell, MA, US)
- 초록 : Porous polymeric membranes including HALAR<sup>®</sup> (poly(ethylene chlorotrifluoroethylene)) and related compounds and the methods of production thereof which avoid the use of toxic solvents. Preferred solvents, coating agents and pore forming agents are citric acid ethyl ester or glycerol triacetate. The membranes may be in the form of a hollow fiber or flat sheet, and may include other agents to modify the properties of the membranes, such as the hydrophilic/hydrophilic balance. Leachable agents may also be incorporated into the membranes.

#### ■ Composite membrane

- 등록번호 : 7635062
- 발명자 : Klare, Robert J.(St. Joseph, MO, US), DeYoung, James(Durham, NC, US), McClain, James B.(Raleigh, NC, US)
- 출원인 : BHA Group, Inc.(Kansas City, MO, US)
- 초록 : A composite article, in an exemplary embodiment, includes a porous membrane formed from a first material, a coating formed from a second material applied to at least a portion of the porous membrane, and a third material covering at least a portion of the porous membrane. The third material is substantially incompatible with the first material. The second material of the coating is compatible with the first material and the third material. The coating is positioned between the first material and the third material. The third material is connected to the first material by the coating on the porous membrane.

#### ■ Method for stable oxygen isotope separation and its apparatus using membrane distillation

- 등록번호 : 7638059
- 발명자 : Kim, Jae-Woo(Daejeon, KR), Choi, Hwa-Rim(Daejeon, KR), Chang, Dae-Shik(Daejeon, KR), Choi, Yun-Young(Kyungsangnam-do, KR)
- 출원인 : Korea Atomic Energy Research Institute(KR)
- 초록 : The present invention relates to an oxygen isotope separation system and a method therefor. More specifically, the invention relates to a newly invented pressure-driven AGMD (Air Gap Membrane Distillation) system applied to a multi-stage membrane distillation cells which can produce an oxygen isotope effectively and economically, and a method therefor. The invention provides an oxygen isotope separation system

including a number of Air Gap Membrane Distillation (AGMD) permeation cells connected in series to separate a feed into a product and a tail, wherein each of the AGMD cell is connected at a tail outlet with a reflux pump and at a product outlet, whereby the product from (i-1)th cell and the tail from (i+1)th cell are pumped as the feed into ith cell.

■ **Membrane encapsulated fiber and method for producing same**

- 등록번호 : 7638445
- 발명자 : Patrick, Gilbert(635 Dixon School Rd., Kings, Mountain, NC, US)
- 출원인 : Patrick, Gilbert(635 Dixon School Rd., Kings, Mountain, NC, US)
- 초록 : This invention generally relates to the production of a composite yarn or non-woven strand wherein a core of super absorbent fibers or polymers (SAP's) having a swell factor of approximately 25% and greater are encapsulated by a nonwoven membrane of defined porosity. The membrane is then sealed in a fashion to generally deter or prevent the SAP material from migrating out of the core as water is freely absorbed and desorbed from the composite yarn structure. The strands of yarns or strips of non-woven material are subsequently constructed into an open or unorientated fabric formation. When used as a subterranean fabric, structure or material, the resultant fabric structure retains moisture while permitting normal root growth and allowing excess water to pass through and beneath the fabric while facilitating movement of water from lower levels to the surface.

■ **Membrane contactor**

- 등록번호 : 7641795
- 발명자 : Taylor, Gareth P.(Indian Trail, NC, US), Price, Timothy D.(Monroe, NC, US)
- 출원인 : Celgard LLC(Charlotte, NC, US)

• 초록 : A membrane contactor includes a housing, a stack of membrane mats, and a cap. The housing has a closed end and an open end. The closed end includes an outlet port. The cap is united to the open end and includes an inlet port. A stack of membrane mats is within the housing stacked substantially perpendicular to the longitudinal axis of the housing. Each membrane mat has a plurality of hollow fiber members. A potting material bonds the membrane mats to each other and simultaneously bonds one end of the stack to the closed end and bonds the other end of the stack to the cap. The potting material forms an internal chamber and at least one external chamber within the housing. The hollow fiber members extend through the potting material from the internal chamber into the external chambers. The inlet port and the outlet port are in communication with the internal chamber. At least one side port is in communication with the external chambers.

■ **Nanoengineered membranes for controlled transport**

- 등록번호 : 7641863
- 발명자 : Doktycz, Mitchel J.(Oak Ridge, TN, US), Simpson, Michael L.(Knoxville, TN, US), McKnight, Timothy E.(Greenback, TN, US), Melechko, Anatoli V.(Oak Ridge, TN, US), Lowndes, Douglas H.(Knoxville, TN, US), Guillorn, Michael A.(Knoxville, TN, US), Merkulov, Vladimir I.(Oak Ridge, TN, US)
- 출원인 : UT-Battelle LLC(Oak Ridge, TN, US)
- 초록 : A nanoengineered membrane for controlling material transport (e.g., molecular transport) is disclosed. The membrane includes a substrate, a cover defining a material transport channel between the substrate and the cover, and a plurality of fibers positioned in the channel and connected to and extending away from a surface of the substrate. The fibers are aligned perpendicular to the surface of the sub-

strate, and have a width of 100 nanometers or less. The diffusion limits for material transport are controlled by the separation of the fibers. In one embodiment, chemical derivatization of carbon fibers may be undertaken to further affect the diffusion limits or affect selective permeability or facilitated transport. For example, a coating can be applied to at least a portion of the fibers. In another embodiment, individually addressable carbon nanofibers can be integrated with the membrane to provide an electrical driving force for material transport.

■ **Membrane apparatus and method of preparing a membrane and a method of producing hydrogen**

- 등록번호 : 7641888
- 발명자 : Gobina, Edward(Aberdeen, GB), Olsen, Susanne(Aberdeen, GB)
- 출원인 : Gas2 Limited(Aberdeen, GB)
- 초록 : The present invention discloses a method, apparatus and method of manufacturing an apparatus; all to produce hydrogen gas, particularly synthesis gas. Preferred embodiments of the invention include an alpha alumina membrane which has been treated with a  $TiO_2$  wash coat on one side and has an active gamma alumina layer on an opposite side. A metal catalyst, preferably rhodium, is deposited within the pores of the alumina. Oxygen travels through the membrane and is activated before contacting methane on the other side of the membrane and forming synthesis gas through partial oxidation of the methane. Embodiments of the invention have a number of benefits including the high conversion rate of oxygen (100%), the separate feed streams of methane and oxygen which allow for optimal ratios to be used without danger of explosion, and the opportunity to vary the feed rates without changing the products formed. Normally gaseous hydrocarbons recovered from remote oil wells (e.g. offshore oil wells) can thus be

converted to synthesis gas and then to normally liquid hydrocarbons via a Fischer-Tropsch type reaction. The normally liquid hydrocarbons are easier to transport away from the remote oil well than normally gaseous hydrocarbons.

■ **Electrolyte membrane of siloxane-based polymer and solid polymer fuel cell utilizing the same**

- 등록번호 : 7642295
- 발명자 : Zhang, Zuyi(Yokohama, JP), Sakakibara, Teigo(Yokohama, JP), Kobayashi, Motokazu(Yokohama, JP), Yamada, Masayuki(Tokyo, JP), Eritate, Shinji(Kawasaki, JP), Ito, Iko (Takatsuki, JP), Kanzaki, Yoshio (Ikoma-gun, JP)
- 출원인 : Canon Kabushiki Kaisha(Tokyo, JP)
- 초록 : An electrolyte membrane made of a phosphate-containing siloxane-based polymer for fuel cell, where the polymer comprises a siloxane backbone and a poly(meth)acrylate chain to which phosphate groups are attached, and the polymer is formed by vinyl polymerization of a silane compound having a (meth)acrylate functional group or a hydrolysis-polycondensation product thereof and a (meth)acrylate compound having a phosphate group, followed by siloxane crosslinking. The electrolyte membrane of a siloxane-based polymer has a high conductivity for a fuel cell.

■ **Membrane and use thereof**

- 등록번호 : 7644825
- 발명자 : Krause, Bernd(Rangendingen, DE), Wessling, Matthias(Enschede, NL), Göhl, Hermann(Bisingen, DE), Storr, Markus(Filderstadt, DE)
- 출원인 : Gambro Lundia AB(SE)
- 초록 : The membrane producible by shaping a

polymer blend or a block copolymer comprising blocks of monomer units, loading the polymer blend or block copolymer with a blowing gas concentration within the polymer blend or block polymer above a critical concentration at a temperature below a critical temperature, but above the glass transition temperature of the polymer blend/gas or block copolymer/gas mixture and finally stabilizing the foam structure is characterized in that as polymer blend a homogeneous polymer blend comprising at least one hydrophilic and at least one hydrophobic polymer and/or a block copolymer of alternating blocks of hydrophilic and hydrophobic monomer units is used, both the polymer blend and the block copolymer having a solubility relating to the used foaming gas above the critical concentration. The said membrane is used for medical purposes, especially for the haemodialysis, haemofiltration, haemodiafiltration, plasmapheresis, immunotherapy, micro- or ultrafiltration or gas separation.

■ **Method and apparatus for humidification of the membrane of a fuel cell**

- 등록번호 : 7645530
- 발명자 : Buechi, Felix(Langenthal, CH), Ruge, Martin(Starrkirch-Wil, CH), Schmid, Daniel(Winterthur, CH)
- 출원인 : Paul Scherrer Institute(Villigen, CH)
- 초록 : A fuel cell has an electrochemical process area having a cathode area, an anode area and an ion-exchanging membrane that separates these areas. The cathode area has a gas passage way having a gas inlet, a gas channel and a gas outlet, wherein the gas passage way is for an oxygen-containing gas to flow from the gas inlet through the gas channel to the gas outlet. The fuel cell includes further a humidity transfer area having a dehumidifying zone, a humidifying zone and a humidity transfer membrane that separates these zones. An exhaust channel connects the gas outlet to the dehumidifying zone, and an inlet channel connects the gas inlet to the humidifying zone. Humidity is

extracted from the oxygen-containing gas in the dehumidifying zone, and added to the oxygen-containing gas in the humidifying zone via the humidity transfer membrane.

■ **Asymmetric membrane cMUT devices and fabrication methods**

- 등록번호 : 7646133
- 발명자 : Degertekin, F. Levent(Decatur, GA, US)
- 출원인 : Georgia Tech Research Corporation (Atlanta, GA, US)
- 초록 : Asymmetric membrane capacitive micro-machined ultrasonic transducer ("cMUT") devices and fabrication methods are provided. In a preferred embodiment, a cMUT device according to the present invention generally comprises a membrane having asymmetric properties. The membrane can have a varied width across its length so that its ends have different widths. The asymmetric membrane can have varied flex characteristics due to its varied width dimensions. In another preferred embodiment, a cMUT device according to the present invention generally comprises an electrode element having asymmetric properties. The electrode element can have a varied width across its length so that its ends have different widths. The asymmetric electrode element can have different reception and transmission characteristics due to its varied width dimensions. In another preferred embodiment, a mass load positioned along the membrane can alter the mass distribution of the membrane. Other embodiments are also claimed and described.

■ **Coated membranes and other articles**

- 등록번호 : 7648034
- 발명자 : Charkoudian, John(Carlisle, MA, US), Soice, Neil P.(Merrimack, NH, US)
- 출원인 : Millipore Corporation(Bedford, MA, US)
- 초록 : The present invention provides porous media or membranes having a surface coating

that includes a cross-linked terpolymer which has a superior combination of properties, including heat stable biomolecule resistant adsorptive properties, resistance to strong alkaline solutions, and low levels of extractable matter. In some preferred embodiments, the porous media is a porous membrane.

#### ■ Composite ion-exchange membrane

- 등록번호 : 7649025
- 발명자 : Kitamura, Kota(Otsu, JP), Sakaguchi, Yoshimitsu(Otsu, JP), Nagahara, Shigenori(Otsu, JP), Hamamoto, Shiro(Otsu, JP), Takimoto, Naohiko (Yokohama, JP), Sugihara, Hideki (Otsu, JP), Takase, Satoshi(Otsu, JP), Kitagawa, Tooru(Otsu, JP), Noshiro, Miyako(Osaka, JP)
- 출원인 : Toyo Boseki Kabushiki Kaisha (Osaka-Shi, JP)
- 초록 : A composite ion exchange membrane having a high swelling resistance and being superior in mechanical strength and ion conductivity can be provided by means of an composite ion exchange membrane including an ion exchange resin composition and a support membrane having a continuous pore penetrating the support membrane, wherein the support membrane is one which accepts the ion exchange resin composition within the pore, and wherein the ion exchange resin composition is one which contains an ion exchange resin containing, as a main component, an aromatic polyether and/or its derivative, the aromatic polyether being obtained by mixing a compound having a specific structure, an aromatic dihalogenated compound and a bisphenol compound with a carbonate and/or a bicarbonate of an alkali metal and polymerizing the mixture in an organic solvent.

#### ■ Membrane air dryer with pre-charge volume

- 등록번호 : 7651551
- 발명자 : Wright, Eric(Evans Mill, NY, US), Kohar, Richard(Kingston, CA)
- 출원인 : New York Air Brake Corporation (Watertown, NY, US)
- 초록 : A membrane air dryer includes a housing with an air inlet, an air outlet, a sweep air inlet and a sweep air outlet; and a membrane separator having surfaces extending between and having an inlet and an outlet respectively connected to the air inlet and the air outlet. A sweep air passage in the housing extends between first and second ends of the membrane along and includes surfaces of the membrane. The sweep air passage has an inlet adjacent the air outlet and has an outlet adjacent the air inlet and connected to the sweep air outlet. A volume is concentric to the membrane separator, has an inlet connected to the outlet of the membrane separator and has an outlet connected to the sweep air inlet. The filter may be mounted in a reservoir with the membrane separator extending into the reservoir.

#### ■ Coating solution for glucose sensing membrane and method of manufacturing optical glucose sensor chip

- 등록번호 : 7651864
- 발명자 : Kasai, Shingo(Yokohama, JP), Oomiya, Kayoko(Yokohama, JP), Uematsu, Ikuo(Yokohama, JP), Tono, Ichiro (Yokohama, JP)
- 출원인 : Kabushiki Kaisha Toshiba(Tokyo, JP)
- 초록 : method of preparing a coating solution for a glucose sensing membrane, the method comprising preserving a first solution containing an oxidizing enzyme or a reducing enzyme of glucose and a reagent for generating a substance for coloring a coloring agent dissolved in a buffer solution, preserving a second solution containing a mixed solution

of an alcohol solution of the coloring agent and a solution of a membrane-forming polymer compound, and mixing the first solution and the second solution.

■ **Nanocomposite, nanocomposite electrolyte membrane and fuel using the same**

- 등록번호 : 7652089
- 발명자 : Choi, Yeong Suk(Suwon-si, KR), Kim, Hae Kyung(Seoul, KR)
- 출원인 : Samsung SDI Co., Ltd.(Suwon-si, KR)
- 초록 : A nanocomposite including: a sulfonated polysulfone and a nonmodified clay dispersed in the sulfonated polysulfone, the nonmodified clay having a layered structure, and the nonmodified clay being intercalated with the sulfonated polysulfone, or the layers of the layered structure being exfoliated, a nanocomposite electrolyte membrane and a fuel cell using the same. In the nanocomposite, a nanoscale amount of the nonmodified clay, which has a layered structure, is dispersed in sulfonated polysulfone having excellent ionic conductivity. Thus, the nanocomposite has excellent ionic conductivity and mechanical properties. The nanocomposite electrolyte membrane formed using this nanocomposite has an improved ability to suppress permeation of polar organic fuels, such as methanol, while maintaining appropriate ionic conductivity. In addition, the fuel cell with the nanocomposite electrolyte membrane can effectively prevent crossover of methanol used as a fuel, thereby providing improved working efficiency and an extended lifespan.

■ **Durable pd-based alloy and hydrogen generation membrane thereof**

- 등록번호 : 7655183
- 발명자 : Benn, Raymond C.(Madison, CT, US), Opalka, Susanne M.(Glastonbury, CT, US), Vanderspurt, Thomas Henry (Glastonbury, CT, US)

- 출원인 : UTC Power Corporation(South Windsor, CT, US)
- 초록 : A durable Pd-based alloy is used for a H<sub>2</sub>-selective membrane in a hydrogen generator, as in the fuel processor of a fuel cell plant. The Pd-based alloy includes Cu as a binary element, and further includes "X", where "X" comprises at least one metal from group "M" that is BCC and acts to stabilize the  $\beta$  BCC phase for stability during operating temperatures. The metal from group "M" is selected from the group consisting of Fe, Cr, Nb, Ta, V, Mo, and W, with Nb and Ta being most preferred. "X" may further comprise at least one metal from a group "N" that is non-BCC, preferably FCC, that enhances other properties of the membrane, such as ductility. The metal from group "N" is selected from the group consisting of Ag, Au, Re, Ru, Rh, Y, Ce, Ni, Ir, Pt, Co, La and In. The at. % of Pd in the binary Pd-Cu alloy ranges from about 35 at. % to about 55 at. %, and the at. % of "X" in the higher order alloy, based on said binary alloy, is in the range of about 1 at. % to about 15 at. %. The metals are selected according to a novel process.

■ **Titania composite membrane for water/alcohol separation, and preparation thereof**

- 등록번호 : 7655277
- 발명자 : Lee, Kew-Ho(Daejeon, KR), Lee, Yoon-Kyu(Daejeon, KR), Lee, Dong-Wook (Daegu, KR), Sea, Bong-Kuk(Daejeon, KR)
- 출원인 : Korca Research Institute of Chemical Technology(Daejeon, KR)
- 초록 : The present invention relates to a titania composite membrane for separating water/alcohol mixtures and a method of preparation thereof, and more particularly to the titania composite membrane and the method of preparation thereof, wherein a surface of a porous support is modified with silica xerogel and  $\gamma$ -alumina sol and titania sol is coated on the modified surface to form a titania surface layer

and then the obtained titania surface layer is dried and calcined to optimize performance of separation and promote thermal stability. The titania composite membrane of the present invention has excellent properties such as thermal stability, mechanical strength and good perm-selectivity for water molecule in water/alcohol mixtures due to the hydrophilic property of the titania surface layer, thus being applicable to the membrane for separating water/alcohol mixtures.

■ Proton-conducting electrolyte membrane method for production and use thereof in a fuel cell

- 등록번호 : 7655334
- 발명자 : Melzner, Dieter(Göttingen, DE), Kiel, Suzana(Göttingen, DE), Mahr, Ulrich (Berlin, DE), Reiche, Annette(Göttingen, DE)
- 출원인 : Volkswagen AG(Wolfsburg, DE)
- 초록 : A proton-conducting electrolyte membrane is disclosed, comprising at least one base material and at least one dopant, which is the reaction product of an at least dibasic inorganic acid with an organic compound, comprising one acidic hydroxyl group, or the condensation product of said compound with a polybasic acid. The membrane may be produced by a single step method, which avoids the use of dangerous materials and environmental pollutants. Subsequent doping of the membrane, e.g., in conjunction with assembly of the membrane electrode assembly (MEA) is not excluded. The electrolyte membrane has a high and constant mechanical stability and flexibility, excellent chemical and thermal stability and a high and constant conductivity. The membrane may be used in a fuel cell in a wide temperature range from 50°C. to more than 200°C., for example, whereby the

fuel cell has a high and constant power level over the entire temperature range.

■ Sheet-form membrane sample probe, method and apparatus for fluid concentration analysis

- 등록번호 : 7658094
- 발명자 : Brumboiu, Aurel D.(Calgary, CA), Norquay, Darrell A.(Calgary, CA), William, Bruce(Calgary, CA)
- 출원인 : DataLog Aquisition Corp
- 초록 : A sheet form membrane probe, an apparatus and method, wherein the probe includes a probe body, a sheet-form membrane secured to the probe body and including an open surface exposed to the exterior of the probe; a channel formed between the probe body and the membrane through which a collector fluid can flow; an inlet port opening to the channel to conduct collector fluid to the channel; and an outlet port spaced from the inlet port such that the collector fluid passes through the channel from the inlet port to the outlet port in a flow direction substantially parallel to the membrane. The channel may be formed to provide broad surface contact of the collector fluid with the membrane. The membrane open surface may include an active area open to a sample fluid and open on an opposite side for contact with collector fluid flow in the channel. The active area may be large relative to the total membrane area to provide for an effective use of the expensive membrane material. Another probe includes a fitting end and a membrane stem and secures membranes to at least two sides of the membrane stem such that permeation can occur along a channel passing from the fitting end along the membrane stem and returning to the fitting end from the membrane stem.