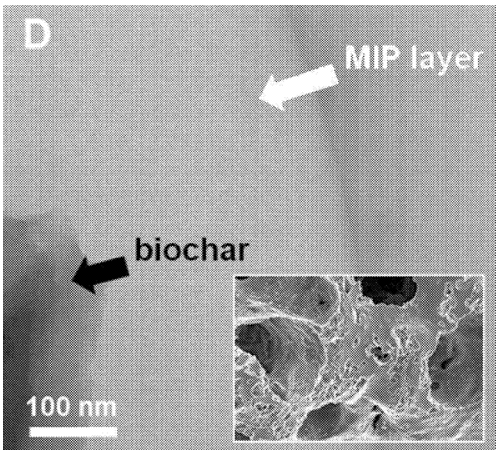
PATENT HIGHLIGHTS Q1/2025

Patent Highlights are quarterly reports on emerging patents related to process intensification. This report highlights a selection of 27 out of ca. 350 patents on different PI-technologies published in Q1/2025, ranging from multifunctional catalysts to hybrid separation techniques. Technologies utilizing various electricity-based energy transfer mechanisms still present a significant part of the current report, with the gravity point moving from the microwave- to plasma-assisted processing, induction and Joule heating. Chinese patents dominate the process intensification field, exceeding 80% of all patents filed.

IMPRINTED POLYMER SURFACE FUNCTIONALIZATION OF ACTIVATED CARBON FOR SELECTIVE ADSORPTION OF PER- AND POLYFLUOROALKYL SUBSTANCES

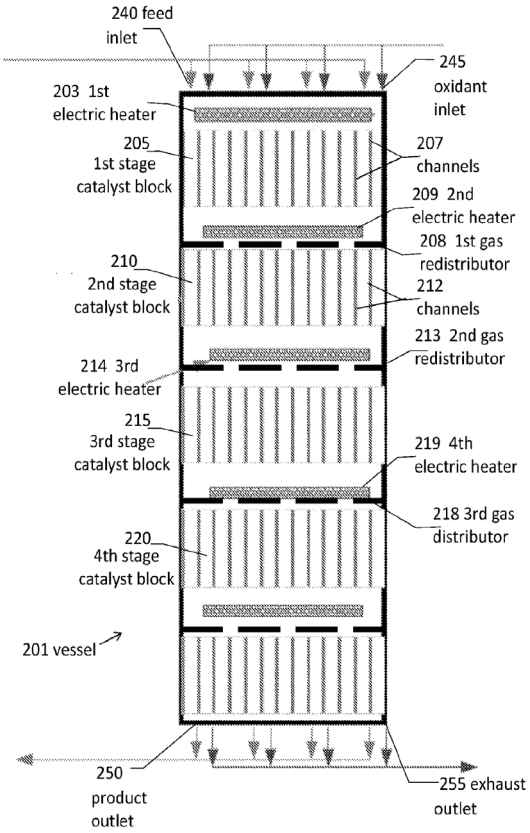
Publication number: US2024326016 (A1)
Publication date: 2024-10-03
Inventor(s): STEIGERWALD JESSICA [US]; RAY JESSICA [US] +
Applicant(s): UNIV WASHINGTON [US] +

Methods of functionalizing activated carbon for selective adsorption of a per- or polyfluoroalkyl substance (PFAS), methods of removing PFAS, and compositions comprising activated carbon; and a molecularly imprinted polymer (MIP) coupled to the activated carbon are described. In the embodiment, the method of functionalizing activated carbon for selective adsorption of a PFAS comprises coordinating a PFAS template with a plurality of functional monomers; polymerizing the plurality of functional monomers coordinated with the PFAS template in the presence of an activated carbon substrate to provide a molecularly imprinted polymer (MIP) coupled to the activated carbon; and extracting the PFAS template from the MIP.



REACTOR WITH MONOLITH CATALYST BLOCKS FOR HYDROGEN PRODUCTION

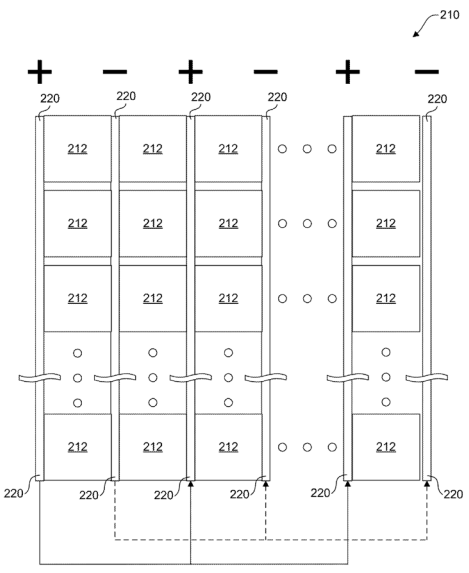
Publication number: WO2025043218 (A2)
Publication date: 2025-02-27
Inventor(s): OUYANG XIAOYING [US]; LUO HUPING [US]; KUPERMAN ALEXANDER [US]; LI LIN [US] +
A reactor uses catalyst blocks for conversion of light hydrocarbons to hydrogen and to liquid hydrocarbons. The catalyst blocks stacked on top of one another within the reactor facilitate conversion of the light hydrocarbons. Electric heaters can be arranged in a variety of orientations within the reactor to supply heat for the conversion reaction. Alternatively, the catalyst blocks can be located within reaction tubes within the reactor and heated by combustion of a fuel adjacent to the reaction tubes. When operated in a regeneration mode, coke that accumulates within the reactor is removed by oxidation.



SYSTEMS AND METHODS FOR REMOVING CARBON DIOXIDE FROM A FLUID

Publication number: AU2023312049 (A1)
Publication date: 2025-03-13
Inventor(s): SANTOS-HEARD JOSHUA IVAN; CAVERO RODRIGUEZ DANIEL; GERTZMAN NATHANIEL BALIN; PETITJEAN LAURENE; DHADWAIWALE ADITI; GARCZYNSKI BRANDON JOHN; FLAIG ROBINSON WIESSINGER; TU ELIZABETH; THOMAS-BOSUM MAARTEN JOHAN +
Applicant(s): NOYA INC +

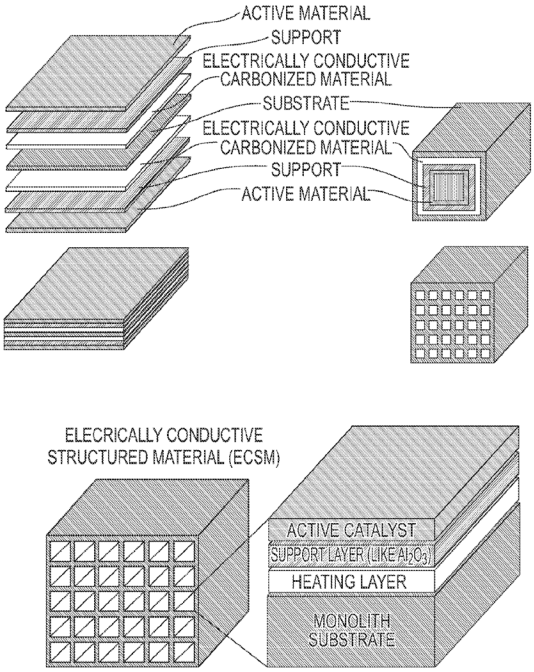
Some embodiments are directed to a system for extracting carbon dioxide from a fluid. The system can include a fluid source and a reactor. The reactor can include one or more chambers, and each chamber can include one or more monoliths for adsorbing carbon dioxide from the fluid. The chambers can be alternatively unsealed for a contacting mode and sealed for a regeneration mode. A power source can provide an electric current to the monoliths to release carbon dioxide adsorbed by the monoliths. Each chamber can include an array of monoliths. Each monolith can include a sorbent that adsorbs carbon dioxide from fluid. The system can include modular components such that the number of reactors can be increased or decreased.



ELECTRICALLY HEATED SUBSTRATES, ASSEMBLIES, SYSTEMS, AND PROCESSES FOR CATALYTIC, CHEMICAL, AND SORBENT APPLICATIONS

Publication number; WO2025042924 (A1)
Publication date: 2025-02-27
Inventor(s): SHEN JIAN [US]; GUPTA RAGHUBIR [US]; HARIBAL VASUDEV [US]; TONG ANDREW [US]; PETERS JONATHAN [US]; ABDALLAH MONICA [US]; ZELINSKY RYAN [US] +

An article for joule heating is described, including a three-dimensional substrate on and/or in which a pyrolyzate of a phenolic resin or polymer forms an electrically conductive carbon network. Such articles may be incorporated in structured materials applications, which may include support, sorbent, and or catalyst components. Also described are methods of fabricating such articles and structured materials, and apparatus comprising same, and methods of use of such articles and structured materials and apparatus for conducting material transformation processes requiring input of heat for their performance, such as CO2 adsorption, methane pyrolysis for hydrogen and carbon production, hydrogen-assisted conversion of CO2 to hydrocarbons, including catalytic conversion of CO2 to olefins, catalytic conversion of CO2 to propane (liquefied petroleum gas), and catalytic conversion of CO2 to renewable natural gas, reverse water gas shift reaction, steam ethane cracking, propane cracking, steam methane reforming, and dry methane reforming.

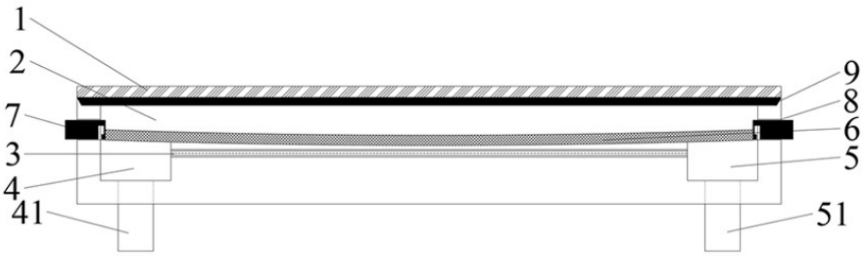


MICRO-CHANNEL EXTRACTION REACTOR WITH GRID PLUG-IN AND APPLICATION OF MICRO-CHANNEL EXTRACTION REACTOR

Publication number: CN119318819 (A)
Publication date: 2025-01-17
Inventor(s): LUO JIANHONG; LIU RUN; YANG JUN; YE YI +
Applicant(s): UNIV SICHUAN +

The invention relates to the technical field of micro-channel equipment extraction, in particular to a micro-channel extraction reactor with a grid plug-in and application of

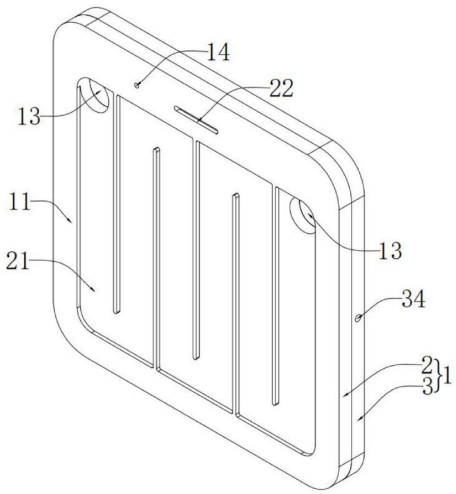
the micro-channel extraction reactor. The microchannel extraction reactor includes: a microchannel panel; an extraction unit; comprising a containing groove, a linear micro-channel, a front chamber and a rear chamber, the stainless steel filter screen set comprises at least one slightly-curved stainless steel filter screen arranged in the containing groove, the protruding end of the slightly-curved stainless steel filter screen faces the containing groove, and the slightly-curved stainless steel filter screen is arranged between a micro-channel panel and the containing groove; each adjusting unit comprises a sliding supporting piece and an adjusting groove for containing the sliding supporting piece, the sliding supporting pieces stretch out and draw back through the adjusting grooves, and one end of each sliding supporting piece is fixedly connected with the corresponding slightly-bent stainless steel filter screen. The micro-channel extraction reactor can promote sufficient mass transfer of phosphoric acid on an extraction phase interface so as to improve the separation effect of metal element impurities in a phosphoric acid raw material under different flow velocity conditions.



MICRO-CHANNEL REACTION BLOCK AND MICRO-CHANNEL REACTOR

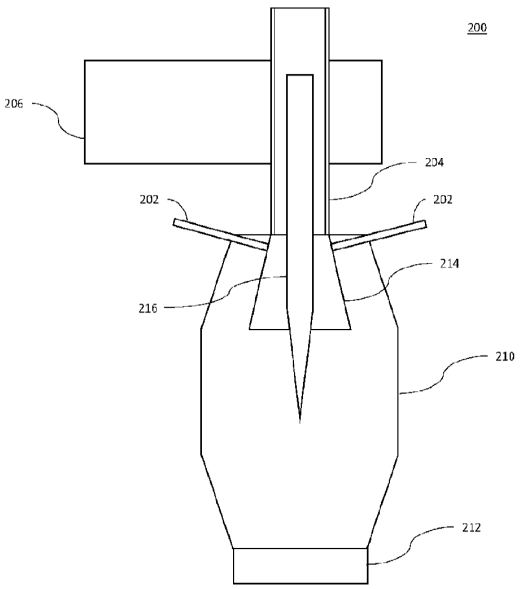
Publication number: CN222401423 (U)
Publication date: 2025-01-28
Inventor(s): LI BIN; ZHAO XIAOYANG; ZHANG JIAGENG +
Applicant(s): HIMILE MECHANICAL MFG CO LTD +

The utility model discloses a micro-channel reaction block and a micro-channel reactor, and belongs to the technical field of micro-channel reaction equipment, the micro-channel reaction block comprises a reaction block body which is provided with a first surface, a second surface and two heat exchange medium ports, and the first surface and the second surface are distributed along a first direction; the heat exchanger is formed by stacking heat exchange plates and reaction plates. The first surface is positioned on the heat exchange plate, and the second surface is positioned on the reaction plate; heat exchange runners are arranged on the heat exchange plates; the first surface is provided with a drainage channel; the reaction plate sheet is provided with a reaction flow channel communicated with the drainage channel, and the second surface is provided with a reaction inlet; the projection of the reaction inlet in the first direction is located in the drainage channel; the projection of the reaction inlet in the first direction is located in the reaction flow channel, and when a plurality of reaction block bodies are connected in a stacked and sealed mode, a continuous reaction channel allowing fluid to flow and be mixed can be formed without using a connecting pipeline; each reaction block body is provided with a heat exchange runner, so that the heat exchange effect is excellent; all the reaction block bodies are uniform in specification and high in universality.



SYSTEMS, METHODS, AND DEVICES FOR DESTRUCTION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) AND FOR REACTIVATING SPENT ACTIVATED CARBON

Publication number: WO2025049798 (A1)
Publication date: 2025-03-06
Inventor(s): LEE JUDITH [US]; REDJDAL MAKHLOUF [US]; MAJCHER JARED [US]; KAISER ASHLEY [US] +
Applicant(s): 6K INC [US] +

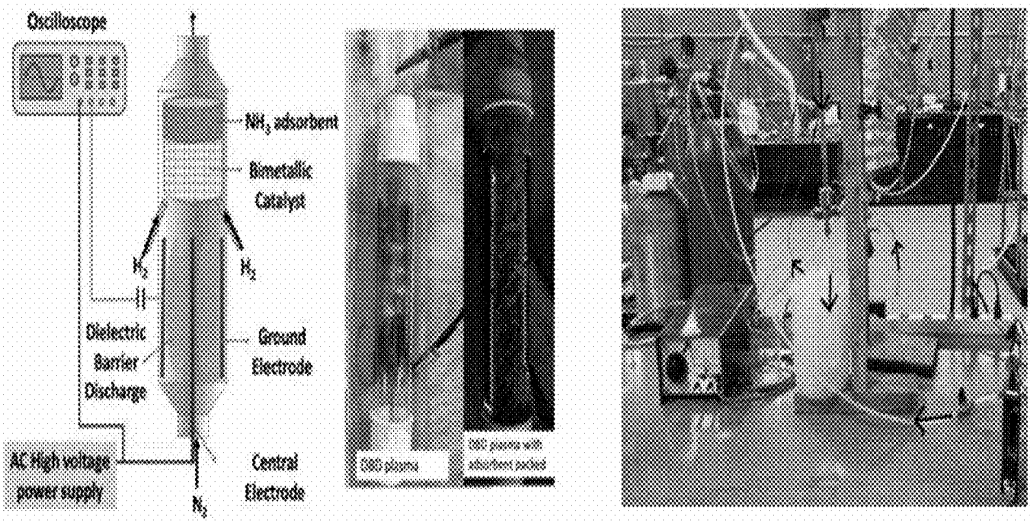


Embodiments disclosed herein relate to a systems, methods, and apparatus for the destruction of per- and polyfluoroalkyl substances (PFAS). These embodiments may be applied to spent activated carbon or biosolids containing PFAS. Embodiments disclosed herein involve destruction of PFAS using a microwave generated plasma, including propagating microwaves through a microwave plasma apparatus, the microwaves generated using a microwave generator to generate a microwave plasma; introducing the PFAS into the microwave plasma apparatus; and contacting the PFAS with the microwave plasma, wherein contacting the PFAS with the microwave plasma initiates a chemical reaction that destroys the PFAS. Embodiments disclosed herein also involve reactivating spent activated carbon using a microwave generated plasma. Spent activated carbon can include activated carbon and adsorbates adsorbed onto the activated carbon. Contacting the spent activated carbon with the microwave plasma can reactivate the spent activated carbon by, for example, removing the adsorbates from the activated carbon.

MODULAR PRODUCTION OF AMMONIA

Publication number: US2025051175 (A1)
Publication date: 2025-02-13
Inventor(s): SUNKARA MAHENDRA [US]; VASIREDDY SIVAKUMAR [US]; KUMAR VIVEKANAND [US] +
Applicant(s): ADVANCED ENERGY MAT LLC [US] +

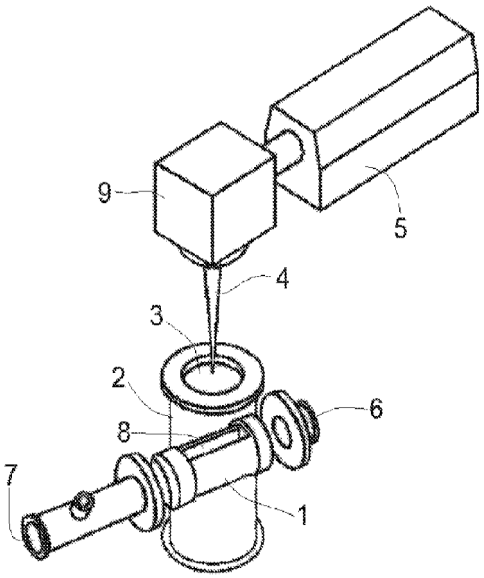
A method of producing ammonia is provided. The method includes steps of oxidizing N2 gas in a plasma discharge reactor to form NOx where x is 1 or 2 and hydrogenating NOx in the presence of H2 on a catalyst to form ammonia. The method may also include steps of providing a plasma discharge reactor with a fixed or fluidized catalyst bed, introducing N2 gas, an oxidizing agent, and H2 gas into the plasma discharge reactor to produce ammonia, and collecting the ammonia produced.



METHOD AND DEVICE FOR BREAKING DOWN CARBON DIOXIDE

Publication number: WO2025003533 (A1)
Publication date: 2025-01-02
Inventor(s): MORO FRANCO EUSEBIO [ES]; DE LA FUENTE LEIS GERMÁN [ES]; MOLINA MANSILLA RICARDO [ES]; NUÑEZ COELLO PEDRO FELIPE [ES]; ANGUREL LAMBAN LUIS ALBERTO [ES] +
Applicant(s): CO2 BREAKERS S L 60% [ES]; AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIG CIIENTIFICAS CSIC 20% [ES]; UNIV DE ZARAGOZA 10% [ES]; UNIV DE LA LAGUNA 10% [ES] +

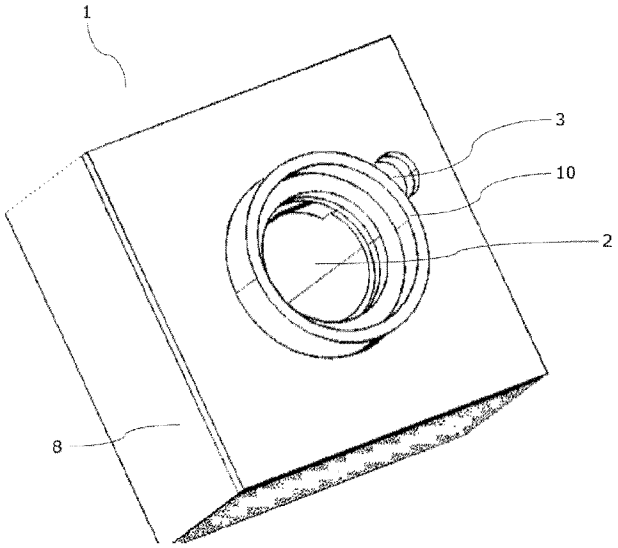
The present invention relates to a method and device for transforming carbon dioxide (CO2) into its elements, C and O2, by means of the combined use of laser irradiation (4) and dielectric barrier discharge plasma (1) which are applied to high-melting-point ceramic or metallic substrate catalysts in a chamber (2). In this way, laser radiation increases the temperature only in the area in which it is applied, to the catalysts, in order for the emission plasma to reach a temperature close to 3400 K, capable of breaking down CO2, only in that area and not in the entire plasma reactor chamber.



A MASSIVE PARALLEL PLASMA REACTOR ARRAY FOR GAS CONVERSION APPLICATIONS

Publication number: EP4489903 (A1)
Publication date: 2025-01-15
Inventor(s): TRENCHEV GEORGI [BE]; SCHELTJENS GILL [BE]; ZIEGLER DAVID [BE] +
Applicant(s): D CRBN BV [BE] +

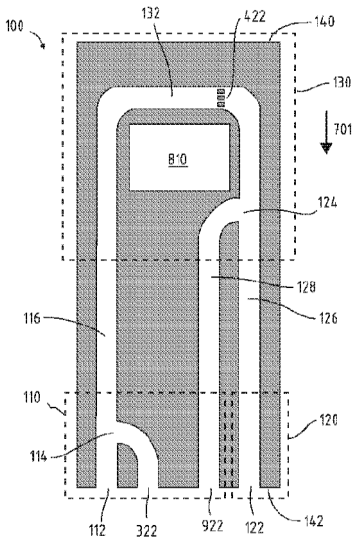
The current invention relates to a reactor module for converting chemical compounds into materials, gases or energy, wherein the reactor module is suitable for contiguous radial stacking, comprising: a reaction chamber and at least one inlet pressure chamber, wherein at least one tangential flow channel, connected to said inlet pressure chamber, wherein said tangential flow channel is further connected to the reaction chamber tangentially to its circular cross-section, wherein said tangential channel is suitable for directing the flow of reactant gas into the reaction chamber. The invention also relates to a reactor stack comprising two or more reactor modules contiguously stacked in the radial plane. The invention also relates to the use of aforementioned module or a stack of modules for gas conversion.



MICROREACTOR, SYSTEM AND METHOD FOR INVESTIGATING A SOLID-FLUID CHEMICAL REACTION IN A MICROREACTOR

Publication number: WO2025005863 (A2)
Publication date: 2025-01-02
Inventor(s): KLEINSMIT MARIE-LOUISE HELENA [NL]; VOLLENBROEK JEROEN CHRISTIAAN [NL]; ODIJK MATHIEU [NL] +
Applicant(s): PAEBBL AB [SE] +

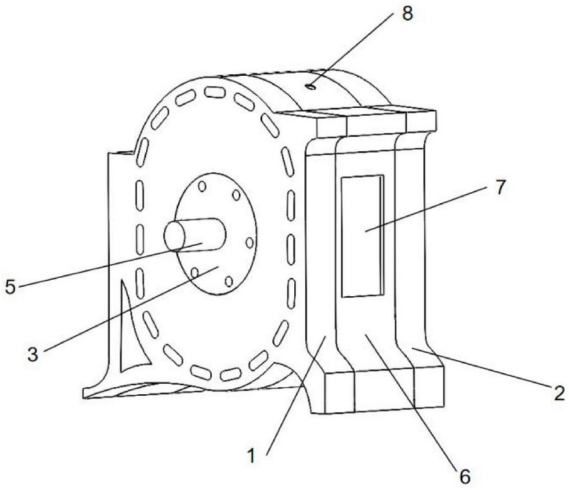
Embodiments of the present disclosure may include a microreactor for investigating solid-fluid chemical reactions, the microreactor including an inlet section including a first inlet microchannel. Embodiments may also include an outlet section including an outlet microchannel. Embodiments may also include a reaction section including. Embodiments may also include a reaction chamber configured to hold one or more solid particles. In some embodiments, the reaction chamber may be arranged in fluid communication with the first inlet microchannel and the outlet microchannel. In some embodiments, the microreactor may be configured to be observed by one or more experimental techniques under reaction conditions comprising liquid and/or supercritical carbon dioxide conditions.



ROTARY COMPRESSION TYPE CONCENTRATING SOLAR WATER SPLITTING HYDROGEN PRODUCTION REACTOR

Publication number: CN119236839 (A)
Publication date: 2025-01-03
Inventor(s): WANG BO; SHUAI YONG; DU HONGCHEN; JIAO YONGQI; LI LIFENG; WANG WEI; WUSIMAN ERFANJIANG; LIU DONGHANG +
Applicant(s): HARBIN INST TECHNOLOGY +

The invention discloses a rotary compression type concentrating solar water splitting hydrogen production reactor, relates to the technical field of energy conversion and storage, and solves the problems that a traditional solar hydrogen production mode is low in efficiency and the hydrogen solid phase heat regeneration process is complex. A plurality of hydrogen production reactors are connected to a shaft in series, and the hydrogen production reactors are used in cooperation with an external solar condenser; the hydrogen production reactor comprises a front end cover, a rear end cover, a rotor, a reaction chamber and a cam; the front end cover, the reaction chamber and the rear end cover are connected in sequence; rotors are arranged in the reaction chamber and divide the reaction chamber into a plurality of chambers; the rotor is arranged on the shaft through the cam; a quartz window and air holes are formed in the reaction chamber, sunlight radiation collected by the solar condenser is transmitted into the reaction chamber through the quartz window, and gas exchange is performed through the air holes; and a cerium oxide oxygen carrier is arranged on the rotor. By optimizing the solid-phase heat regeneration process of the oxygen carrier, the structure of the reactor is remarkably simplified, and efficient conversion from solar energy to hydrogen energy is achieved.

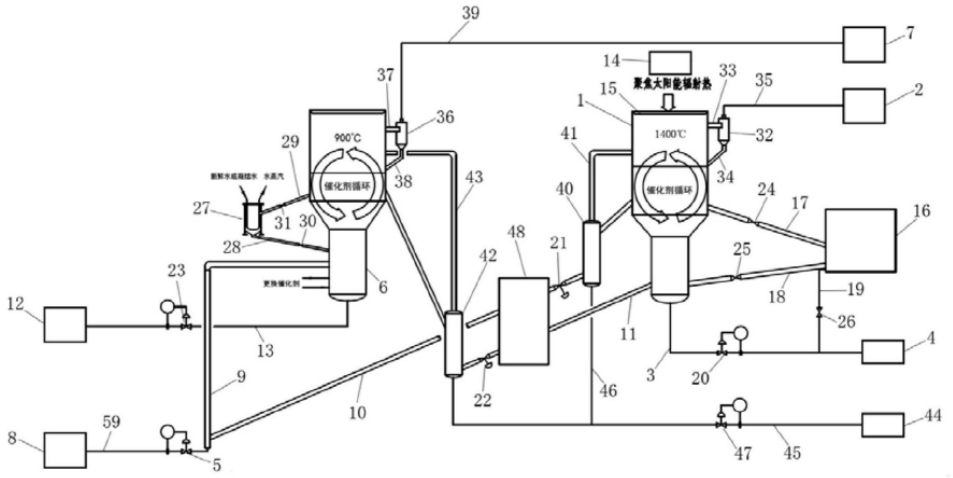


SYSTEM FOR PRODUCING HYDROGEN THROUGH SOLAR PHOTO-THERMAL CATALYTIC FLUIDIZATION REACTION

Publication number: CN222325120 (U)
Publication date: 2025-01-10
Inventor(s): LIN ZHIWEI; LIU JINGJING; ZHANG HAN +
Applicant(s): BOYING RUIKE BEIJING TECH CO LTD; PROINVENT TECH SA; SHANGHAI HOTO ENG INC +

The utility model discloses a system for producing hydrogen through solar photo-thermal catalytic fluidization reaction. The system comprises a reduction reactor, a first waste heat recovery and heat exchange mechanism, a first pipeline, a first gas supply mechanism, an oxidation reactor, a second gas supply mechanism, a second

pipeline, a third pipeline and a second waste heat recovery and heat exchange mechanism. A catalyst is arranged in the reduction reactor, and the reduction reactor is used for reducing the catalyst to obtain the reduced catalyst and a first mixed gas. The first waste heat recovery and heat exchange mechanism is arranged outside the reduction reactor, and the first waste heat recovery and heat exchange mechanism is used for receiving the first mixed gas and generating oxygen. And the second waste heat recovery heat exchange mechanism is used for receiving the second mixed gas and generating hydrogen. The technical scheme provided by the embodiment of the utility model is low-carbon and environment-friendly, and can produce hydrogen on an industrial economic scale.



ENHANCED ELECTROLYTIC REACTIONS

Publication number: US2025011942 (A1)
Publication date: 2025-01-09
Inventor(s): SANDSTROM ROBERT E [US] +
Applicant(s): SANDSTROM ROBERT E [US] +

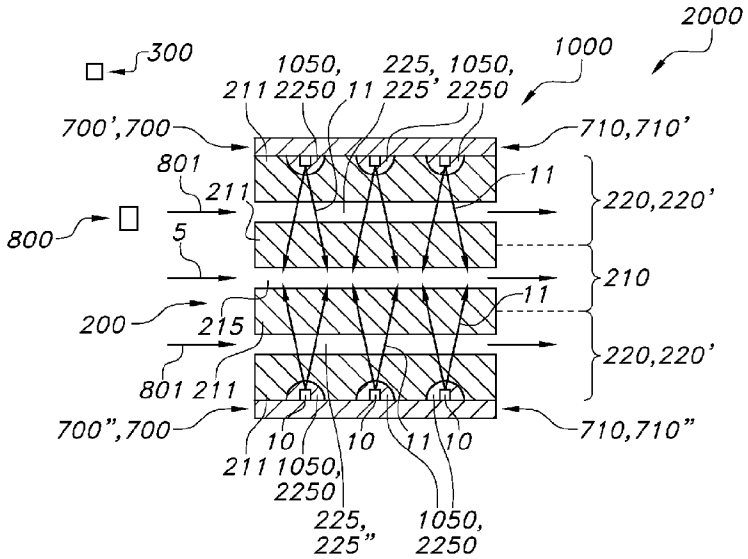
Methods of enhancing an electrolytic reaction, including preparing an electrochemical apparatus including an electrolyte supply, two electrodes immersed in the electrolyte supply, and an electrolytic reactant; exposing the electrochemical apparatus to a magnetic field having a field strength selected to prolong a lifetime of a free radical entity generated by the electrochemical apparatus, for a time sufficient to prolong the lifetime of the free radical entity; and passing an electric current through the electrochemical apparatus between the two electrodes, where the electric current is selected to electrolyze the electrolytic reactant via a production of free radical entities.

INTEGRATED PHOTOCHEMICAL FLOW REACTOR WITH LED LIGHT SOURCE

Publication number: EP4486498 (A1)
Publication date: 2025-01-08
Inventor(s): BENOY DANIËL ANTON [NL]; BROERSMA REMY CYRILLE [NL]; SWEEGERS NORBERTUS ANTONIUS MARIA [NL] +
Applicant(s): SIGNIFY HOLDING BV [NL] +

The invention provides a photoreactor assembly (1000) comprising a photochemical reactor (200) and a light source arrangement (700); wherein the light source

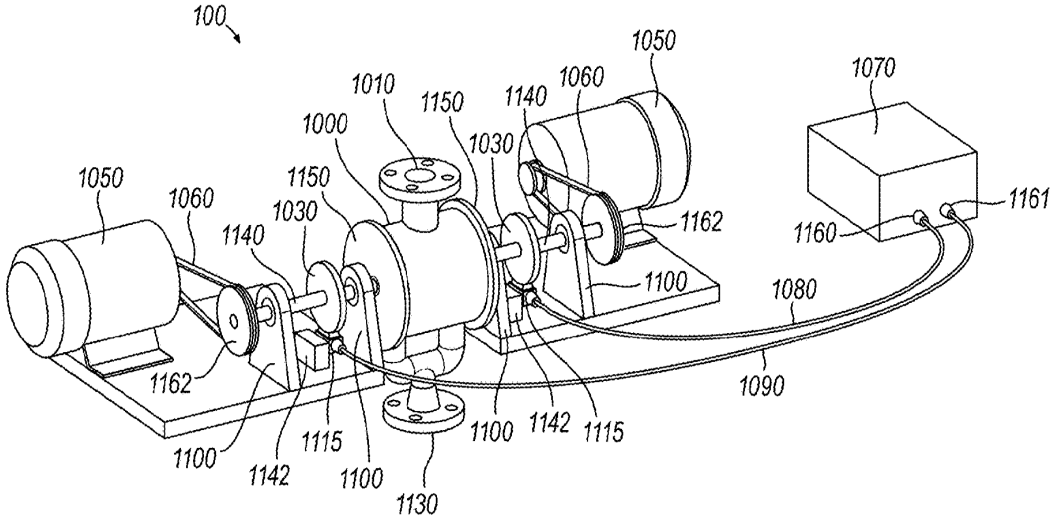
arrangement (700) comprises (i) a plurality of light sources (10) configured to generate light source radiation (11) selected from one or more of UV radiation, visible radiation, and IR radiation, and (ii) a support arrangement (710) for the one or more light sources (10); wherein the photochemical reactor (200) comprises a first region (210) comprising a flow reactor system (215) configured to host a fluid (5) to be treated with the light source radiation (11), and a second region (220) comprising a fluid channel system (225), which is not in fluid contact with the flow reactor system (215), and which is configured for temperature control of one or more of the photochemical reactor (200) and the light sources (10); wherein the first region (210) and the second region (220) are configured in thermal contact with each other or form a (monolithic) body; wherein the photochemical reactor (200) comprises a light transmissive material (211) that is transmissive for the light source radiation (11); wherein the support arrangement (710) is configured in thermal contact with the second region (220); wherein one or more of the second region (220) and the support arrangement (710) provide light source cavities (1050) for hosting at least part of the light sources (10); wherein the plurality of light sources (10) are configured to irradiate at least part of the flow reactor system (215) via the light transmissive material (211); and wherein the light sources (10) are in thermal contact with the second region (220) via the support arrangement (710).



PROCESS AND APPARATUS FOR MULTI-PHASE REACTION PROCESSING OF LIQUIDS

Publication number: US2025026667 (A1)
Publication date: 2025-01-23
Inventor(s): SAINT-VINCENT STEPHEN [US]; BROUSSARD GERARD J [US] +
Applicant(s): SHOCKWATER SOLUTIONS LLC [US] +

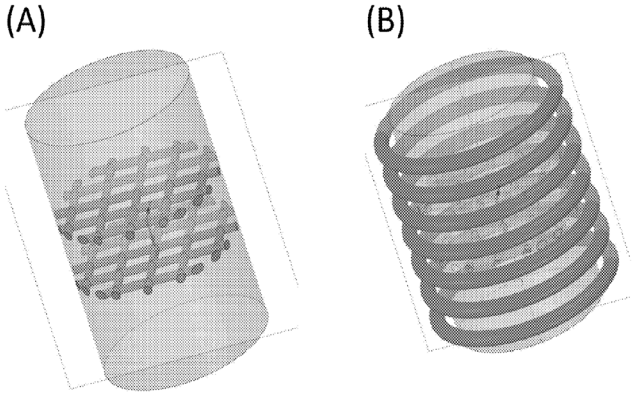
Embodiments under the present disclosure include the application of an electric field in a region of liquid undergoing ultra-high shear impact, mixing and or cavitation. The co-location of electrolysis and high shear mixing and or cavitation has demonstrated the ability to cause advanced oxidation reactions and advanced reduction reactions in fluid systems such as water with both dissolved and suspended solids, and hydrocarbon with and without water emulsion.



INDUCTIVE HEATING REACTORS

Publication number: US2025050295 (A1)
Publication date: 2025-02-13
Inventor(s): BOON JURRIAAN [NL]; JAMES JEBIN DUTHIE [NL]; SEBASTIANI FRANCESCO [NL]; RAIDA MARIE [NL]; TWERDA ARIS [NL]; ELZINGA GERARD DOUWE [NL] +
Applicant(s): NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO [NL] +

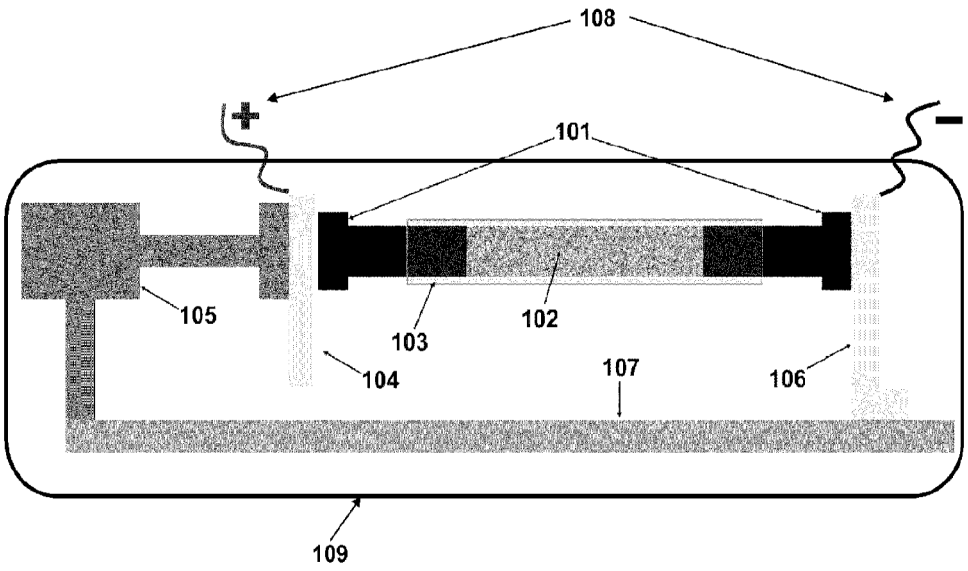
Provided herein are one or more heating structures within a reactor for inductive heating, which greatly improve(s) the heating within the reactor. Placing the heating structure results in a more homogenous temperature distribution throughout the reactor interior, which may lead to higher yields, better selectivities, faster adsorbent regeneration, reduced catalyst degradation rates and higher heating rates. The heating structure is formed by connected strands of material which have a diameter of 0.5-100 mm. The heating structure has areas that are susceptible to induction heating. The volume of the total heating structures in the reactor is less than 20 vol. % of the total empty reactor volume. At least a part of the network is formed by strands with a thermal conductivity of 10 W·m−1·K−1 or more at the operating temperature of the reactor.



COMPOSITIONS, SYSTEMS AND METHODS FOR FLASH JOULE HEATING CARBON NANOTUBES

Publication number: WO2025039082 (A1)
Publication date: 2025-02-27
Inventor(s): MANCEVSKI VLADIMIR [US] +
Applicant(s): UNIVERSAL MATTER INC [CA] +

A system and method for a conversion of plastic and carbon feedstock resulting in a hybrid morphology of carbon nanotubes is provided herein. The system includes a feedstock containing a plastic, a conductive carbon, and a metal-based catalyst. The system further includes a plurality of graphite electrodes configured to conduct a current through the feedstock. The system further includes a reservoir configured to contain the feedstock while allowing outgassing during the conversion. The system further includes a chamber configured to contain combustible volatile substances. The system further includes a power source configured to provide electrical power for the conversion. The system further includes an electrical controller configured to use a feedback mechanism for controlling the conversion and growth of the carbon nanotubes.

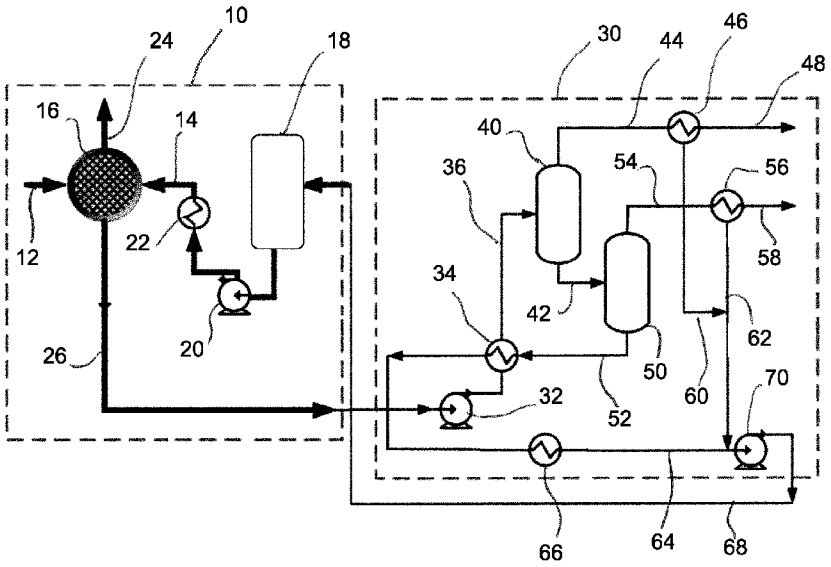


INTEGRATED ROTATING PACKED BED ADSORBER, COOLER, AND AMINE ENTRAINMENT UNIT

Publication number: US2025058270 (A1)
Publication date: 2025-02-20
Inventor(s): FEDERICI JUSTIN A [US]; KALYANARAMAN JAYASHREE [US]; SIMMERS ERIC R [US]; SHEN ERIC B [US]; SUTTON CLAY R [US]; BAUGH LISA S [US] +
Applicant(s): EXXONMOBIL TECHNOLOGY & ENGINEERING COMPANY [US] +

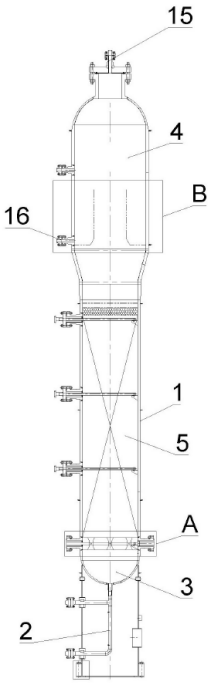
Systems and methods are provided for performing amine capture on a heated flue gas using multiple rotating packed beds. By integrating a series of rotating packed beds to perform cooling of the flue gas, removal of CO2 from the flue gas by contact with an aqueous amine, and washing of the gaseous effluent from CO2 removal step to remove any entrained amine, the equipment footprint and overall equipment volume required for CO2 capture can be significantly reduced. The integration of

cooling, CO2 removal, and washing can be integrated into a series of packed beds in part by using different packing materials in the various packed beds.



HYDROGENATION REACTOR

Publication number: CN119264937 (A)
Publication date: 2025-01-07
Inventor(s): DONG JIANPING +
Applicant(s): WUXI KELUNDA CHEMICAL AND THERMAL EQUIPMENT CO LTD +



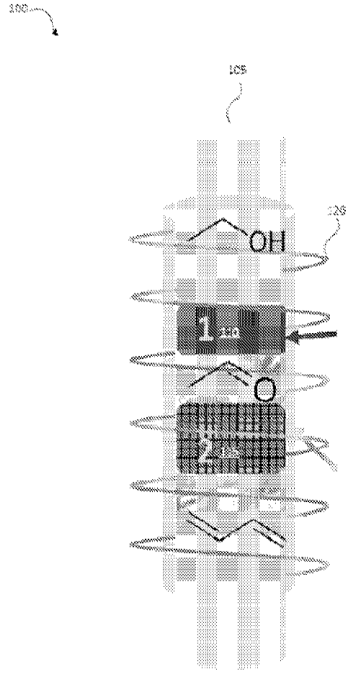
The invention provides a hydrogenation reactor which can enable materials input by the hydrogenation reactor to be mixed with hydrogen more sufficiently. The invention relates to a hydrocarbon reactor, which comprises a cylinder, one end of the cylinder is provided with a feeding section connected with a feeding port, the feeding port is used for inputting hydrocarbon substances, the other end of the cylinder is provided with a discharging section connected with a discharging port, and a catalyst bed section is arranged in the middle of the cylinder. A plurality of venturi tubes are uniformly arranged on the partition plate, the middle parts of the venturi tubes are shrunk inwards to form throat parts, and the feeding section and the catalyst bed section are communicated with each other through the venturi tubes; a Venturi tube is arranged in the cylinder body, a hydrogen input port is further formed in the cylinder body, the hydrogen input port is connected with a hydrogenation pipeline extending into the cylinder body, the throat part of the Venturi tube is connected with the hydrogenation pipeline, and the hydrogenation pipeline is tangent to the throat part of the Venturi tube.

TUNING REACTION SELECTIVITY WITH INDUCTION HEATING

Publication number; WO2025054118 (A1)
Publication date: 2025-03-13

Inventor(s): LIZANDARA PUEYO CARLOS [DE]; CHEN JIAN-PING [US]; GOKHALE AMIT [US]; SASMAZ ERDEM [US]; WANG HAN [US]; KO BEN [US] +
Applicant(s): BASF CORP [US]; UNIV CALIFORNIA [US] +

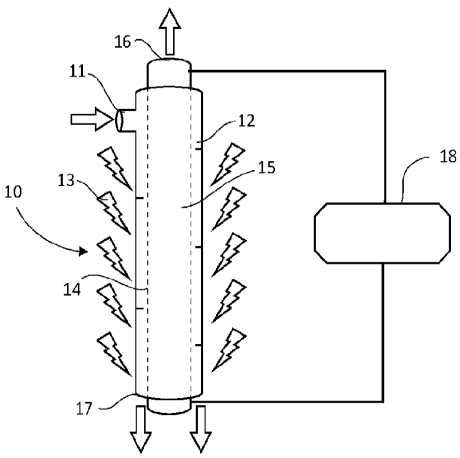
Disclosed herein is a system and method that has been developed that includes heating a reactor with an induction heater. The reactor includes a multifunctional catalyst bed with a first catalyst bed and a second catalyst bed, which are heated to different temperatures. The system also includes an induction heater that is configured to heat the first and second catalyst beds.



A MEMBRANE REACTOR FOR THE CRACKING OF HYDROCARBONS

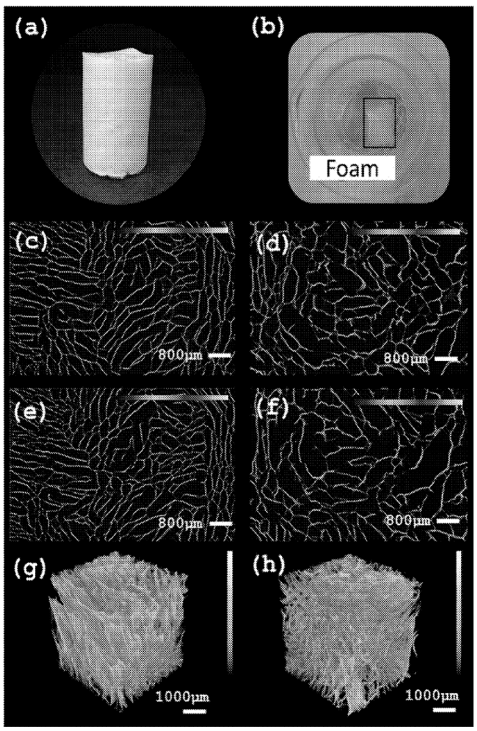
Publication number: WO2025045391 (A1)
Publication date: 2025-03-06
Inventor(s): MANSOURI ALI [IT]; AMIDEI SIMONE [IT] +
Applicant(s): NUOVO PIGNONE TECNOLOGIE SRL [IT] +

A membrane reactor for the cracking of hydrocarbons is disclosed. The reactor comprises a hydrocarbon feed inlet (11), a reaction zone (12) wherein hydrocarbons are cracked into reaction products composed of smaller molecules, energy supply means (13) configured to supply energy to said reaction zone (12), a membrane (14) configured to be selectively permeated by a permeate composed of at least part of the reaction products moving from the reaction zone (12) to a permeation zone (15) and separating from a retentate composed of a remaining part of the reaction products and unreacted hydrocarbons that remain in the reaction zone (12), an outlet (16) of the permeation zone (15) and an outlet (17) of the reaction zone (12). The membrane reactor comprises vibration generating means (18), configured to vibrate the membrane (14), said vibration generating means (18) being configured to generate ultrasonic vibrations.



HYDROPHILIC FOAM FOR RETENTION OF ORGANIC AND INORGANIC COMPOUNDS, PRODUCTION PROCESS AND USES THEREOF

Publication number: US2025018368 (A1)
Publication date: 2025-01-16
Inventor(s): LOREVICE MARCOS VINICIUS [BR]; FIGUEREDO GOUVEIA RUBIA [BR] +
Applicant(s): CNPEM CENTRO NAC DE PESQUISA EM ENERGIA E MATERIAIS [BR] +

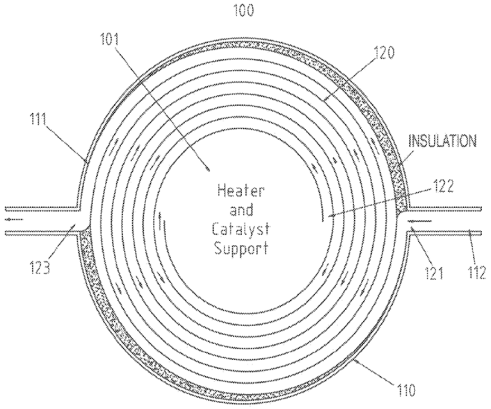


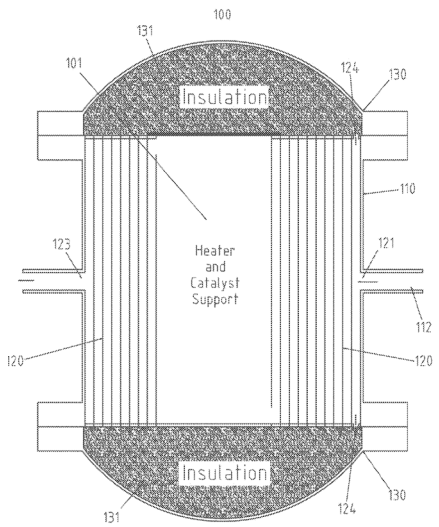
Foams based on micro and nanofibrillated cellulose, subjected to the oxidation process, and combined with natural rubber latex are revealed, as well as their production process, which involves mixing, freezing and freeze-drying steps. Foams have high porosity, structural resilience in liquid media and high adsorption capacity for organic compounds (such as dyes and detergents) and inorganic heavy metal compounds, not showing ecotoxicity and can be applied to remediate environments contaminated by these compounds.

CHEMICAL REACTOR WITH INTEGRATED HEAT EXCHANGER, HEATER, AND HIGH CONDUCTANCE CATALYST HOLDER

Publication number: US2025091888 (A1)
Publication date: 2025-03-20
Inventor(s): BEACH JOSEPH D [US]; KINTER JONATHAN D [US]; WELCH ADAM W [US] +
Applicant(s): STARFIRE ENERGY [US] +

A chemical reactor that combines a pressure vessel, heat exchanger, heater, and catalyst holder into a single device is disclosed. The chemical reactor described herein reduces the cost of the reactor and reduces its parasitic heat losses. The disclosed chemical reactor is suitable for use in ammonia (NH3) synthesis.

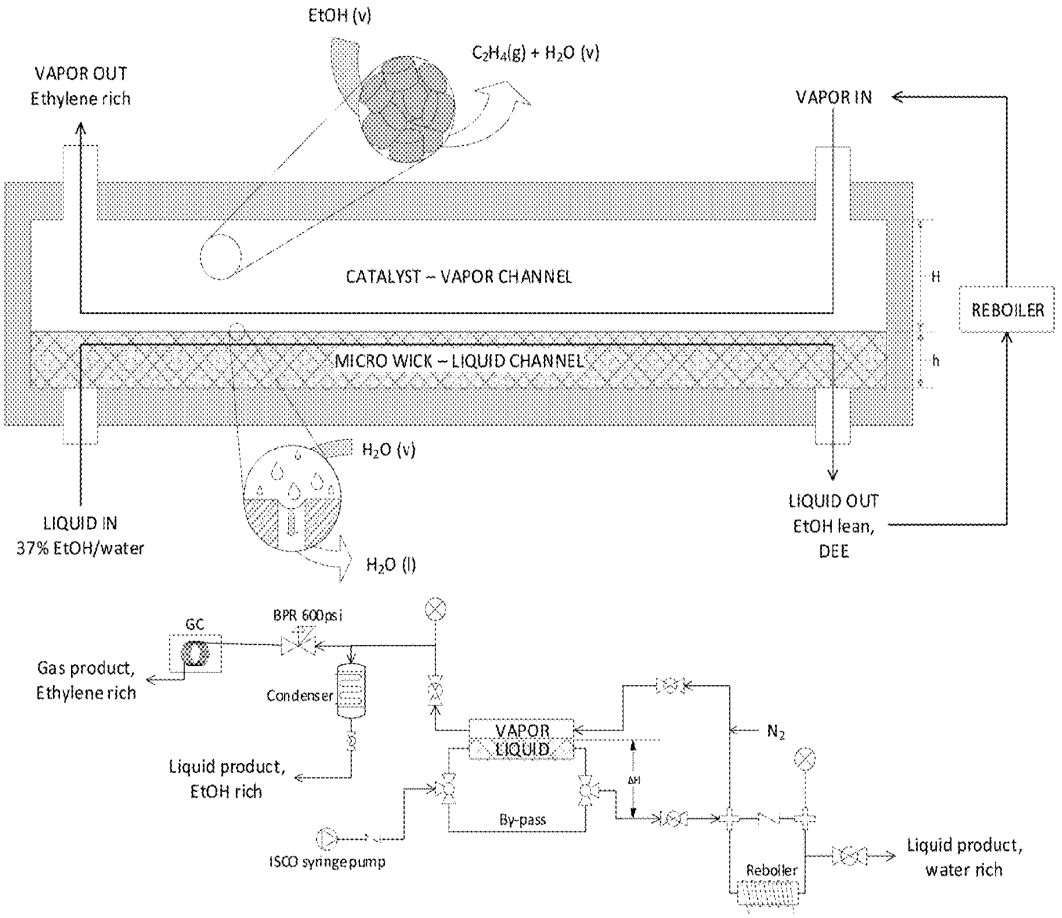




METHOD OF COMBINED SEPARATION AND CONVERSION OF AN OXYGENATE AND MICROCHANNEL REACTIVE DISTILLATION APPARATUS

Publication number: US2025066269 (A1)
Publication date: 2025-02-27
Inventor(s): DAGLE ROBERT A [US]; SAAVEDRA LOPEZ JOHNNY [US]; TEGROTENHUIS WARD E [US]; ZHENG RICHARD F [US]; BOTTENUS DAN R [US]; HUMBLE PAUL H [US]; DAVIDSON STEPHEN D [US] +
Applicant(s): BATTELLE MEMORIAL INSTITUTE [US] +

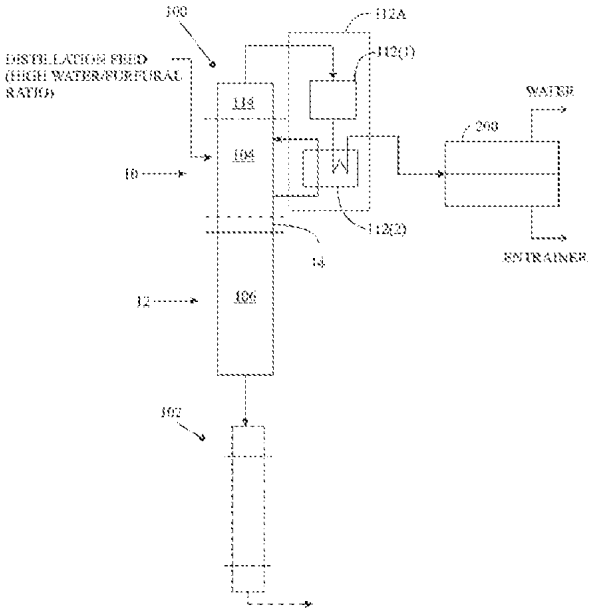
A reactive distillation method, system, and apparatus are described for a combined separation and conversion of an oxygenate(s) in aqueous solution to more volatile intermediates for gas phase conversion. A mixture of oxygenate and water flow into a microchannel apparatus comprising a hydrophilic wick adjacent a reaction channel comprising a hydrophobic solid acid catalyst. During operation, water is produced in a dehydration reaction, produced water vapor is condensed away from the reaction channel and travels out through the wick layer, thus driving equilibrium toward more product. The combination of microchannel architecture with the catalytic distillation reaction was characterized by unexpectedly superior stability.



APPARATUS FOR AND METHOD OF HETEROAZEOTROPIC EXTRACTIVE DISTILLATION

Publication number: FI20235786 (A1)
Publication date: 2025-01-04
Inventor(s): KANTOMAA JUHANI [FI]; ANTTILA JUHA [FI] +
Applicant(s): CHEMPOLIS OY [FI] +

A heteroazeotropic extractive distillation method is performed using two-stage distillation within a column (100, 102). A first stage (10) distills a first mixture (104) of water, acetic and formic acid and entrainer inside a temperature difference 5 °C to 20 °C for separating water from the first mixture (104) of a first percentage of said entrainer and a first percentage of water. A second stage (12) receives a bottom product from the first stage (10). The second stage (12) has a second percentage of said entrainer and a second percentage of water that are greater than the first percentages. Overhead vapor of the first and the second stages (10, 12) is pressurized by vapor recompression. The first mixture (104) is circulated back to the first stage (10), and heat of the overhead vapor to first mixture (104) is circulated to the first stage (10).



METHODS AND SYSTEMS FOR MAKING ELECTRICALLY CONDUCTIVE COMPOSITES, FABRICS, AND TEXTILES

Publication number: WO2025038549 (A1)
Publication date: 2025-02-20
Inventor(s): BOTTE GERARDINE G [US]; JAFARI BEHNAZ [US] +
Applicant(s): UNIV TEXAS TECH SYSTEM [US] +

Devices, methods and systems for producing functional textiles and electrically conductive composites including for electro-thermal membrane distillation using a reduced graphene oxide (rGO) coated membrane. The method includes introducing a feed solution to a membrane distillation module including rGO-coated membranes. The methods also includes applying a controlled voltage to the rGO-coated membrane. The method also includes generating joule heating. The joule heating locally heats the feed solution. The method also includes adjusting the controlled voltage. The method also includes volatilizing the target elements. The method also includes, responsive to the volatizing of the target elements, separating the target elements from the feed solution. The methods and systems producing functional textiles usable for electrochemical distillation of complex mixtures and for healthcare applications based on antimicrobial activity.