HYDROCARBON ADVANCEMENT METHOD

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Abstract

The present invention relates to a method for developing fuel such as various raw materials and biodiesel having hydrocarbon wherein a carbon-carbon double bond and oxygen are removed by a hydrotreating reaction using a proton medium having conductivity, and the present invention is capable of producing advanced biofuel at low costs from various hydrocarbon sources and improving energy efficiency and hydrogen usage efficiency.

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Diagram
HYDROCARBON ADVANCEMENT METHOD

TECHNICAL FIELD

[0001] The present invention relates to a process for upgrading hydrocarbon using proton conductive material and, more specifically to a method for upgrading a fuel such as various raw materials and bio-diesel having hydrocarbon by removing a carbon-carbon double bond and oxygen through a hydrotreating reaction using a proton carrying medium with proton (H\(^+\)) conductivity.

BACKGROUND ART

[0002] Bio-diesel (BD), which is an environmentally friendly fuel that reduces CO\(_2\) causing global warming, is a low-grade alkyl ester compound of long-chain fatty acid purified by exchange reaction of animal and/or vegetable oil and alcohol as shown in reaction formula 1. Physicochemical characteristics of bio-diesel are almost similar to ordinary light diesel oil, so it is a fuel that can be used in currently used transport vehicle engines. But the first-generation bio-diesel (Fatty Acid Methyl Ester, FAME) entails problems of fuel filter blockage, corrosion of an internal control device of a distributor type high-pressure pump, and corrosion of fuel injection nozzles. Because of such physical properties of low-grade fuel, it is used in vehicles at a substantially low mixture rate (5 to 20%). Moreover, a considerable quantity of glycerin, soap, salt, or the like is generated during manufacture of bio-diesel, and a lot of energy is consumed to separate and purify these components.

Oil and fats+Methanol→First-generation Bio-diesel (FAME)+Glycerin [Reaction Formula 1]

[0003] In order to improve on the disadvantages of the first-generation bio-diesel production process through the existing transition esterification reaction formula 1, research into new production processes such as the continuous process, supercritical fluid process and biological transfer process is under way. However, since the first-generation bio-diesel contains oxygen in all the molecular structures thereof, it has a natural problem in actual production and use of bio-diesel. Therefore, in order to produce high-quality bio-diesel, quality upgrading is necessary to remove the oxygen and double bond in bio-diesel, and the resulting product is second-generation bio-diesel.

[0004] Since first-generation bio-diesels are different in fuel properties according to the properties of the raw materials, limited types of raw materials are used, and as such it is not easy to supply a low-priced large-quantity of raw material. As an example, bio-diesel produced from palm oil, which is the lowest in production costs among vegetable oils, is difficult to be used for vehicles because it has poor low-temperature fluidity. That is, in order to manufacture high-quality bio-diesel using various raw materials available with a low-priced large quantity supply such as palm oil with excellent titn per unit area, a fuel transfer technology that can actively cope with raw material diversification is necessary.

[0005] Hydrogenation is a reaction applied for bio-diesel upgrading for production of high-quality bio-diesel or production of bio-diesel directly from oil. Research into the production process of hydrogenated bio-diesel (HE), which is a second-generation bio-diesel using hydrogenation, is under way (Reaction Formula 2). Second-generation bio-diesels are excellent in physicochemical properties in terms of a high cetane value (80 to 90), cloud point (-5 to -30° C) and storability, so it does not have a limit to the ratio of mixing with conventional light diesel oil.

Oil and fats+Hydrogen→Second-generation Bio-diesel (HBD)+Propene [Reaction Formula 2]

[0006] The second-generation bio-diesel production process is excellent in concordance with the current oil refining process, so it is actively adopted by major oil companies such as Neste Oil (Finland, NEXBTL), UOP (America, Ecolfining), Petrobras (Brazil, Hi-Bio) and Nippon Oil Corporation (Japan, BHD). It is a hydrodenitrogenation process in which fuel is made into a high grade by supplying hydrogen gas to the fuel, which is the raw material, and whereby the hydrogen is added to the fuel by an agitating apparatus which has catalysts as a medium. Such a hydrogenation process is a process in use in the conventional petrochemical industry and its safety and performance have been proven. But in order to dissolve the hydrogen gas of a reactant in oil and fats, an operating condition of high pressures (50 to 60 bars) is required, and since it has a disadvantage that the initial investment cost and the operating cost are high for the construction of a new plant, it has a critical limitation in which commercialization is possible only in conjunction with an existing plant. Furthermore, despite that the second-generation bio-diesel production process requires a large quantity of hydrogen, the usage efficiency is rather low.

[0007] As a prior art, U.S. Pat. No. 7,244,351 discloses a process for removing sulfur from hydrocarbon including a step of flowing a hydrogen source through a membrane, wherein the hydrogen is generated by electrolysis of water or an aqueous electrolyte solution by electrodes. Accordingly, there is a need for supplying separate electrical energy and entails a problem related to a treatment of byproducts generated during the electrolysis. In particular, in the above process, a fouling phenomenon is generated by the electrolysis which may result in clogging of the membrane.

DISCLOSURE

Technical Problem

[0009] Accordingly, to solve the above-mentioned problems, it is an object of the present invention to provide a method for upgrading a fuel such as various raw materials and bio-diesel having hydrocarbon by removing a carbon-carbon double bond and oxygen through a hydrotreating reaction using a proton carrying medium with proton (H\(^+\)) conductivity.

Technical Solution

[0010] First, the reason why it is essential to operate at high pressures in the hydrogenation process is because the reaction of hydrogen atoms and a raw material is necessary to remove the double bond between carbons and oxygen. (C—C, R—CH==O, ROH, etc.), but this reaction progresses on the catalyst surface for hydrogenation. So dissolution of hydrogen gas in a raw material should precede (step 1), and the dissolved hydrogen should diffuse up to the catalyst surface (step 2), and hydrogen...
cannot take part in this reaction unless the process (step 3), in which the hydrogen adsorbed on the catalyst surface is dissociated, occurs on first.

0011 In particular, the step in which hydrogen is dissolved in oil and fats (step 1) is the step in which the reaction rate is determined in hydrogenation. If the step in which hydrogen molecules in oil and fats are dissolved is excluded, the operating pressure the process can maintained low.

0012 Therefore, in the present invention, in order to exclude the hydrogen molecules dissolving step, a proton carrying medium having proton conductivity is interposed between a part supplied with hydrogen gas and a part supplied with a raw material so that the form of the hydrogen supplied to the raw material is that of a proton, so that the proton, which is supplied by being directly dissociated from hydrogen by the proton carrying medium, comes into direct contact with the raw material.

0013 Hydrogen molecules move after they move in hydrogen atom form or are ionized into protons and electrons after dissociative adsorption into hydrogen atoms on the surface of the proton carrying medium. That is, if such a proton carrying medium is interposed between the part supplied with hydrogen gas and the part supplied with the raw material, hydrogen atoms or protons can be transmitted and contacted directly to the raw material. At this time, hydrogen atoms or protons are moved on the surface of the proton carrying medium or by penetrating the same.

0014 Therefore, according to the present invention, there is provided a method for upgrading hydrocarbon including: contacting hydrogen gases to a proton carrying medium having proton conductivity in a predetermined space; dissociating the hydrogen gases into protons (H+) by the proton carrying medium; moving the protons (H+) along the proton carrying medium to supply the protons (H+) to a raw material contacted on the proton carrying medium; and contacting the protons and the raw material with surface of a reactive catalyst disposed on or around a surface of the proton carrying medium to remove a carbon-carbon double bond and an oxygen contained in the raw material.

0015 Herein, the proton carrying medium may be a hydrogen separation dense membrane having the reactive catalyst coated thereon. In addition, the proton carrying medium may be a carrying rod having a proton conductive material coated on a surface thereof. That is, the protons may be moved on the surface of the proton carrying medium, or moved by penetrating the proton carrying medium.

0016 Therefore, apparatus for upgrading hydrocarbon by the above mentioned method for upgrading hydrocarbon may be proposed in two ways divided into the case that the protons are moved on the surface of the proton carrying medium, and the case that the protons are moved by penetrating the proton carrying medium, respectively.

0017 First, an apparatus for upgrading hydrocarbon of the case that the protons are moved on the surface of the proton carrying medium includes: a hydrogen separation dense membrane which is a proton carrying medium having a reactive catalyst coated on one side thereof; a hydrogen supplying part configured to supply hydrogen to the other side of the hydrogen separation dense membrane at a predetermined pressure; and a raw material moving part which is isolated from the hydrogen supplying part by the hydrogen separation dense membrane and has a space configured to contact with a raw material on the one side of the hydrogen separation dense membrane.

Herein, the reactive catalyst may include at least one of Co, Ni, Mo, Pt, and Pd.

0019 In addition, the hydrogen separation dense membrane may include a porous support which is disposed on one side thereof to support the hydrogen membrane.

0020 Further, the hydrogen separation dense membrane may be formed in an annular shape to provide the raw material moving part in a center thereof, and the hydrogen supplying part may be a casing which has a space formed therein to surround the hydrogen separation dense membrane.

0021 Next, an apparatus for upgrading hydrocarbon of the case that the protons are moved by penetrating the proton carrying medium includes: a housing having a space formed therein; a raw material supplying pipe which is formed at one side of the housing to supply a raw material; a hydrogen supplying pipe which is disposed at a top of the housing to supply a hydrogen gas; a reactant discharging pipe which is disposed at a bottom of the housing to discharge a reactant after completion of reaction; a carrying rod which is a proton carrying medium, and is configured to contact both of the raw material and the hydrogen gas on a surface thereof in the housing, wherein the surface of the carrying rod has a proton carrying material coated thereon; and a reaction cage which is arranged around the carrying rod and contains a reactive catalyst therein.

0022 Herein, a plurality of the carrying rods may be connected with each other, and the plurality of the carrying rods may be rotated by an agitating unit in the housing.

0023 The housing may include a raw material circulating unit which is mounted therein to circulate the raw material by sucking the raw material from a lower portion of the housing and resupplying the raw material to an upper portion thereof.

0024 In addition, the housing may include a heater which is installed therein to heat the raw material.

Advantageous Effects

0025 The method for upgrading hydrocarbon using the proton conductive material disclosed in the present invention is a process that enables the production of a low-priced high-grade bio-fuel from various hydrocarbon sources, and can improve energy efficiency and a hydrogen utilization factor. Furthermore, it is expected that the supply of environmentally friendly bio-diesel can contribute to a reduction of national CO₂ emissions and pollutants generated from diesel vehicles.

DESCRIPTION OF DRAWINGS

0026 FIG. 1 is a view schematically illustrating the case that protons penetrate a proton carrying medium in a hydrocarbon upgrading method of the present invention.

0027 FIG. 2 is a perspective view illustrating an embodiment of a hydrocarbon upgrading apparatus using the hydrocarbon upgrading method of the present invention.

0028 FIG. 3 is a cross sectional view of the hydrocarbon upgrading apparatus shown in FIG. 2.

0029 FIG. 4 is a schematic cross sectional view illustrating another embodiment of the hydrocarbon upgrading apparatus using the hydrocarbon upgrading method of the present invention.

0030 FIG. 5 is a cross sectional view illustrating a state that hydrogen gases are transferred to hydrogen protons (H+) through a carrying rod coated with a proton carrying material of FIG. 4.
[0031] FIG. 6 is an enlarged cross sectional view of a reaction cage contains hydrogenation reactive catalysts therein of FIG. 4.

[0032] FIG. 7 is a perspective view illustrating another embodiment of the hydrocarbon upgrading apparatus using the proton carrying medium.

BEST MODE

[0033] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings. Referring to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views. In the embodiments of the present invention, a detailed description of publicly known functions and configurations that are judged to be able to make the purport of the present invention unnecessarily obscure are omitted.

[0034] As shown in FIG. 1, in order to exclude a step of dissociating a hydrogen gas in a liquid raw material including a bio-diesel or hydrocarbon, the present invention uses a hydrogen separation dense membrane as a proton carrying medium.

[0035] More specifically, a reactor chamber is divided into a hydrogen supplying part 16 and a reactant moving part 18 by a hydrogen membrane 12 for penetrating hydrogen. Herein, porous supports 10 are disposed on a surface of the hydrogen membrane 12 which contacts the hydrogen supplying part 16 and has hydrogen supplied thereto, and reactive catalysts 14 are disposed on a surface thereof which contacts the reactant moving part 18 and has reactants supplied thereto.

[0036] In an embodiment of the present invention, a Pt-based hydrogen separation dense membrane is used as the hydrogen membrane 12, but the present invention is not limited thereto. Specifically describing a manufacturing process of the hydrogen membrane 12, the porous support 10 is prepared and a fine grinding process is performed on the porous supports 10. Preferably, the porous support has air holes with a diameter of about 10 μm or less formed on a surface thereof through the fine grinding process. Herein, the porous support may be a metal support or a ceramic support including any one metal selected from nickel (Ni), vanadium (V), niobium (Nb), stainless steel (SUS), tantalum (Ta), and titanium (Ti). In the fine grinding process, the porous support is ground at a predetermined speed for a predetermined time using a silicon carbide grinding paper. Alternatively, the porous support is further finely ground at a predetermined speed for a predetermined time using metal powder slurry. A mixture of an alumina powder and distilled water may be used as the metal powder slurry.

[0037] Further, in order to increase adhesion between the porous support 10 and palladium, a surface modification process using publicly known dried plasma may be performed to the porous supports. Next, a palladium layer is formed on the porous supports 10 by a sputtering process, and the reactive catalysts 14 are coated on the top thereof. As the reactive catalysts 14, at least one of Ni, Co, Mo, Pd, Pt, and Ru may be used. Thereafter, a thermal treatment process such as sintering may be further performed. Since the hydrotreating reaction is carried out on the surface of the reactive catalyst 14, it is preferable that the reactive catalyst 14 has a large surface so as to sufficiently contact with the liquid reactants.

[0038] A process of improving oil quality is performed by the above mentioned hydrogen membrane 12 through the following processes. First, hydrogen gases supplied from a hydrogen source such as a hydrogen cylinder through the hydrogen supplying part 16 at a predetermined pressure P1 are moved toward reactants on an opposite side in a proton form through the hydrogen membrane. The reactants (liquid oil) are moved to the surface of the reactive catalysts at a pressure P2 which does not influence hydrogen penetration and directly react with protons diffused through the separation membrane or hydrogen bonded again with the protons to produce a hydrogen-bond donor (HBD).

[0039] As shown in FIG. 1, the hydrogen gases supplied from the hydrogen cylinder are adsorbed to the surface of the hydrogen membrane 12 to be dissociated into protons (H+), and the protons are moved on a surface of the hydrogen membrane 12 contacting the reactant moving part 18. Herein, a pressure needed for penetrating the hydrogen gases may be provided by the hydrogen cylinder. Accordingly, since the hydrogen gases are supplied by the hydrogen cylinder’s own pressure without a separate pressurizing apparatus, it is possible to operate a system for improving oil quality at a relatively low pressure, and thereby improving hydrogen usage efficiency.

[0040] A hydrocarbon upgrading apparatus 30 may be embodied using the above mentioned hydrogen separation dense membrane, as shown in FIG. 2.

[0041] That is, the apparatus includes a hydrogen separation dense membrane 20 formed in an annular shape to provide a reactant moving part 28 therein, a casing 22 surrounding an outer circumference of the hydrogen separation dense membrane 20, and a hydrogen supplying part 26 which is a space formed between the outer circumference of the hydrogen separation dense membrane 20 and an inner circumference of the casing.

[0042] A hydrogen supplying pipe 24 connected with the hydrogen source (not shown) is disposed on an outer circumference of the casing 22.

[0043] In addition, a reactant supplying pipe 32 and a reactant discharging pipe 34, which are communicated with the reactant moving part 28, are connected to the opposite sides of the casing 22. The reactant supplying pipe 32 and the reactant discharging pipe 34 are coupled to the opposite sides of the casing 22 by a publicly known technique such as welding or screwing or the like.

[0044] Therefore, upgrading for such as a bio-diesel may be achieved by supplying the hydrogen gases through the hydrogen supplying pipe 24 at the predetermined pressure P1 and passing reactants through a hydrocarbon upgrading apparatus 30 at a predetermined pressure P2.

[0045] In order to improve upgrading efficiency, it is possible to install a plurality of hydrogen separation dense membranes 20 in one annular shaped casing 22.

[0046] As shown in FIG. 4, in order to exclude a step of dissociating a hydrogen gas in a liquid raw material including a bio-diesel or hydrocarbon, a hydrocarbon upgrading apparatus 100 using a proton conductive material according to another embodiment of the present invention uses a carrying rod coated with the proton conductive material as the proton carrying medium.

[0047] More specifically, the hydrocarbon upgrading apparatus 100 using a proton conductive material may include a housing 110 having a space therein, a raw material supplying pipe 114 which is disposed at one side of the housing 110 to supply the raw material, a hydrogen supplying pipe 112 which is disposed at a top of the housing 110 to supply the
hydrogen gases, a reactant discharging pipe 116 which is disposed at a bottom of the housing 110 to discharge the reactants after completion of the reaction, a carrying rod 124 which contacts both of the raw material and the hydrogen gases in the housing 110 and has a proton carrying material 126 coated on the surface thereof, and a reaction cage 128 which is arranged around the carrying rod 124 and contains a reactive catalyst 130 therein.

It is preferable that the housing 110 is made of a metallic material such as a steel body capable of grounding to the outside of the housing so as to hold electrons generated from the hydrogen.

The installation position of the raw material supplying pipe 114 is not limited, but it is preferable that the raw material supplying pipe is disposed on the top of the housing 110 because it does not receive a pressure generated by the raw material stored in advance. Preferably, a level sensor is installed in the housing 110 so as to control the flow rate of the raw material supplied through the raw material supplying pipe 114.

Hydrogen is supplied into the housing through the hydrogen supplying pipe 112, which may be supplied at a low pressure (10 bars or less).

The reactant discharging pipe 116 discharges the reactants after the upgrading process. Although not shown in drawings, an on-off valve may be mounted in the reactant discharging pipe 116.

The carrying rod 124 installed in the housing 110 has a shape and length capable of contacting both of the hydrogen gases and the liquid raw material. Therefore, a rod type carrying rod 124 arranged upright in a vertical direction may be preferably used. The carrying rod 124 may be made of SUS material.

The proton carrying material 126 is applied to the outer surface of the carrying rod 124. The proton carrying material may include at least one of Pd, Nb, Ti, and Tb. Further the proton carrying material 126 may be fixed to the carrying rod 124. The carrying rod 124 may be a metal support or ceramic support made of any one metal selected from nickel (Ni), vanadium (V), niobium (Nb), stainless steel (SUS), tantalum (Ta), and titanium (Ti).

The reaction cage 128 having the internal space is integrally fixed to the lower portion of the carrying rod 124. The reaction cage 128 has a wall of a net shaped structure so as to freely allow the inflow or outflow of the liquid raw material.

In addition, the reaction cage 128 contains the reactive catalyst 130 including at least one of Co, Ni, Mo, Pt, Pd, and Ru therein. The reactive catalyst 130 may have a large contact area with the protons and the raw material by having a pellet or spherical shape.

Further, the reaction cage 128 may have a cross section selected from various forms such as a polygon, circle, or cross shape.

In particular, the reaction cage preferably includes an agitating unit or circulating unit so as to smoothly contact the reactive catalyst 130 with the raw material, and the carrying rod 124 with the hydrogen gases.

The hydrocarbon upgrading apparatus 100 includes an agitating unit. The agitation unit includes an agitating arm 122 for connecting the plurality of the carrying rods 124, an agitating shaft 120 integrally fixed to the agitating arm 122, and an agitating motor 118 for providing a rotational force to the agitating shaft 120 so as to forcibly rotate the same.

In addition, the housing 110 includes a heater 132 mounted thereon. The heater 132 has a role of heating the raw material to a reaction temperature thereof. The raw material may be supplied to the housing 110 in a heated state, however, since a loss of heat is generated during the reacting time, it is preferable that the housing is provided with the heater 132. An electric heater and other publicly known heaters may be used as the heater 132.

The hydrocarbon upgrading apparatus 100 is basically configured as mentioned above. Hereinafter, an operation state of the hydrocarbon upgrading apparatus 100 will be described.

First, the liquid raw material is supplied in the housing 110 having a predetermined space to a level so as to expose the upper portion of the carrying rod 124. Next, the hydrogen gases are supplied in the housing 110. Then, the agitating motor 118 is operated to increase a contact area between the upper portion of the carrying rod 124 and the hydrogen gases, thereby improving contact of the raw material and the protons with the surface of the reactive catalyst 130 on the lower side of the carrying rod 124.

In this time, the hydrogen gases are dissociated into protons on the upper surface of the carrying rod 124 under a proper reaction temperature of 200 to 400°C to move the dissociated protons toward the lower side of the carrying rod 124 by the proton carrying material 126. In addition, the electrons generated during dissociating the hydrogen gases may be removed by grounding the housing 110 to the outside.

The dissociated protons reach the reactive catalyst 130 near the surface of the carrying rod 124 on the lower portion of the carrying rod 124. Herein, the raw material around the reactive catalyst 130 binds with the protons to remove the carbon-carbon double bond and oxygen.

Accordingly, a carbon-carbon single bond and water are generated from the raw material. When an upgrading process for all raw materials is completed in the housing 110 after a predetermined time, water is discharged to the outside of the housing through the reactant discharging pipe 116 to be subjected to a process of separating the water and the reactants.

Repeating the above mentioned processes, it is possible to achieve an improvement of fuel quality.

FIG. 7 illustrates a hydrocarbon upgrading apparatus 200 according to another embodiment of the present invention. The hydrocarbon upgrading apparatus 200 basically has the same configuration as the above mentioned hydrocarbon upgrading apparatus 100, except that it is provided with a unit for circulating the raw material. Therefore, the same parts of the hydrocarbon upgrading apparatus 200 as the hydrocarbon upgrading apparatus 100 will be omitted, and only differences will be described.

Unlike the hydrocarbon upgrading apparatus 100 including the agitating unit for agitating the raw material, the hydrocarbon upgrading apparatus 200 includes a raw circulating unit disposed therein to circulate the raw material up and down.

The raw circulating unit includes a circulating pipe 222 arranged on the outside of a housing 210, and a circulating pump 224 mounted on the circulating pipe 222.

Since the circulating pipe 222 communicates the upper portion and the lower portion of the housing 210, and the circulating pump 224 has an outlet orientated toward the
upper direction, the raw material in the lower side of the housing 210 is continuously pumped to the upper side of the housing 210.

Therefore, contact efficiency of the raw material to the reactive catalyst can be increased by continuously circulating the raw material.

In addition, it is possible to employ the agitating unit of the hydrocarbon upgrading apparatus 100 and the circulating unit of the hydrocarbon upgrading apparatus 200 together.

Although the present invention has been described in connection with the exemplary embodiments illustrated in the drawings, it is only illustrative. It will be understood by those skilled in the art that various modifications and equivalents can be made to the present invention. Therefore, the true technical scope of the present invention should be defined by the appended claims.

DESCRIPTION OF REFERENCE NUMERALS

10: porous supports, 12, 20: hydrogen separation dense membrane
14: reactive catalyst, 16, 26: hydrogen supplying part
18, 28: reactant moving part 18, 22: casing
24: hydrogen supplying pipe, 30: hydrocarbon upgrading apparatus
32: reactant supplying pipe, 34: reactant discharging pipe
100, 200: hydrocarbon upgrading apparatus, 112, 210: housing
112, 212: hydrogen supplying pipe, 114, 214: raw material supplying pipe
116, 216: reactant discharging pipe, 118: agitating motor
120: agitating shaft, 122: agitating arm
124, 218: carrying rod, 126: proton carrying material
128, 220: reaction cage, 130: reactive catalyst
132, 230: heater, 222: circulating pipe
224: circulating pump

1. A method for upgrading hydrocarbon comprising contacting hydrogen gases to a proton carrying medium having proton conductivity in a predetermined space; dissociating the hydrogen gases into protons (H⁺) by the proton carrying medium; moving the protons (H⁺) along the proton carrying medium to supply the protons (H⁺) to a raw material contacted on the proton carrying medium; contacting the protons and the raw material with a surface of a reactive catalyst disposed on or around a surface of the proton carrying medium to remove a carbon-carbon double bond and an oxygen contained in the raw material.

2. The method according to claim 1, wherein the proton carrying medium is a hydrogen separation dense membrane having the reactive catalyst coated thereon.

3. The method according to claim 1, wherein the proton carrying medium is a carrying rod having a proton conductive material coated on a surface thereof.

4. An apparatus for upgrading hydrocarbon by the method for upgrading hydrocarbon according to claim 1, the apparatus comprising:
   a hydrogen separation dense membrane which is a proton carrying medium having a reactive catalyst coated on one side thereof;
   a hydrogen supplying part configured to supply hydrogen to the other side of the hydrogen separation dense membrane at a predetermined pressure; and
   a raw material moving part which is isolated from the hydrogen supplying part by the hydrogen separation dense membrane and has a space configured to contact with a raw material on the one side of the hydrogen separation dense membrane.

5. The apparatus according to claim 4, wherein the reactive catalyst includes at least one of Co, Ni, Mo, Pt, and Pd.

6. The apparatus according to claim 4, wherein the hydrogen separation dense membrane includes porous supports which are disposed on one side thereof to support the hydrogen membrane.

7. The apparatus according to claim 4, wherein the hydrogen separation dense membrane is formed in an annular shape to provide the raw material moving part in a center thereof, and the hydrogen supplying part is a casing which has a space formed therein to surround the hydrogen separation dense membrane.

8. An apparatus for upgrading hydrocarbon by the method for upgrading hydrocarbon according to claim 1, the apparatus comprising:
   a housing having a space formed therein;
   a raw material supplying pipe which is formed at one side of the housing to supply a raw material;
   a hydrogen supplying pipe which is disposed at a top of the housing to supply a hydrogen gas;
   a reactant discharging pipe which is disposed at a bottom of the housing to discharge a reactant after completion of reaction;
   a carrying rod which is a proton carrying medium, and is configured to contact both of the raw material and the hydrogen gas on a surface thereof in the housing, wherein the surface of the carrying rod has a proton carrying material coated thereon; and
   a reaction cage which is arranged around the carrying rod and contains a reactive catalyst thereon.

9. The apparatus according to claim 8, wherein a plurality of the carrying rods are connected with each other, and the plurality of the carrying rods are rotated by an agitating unit in the housing.

10. The apparatus according to claim 8, wherein the housing includes a raw material circulating unit which is mounted thereon to circulate the raw material by sucking the raw material from a lower portion of the housing and resupplying the raw material to an upper portion thereof.

11. The apparatus according to claim 8, wherein the housing includes a heater which is installed therein to heat the raw material.

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