PRESS RELEASE

May 28th, 2018

Ammonia Synthesis Demonstration Plant Begins Operation

Initial Step Toward Realization of Hydrogen Energy Carriers

JGC Corporation

Yokohama Japan – JGC Corporation announced today the start-up of a demonstration plant featuring the use of a new ammonia synthetic catalyst jointly studied with the National Institute of Advanced Industrial Science and Technology(AIST) under the auspices of the Cross Ministerial Strategic Innovation Promotion Program※2(SIP) “Energy Carriers※1”(Management Entity: JST), led by the Cabinet Office Council for Science, Technology and Innovation※3, to demonstrate the use of a synthetic ammonia process.

<Research and Development Framework>
Currently, amid a world-wide drive toward preserving the environment and creating a sustainable society and where new forms of energy are being sought in the bid to realize a low-carbon world, the use of hydrogen, which produces no carbon dioxide(CO_2) when burnt is receiving increased attention. Since 2014, the Cabinet Office, in its “Cross Ministerial Strategic Innovation Promotion Program(SIP)”, has expressed Japan’s intention to create an innovative low-carbon, hydrogen-fueled economy by the year 2030 and to take the lead in hydrogen related industries on the world market through its “Energy Carriers” research.

<Advantages of Ammonia as an Energy Carrier>
In order to make real use of hydrogen as an energy source, questions of cost and safety arise together with the topics of efficiency of transport and storage, meaning that the use of an energy carrier method for hydrogen such as ammonia is required. Not only does ammonia contain a large amount of hydrogen, is easily liquefied and emits no CO_2 when burned, it is already widely used as a fertilizer meaning that a supply chain is in place. These factors make it an ideal energy carrier for hydrogen.

<Problems Related to the Method of Manufacturing Ammonia>
At present, natural gas is used as the fuel for producing ammonia; the hydrogen and nitrogen obtained through reforming steam and air at high temperature and pressure in the presence of a catalyst produces ammonia in what is called the “Haber-Bosch Process”. As this process results in the emission of large quantities of CO_2, this has been seen as a barrier to the use of ammonia as a hydrogen energy carrier.

As a means of reducing the amount of CO_2 emitted, a method involving the development of the use of renewable energy to produce hydrogen from water through electrolysis has received attention. However, the hydrogen produced by this method is at low pressure. For the use of the “Haber-Bosch Process” , high temperature/high pressure condition is necessary to produce ammonia, meaning that the energy efficiency of the process is reduced.

<Outline of Current Research and Development>
Since 2014, JGC, based on its evaluation of the use of ammonia as an energy carrier has participated in the SIP “Energy Carriers” research title “New Catalysts for producing Ammonia and the Use of Hydrogen Produced Through the Electolysis of Water by Renewable Energy for the Production of Ammonia”.

JGC, together with the AIST and the National Institute of Technology, Numazu College as well as our subsidiary, JGC Catalysts & Chemicals Ltd., we have done research and experimentation with organic compounds and catalysts and developed processes through which a catalyst that will allow the efficient production of ammonia even under low temperature/low pressure conditions.

Responding to the successful development of the new catalyst for producing ammonia, JGC has constructed a demonstration plant for its use at the the Fukushima Renewable Energy Institute, AIST in Koriyama-city, Fukushima-prefecture, which is capable of producing ammonia at the rate of 20kg per day. The demonstration plant will be operated until the end of 2018.

With a view to developing methods for the efficient and stable use of ammonia as a hydrogen energy carrier, JGC plans to proceed with the application of hydrogen produced through the electrolysis of water using renewable energy.

※1 Energy Carriers
A method by which hydrogen, which is difficult to store or transport over long distances, can be made easier to handle by changing it to liquid form.

※2 Cross Ministerial Strategic Innovation Promotion Program
The Overall technical research and development Innovation Council is not bound by the traditional sectionalism of individual ministries and seeks new paths toward achieving innovation and technical progress.

※3 Council for Science, Technology and Innovation
Under the leadership of the Prime Minister and the Minister responsible for technology, this is one of the “important policy making bodies” which leads the work of various ministries with regard to the development of basic and and innovative technical advances.

<Attachments>
Attachment 1: Development Outline
Attachment 2: Ammonia Production Process
Attachment 3: Overall Development Schedule

<Ammonia Synthesis Demonstration Plant>

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<Main Article>

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Attachment 1

Development Outline

Hydrogen Energy Carrier

Liquid Hydrogen

Organic Hydride

Ammonia

Methane

Composition of Ammonia
(Hydrogen + Nitrogen = Ammonia)

<Features of the Traditional Method>
- Steam is created by burning natural gas or similar fuel
- Synthesis Process Under High Temperature/High Pressure Condition
- The raw material, hydrogen, is under high pressure
- Large quantities of CO_2 are emitted in the production of hydrogen
- Cost effectiveness varies with the price of natural gas

As a solution

Ammonia production process using renewable energy to produce the raw hydrogen through electrolysis

(Features)
- No CO_2 is emitted in the production of the hydrogen
- The hydrogen produced is at low pressure
- The catalysts used previously were not efficient
- Easy to vary the quantity of hydrogen produced when renewable energy is used

Background of the development

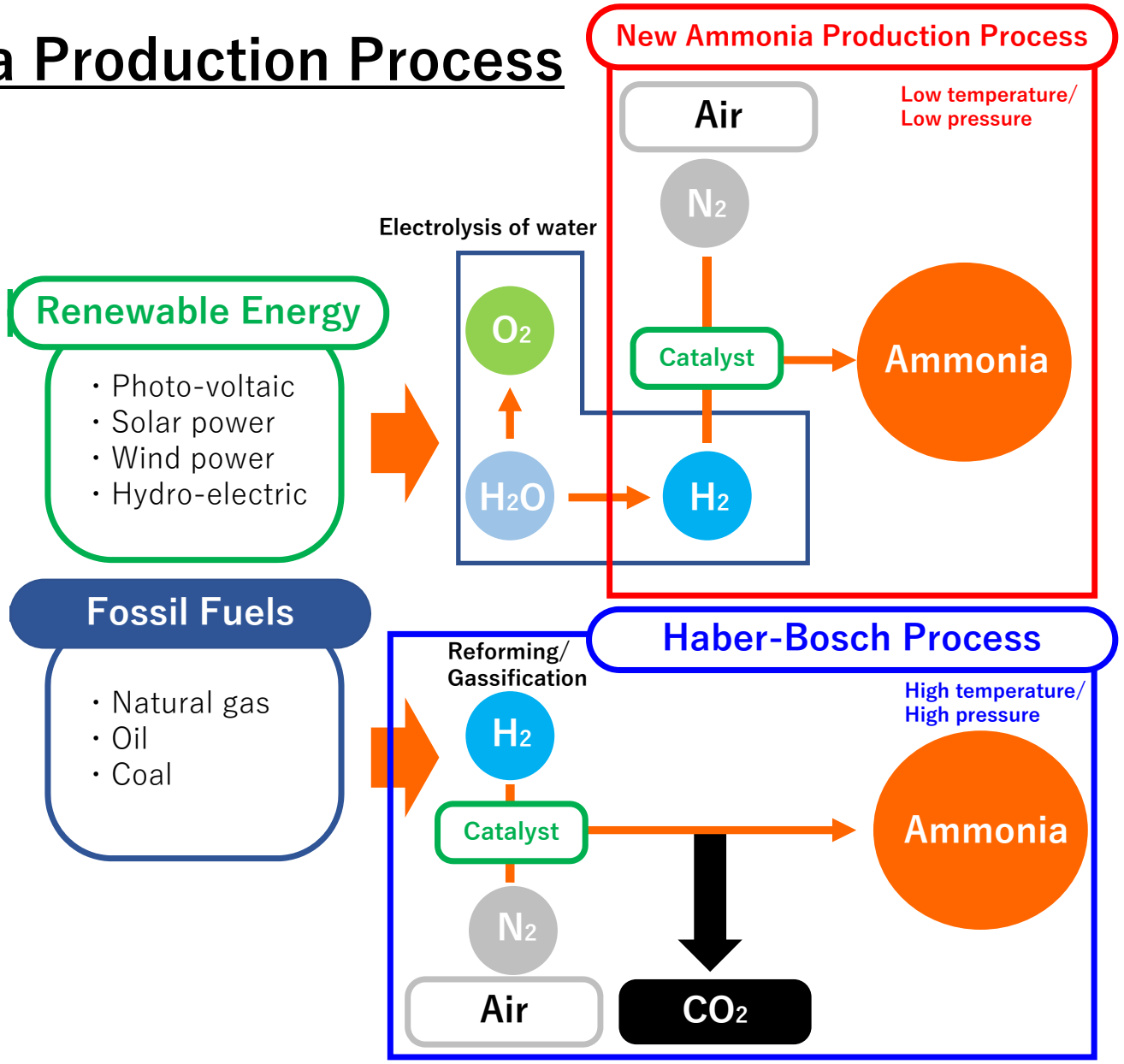
Developments by JGC

Demonstration test of the catalysts for the new ammonia production process
- Development and testing of new catalysts that will function under low temperature/low pressure conditions
- Construction and operation of the demonstration plant for the new catalysts

Production of Ammonia Using Renewable Energy
- Ammonia production tests employing hydrogen produced by electrolysis using renewable energy

Attachment 2

Ammonia Production Process



Attachment 3

Overall Development Schedule