Small and High Output FC Using Solid Stored Hydrogen

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1. Governmental Measures

(1) Administrative Reform Council

On May 15th, the Administrative Reform Council of Japan will finish a report with actual measures for the reformation in early June to act upon the growth strategy. A time table "Reformation Implementation Plan" will be developed to detail each action to be taken, and it will be approved by the Cabinet in June. In this meeting, the working group of the energy and environment reported its studied results including "relaxing the regulations on materials used for hydrogen filling stations" prior to fuel cell vehicle (FCV) growth. (The Sankei Shimbun, Fuji Sankei Business i, May 16, 2013)

On May 28th, the Administrative Reform Council intends to create about 25 reformation actions in the report coming out in early June. Over 20 actions are planned to be in the report to help next generation vehicles to grow fast; for example, the building regulations for hydrogen filling stations are to be eased, and the performance standards of fuel tanks for FCVs are to be set. (The Sankei Shimbun, Fuji Sankei Business i, May 29, 2013)

On June 5th, the Administrative Reform Council submitted the report for the reformation to Prime Minister Shinzo Abe. The report consists of measures to support the economic growth of Japan by relaxing regulations including energy supply from FCVs to homes. The council suggests simplifying the certification scheme for import and export to prepare for the global FCV market and revising the inspection scheme to allow simultaneous developments of vehicles and tanks in the report. (Nikkan Jidosha Shimbun, The Nikkan Kensetsu Kogyo Shimbun, June 6, 2013)

(2) METI

On May 16th, the Ministry of Economy, Trade and Industry (METI) announced that the technical standards of hydrogen filling pressure of tanks for FCVs had been increased from 35 MPa to 70 MPa. The Fuel Container Safety Rules based on the High Pressure Gas Safety Act and the Public Notice to Provide the Details of the rules were amended as well as the Process of Re-inspection of Containers. Also, the Operation of Function Standards of Fuel Container Safety Rules was also revised on the 15th. (Nikkan Jidosha Shimbun, May 17, 2013)

The ministry plans to complete to systemization of technology standards for hydrogen filling stations by the end of 2013 to increase the international competitive power of FCVs which are designated as one of growth strategies of the Japanese government. Technology standards will be prepared for liquid hydrogen storage and hydrogen production by splitting water. (The Nikkan Kogyo Shimbun, May 24, 2013)

METI will work on a more efficient preparation of hydrogen filling stations for FCVs. To avoid uneven distribution, the filling station operators will be asked to survey the numbers of FCVs and hydrogen demand in their areas during their subsidy certification process. The government plans to increase the number of hydrogen filling stations from the current 17 to 100 by 2015. However, operators are expected to turn their hydrogen business profitable around by 2025. The ministry aims for efficient distribution of the filling stations by encouraging communication among fuel providers, automakers and local governments. (Nikkan Jidosha Shimbun, May 29, 2013)

To support preparation of hydrogen filling stations, the ministry will carry out an investigation in technologies to allow filling stations for natural gas vehicles to install hydrogen filling facilities in their premises. In June, a contractor will be chosen through a public tender to investigate whether safety can be secured when easing the installation distance determined by the ministerial ordinance based on the High Pressure Gas Safety Act. (The Denki Shimbun, May 31, 2013)

(3) NEDO

New Energy and Industrial Technology Development Organization (NEDO) offered additional grants of "Development of PEFC Technologies for Commercial Promotion" for FY 2013. They have announced that 11 contract/joint researches and supported projects of 22 businesses and organizations were chosen. The breakdown of 11 is below; three fundamental technology developments, three technology developments for commercial promotion and five next generation technology developments. (Japan Metal Daily, May 17, 2013)

(4) The Government

The government has decided to relax the Building Standards Act and the City Planning Act related to hydrogen filling stations to aim for the world fastest growth of FCVs as the second growth strategy. The Building Standards Act determines the maximum volume of hydrogen to store depending on the area and purpose. Due to this law, hydrogen suppliers cannot store enough hydrogen for business operation without changes. Building permission is required to comply with the City Planning Act to install hydrogen filling station in the urbanization control area. However, it is unclear whether hydrogen filling stations are subjects for the development permission. The state will make clear the subjects of these regulations and ease the regulations quickly for fast hydrogen filling station preparation. (The Nikkei Business Daily, The Nikkan Kogyo Shimbun, Architectures, Constructions & Engineerings News (Daily), Nikkan Jidosha Shimbun, The Denki Shimbun , May 20, 2013)

The government will unify regulations and technology standards on FCVs into the Road Trucking Vehicle Act to support the developments of next generation vehicles and the businesses in the global market as a growth strategy. Currently, METI determines safety regulations and technology standards on hydrogen tanks, and inspects the tanks. These safety operations will be transferred to the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). This change may realize a mutual authentication which is an issue to export vehicles in Japan. To help new vehicle developments, METI intends to set new guidelines which allow appointed facilities to have their own safety management for hydrogen tanks for FCVs under development. The Japanese government will largely relax regulations for development of second generation vehicles which are to be introduced into the market from 2015. (The Nikkan Kogyo Shimbun, May 23, 2013; Nikkan Jidosha Shimbun, May 28, 2013)

(5) MOE

Ministry of the Environment (MOE) announced that 118 lease operators were chosen for the subsidy scheme for FY 2013 to promote products emitting less CO_2. 3 to 10% of total lease expense will be supported for products such as photovoltaic generation systems, highly efficient steam boilers and fuel cell (FC) systems. (The Nikkei Business Daily, May 23, 2013; The Nikkan Kogyo Shimbun, May 27, 2013)

2. Local Governmental Measures

(1) Yamanashi Prefecture

Yamanashi Prefecture decided to invite a "Triple Combined Cycle Generation" system with FCs. According to the industry and labor department of the prefecture, the Kofu Kokubo industrial estate is one of the possibilities. A triple combined cycle has three means of generations starting from solid oxide fuel cell (SOFC) with natural gas connecting to a gas turbine and a steam turbine. A generation efficiency of over 65% and a 40 to 110 MW maximum output are expected. In the future, the prefecture plans to develop an original quadruple system. For the system, heat from the power plant is expected to be used a binary cycle generation that a special liquid with a lower boiling point than water is utilized to make steam to rotate another turbine. (The Yamanashi Nichinichi Shimbun, May 19, 2013)

(2) Tokyo

From June, Tokyo will start a subsidy scheme to promote energy saving instruments for home and business. A total of ¥10 billion will be prepared as a fund. For homes, the scheme will support the expense of Ene-Farm and "Vehicle to Home" providing electricity to home from EVs with a condition of home energy management system (HEMS) installation. A unit of Ene-Farm costs approximately ¥2 million, whereas the real expense including the subsidies of Tokyo and the government is approximately ¥1.4 million. The support for businesses includes installation of cogeneration system. Tokyo aims to 500 MW equivalent systems providing electricity and heat

to be installed at business buildings and hotels by 2020. (The Nikkei, May 20, 2013)

(3) Suzuka City

On May 24th, Mayor Noriko Suematsu of Suzuka City, Mie Prefecture, revealed an intention to invite a hydrogen filling station in coordination with the governmental infrastructure preparation subsidy for FCVs at a scheduled press conference. The city will establish a financial incentive including a five-year refund of the fixed property tax and 5% of the site acquisition cost up to ¥10 million as a subsidy. (The Chunichi Shimbun, Ise Shimbun, May 25, 2013; The Nikkan Kogyo Shimbun, May 28, 2013)

(4) Sapporo City

The energy business study group of Sapporo Chamber of Commerce & Industry established a working group to support a hydrogen storage experiment. The hydrogen is intended to be produced by the wind power systems which are planned by members of the organization. A public relations activity will be carried out this summer for the experiment. (The Hokkaido Shimbun, May 29, 2013)

(5) Osaka Prefecture

Osaka Prefecture is inviting grant applications for the expense of research, development, test and analysis as a promotion for battery related businesses. The eligible organizations for the subsidy are firms which have businesses or plan to start in the prefecture. A half of the expense of the target projects will be financed to smaller businesses as well as a third for the others with the maximum amount of ¥3 million.

Osaka Prefecture started a human resource development project for the electric vehicle (EV) and FCV related field. Job training will be offered for unemployed university graduates and young people in the field to build expertise to develop human resource in the industry. The contractor was chosen, and the prefecture aims for a growth in the industry in its area by supporting the next generation vehicle field. (The Nikkan Kogyo Shimbun, June 4, 2013; Nikkan Jidosha Shimbun, June 5, 2013)

3. FC Related Element Technology Developments & Business Plans of Component

(1) JST etc. [1)]

A study group of Japan Science and Technology Agency (JST) and the California Institute of Technology in the US found properties of a material which allows SOFCs to operate at a lower temperature. The result revealed the mechanism that the elements in the electrolyte prevent proton transport, the essential process for generation. The group analyzed the relationship between the elements and protons in the electrolyte used in the SOFC. The analysis shows that the elements trap protons and the force varies depending on type of elements. The weaker the force is the freer the protons, which allow SOFC to operate at a lower temperature. According to their calculation, yttrium-doped barium zirconate used as an electrolyte possibly enables the FC to function at 350°C. SOFC has better generation efficiency, but disadvantageously requires a higher operating temperature. The finding helps in reducing in the temperature to hopefully extend FCs application. (The Nikkei Business Daily, The Denki Shimbun, May 14, 2013,)

(2) Kyoto University

The study group of Prof. Hiroshi Kitagawa and Project Associate Prof. Hirokazu Kobayashi developed a FC electrode for the generator to improve the acceleration of FCV to the same level as a gasoline fed car. The electrode uses a nano-level metal catalyst inside, which doubles the cell output. A very small, 10 nm, palladium cube is covered with organic compounds a couple of nm thick. Due to the organic compounds, hydrogen stays around the palladium. With the new electrode, hydrogen is more ionized than a conventional electrode which uses palladium particles without a coating. This allows the output of FC to rise. The new electrode is easy to manufacture, and the production cost is expected to be at the same level as conventional electrodes. The group will study further with a manufacturer of electrode and catalyst to commercialize the product in two to three years. (The Nikkei, May 14, 2013)

(3) Noritake

On May 16th, Noritake, Nagoya City, announced that a “sealing glass” has been developed for joining ceramic cells and metal parts of SOFCs. Because the product accommodates a rapid temperature rise and drop, the pre-heating time to reach the SOFC operating temperature of approximately 700°C can be shorten to a couple of minutes, a tenth that of a

conventional product. Samples have been distributed to FC manufacturers since early May, and the firm aims at rapid commercialization. (The Nikkan Kogyo Shimbun, The Chunichi Shimbun, May 17, 2013; The Chemical Daily, May 22, 2013; The Nikkei Business Daily, June 6, 2013)

(4) Porite

Porite, Saitama City, will start large scale production of metal separator for SOFC with 200 kW level power output from FY 2014. The metal separator has a smaller coefficient of thermal expansion than ceramic separators, the majority. Powder metallurgy is used for the production. The firm developed a small separator with chromium group alloy with the Iwate University and smaller die businesses. (The Nikkan Kogyo Shimbun, May 22, 2013)

(5) NIMS

The National Institute for Materials Science (NIMS) developed a method to quickly fix catalyst on electrode material for direct methanol fuel cells (DMFC) using methanol. The method uses plating to coat the electrode material surface with a platinum film as a catalyst in few dozen seconds, which allows reduction in cost. The volume of an electrode can be reduced to approximately 5% or more, and the efficiency of the catalyst increases to approximately 20 times. The group made a porous film of platinum with 2 to 100 nm diameter holes, and the thickness of the film is approximately 10 μm. Copper and indium tin oxide (ITO) were used for the substrate of the electrode material for conductivity. The product is planned to be commercialized with the cooperation of businesses. (The Nikkei Business Daily, May 28, 2013)

(6) JAIST[4)]

On May, 29th, a research group of Associate Prof. Yuki Nagao of School of Materials Science of Japan Advanced Institute of Science and Technology announced that a design technology was established to improve the performance of proton exchange membranes for FCs. A thin film was experimentally made with oriented molecule chains of aspartic acid, a type of amino acid, for a more efficient proton conductive mechanism. The technology may enhance performance of other membrane materials, and they possibly outperform current membrane material Nafion. (The Nikkan Kogyo Shimbun, The Hokkoku Shimbun, May 30, 2013)

4. Element Technology Development of Photofuel Cell[2)]

A study group of Associate Prof. Yasuo Izumi at the Chiba University developed a method to produce an electrode without using expensive platinum for a FC system to generate using light. The electrode uses silver (Ag) added titanium oxide (TiO_2), known as a photocatalyst. The production cost can be reduced to a fiftieth that of conventional products. The group coated a transparent glass substrate with TiO_2 for the anode and then another layer of Ag added TiO_2 to make the cathode film. The FC was created with the electrodes for both cathode and anode and a proton exchange membrane in the middle. An approximately 500W "xenon arc lamp" which includes ultraviolet light was applied to both electrodes, and approximately 1.4V electricity was generated. This system potentially creates a maximum 3V. The group aims for commercialization in three years with a business firm. (The Nikkei Business Daily, May 29, 2013)

5. Research & Development for MFC[3)]

On May 29, NEDO and the Tokyo University of Pharmacy and Life Sciences announced that the study group of Prof. Kazuya Watanabe of the university confirmed a practical level of its newly developed microbial fuel cell (MFC) suitable for sewage treatment in a simulation. The study is a part of the "Development Fundamental Technologies Project" of NEDO. This time, the group created a cassette-electrode which is composed of proton exchange membranes sandwiched in between cathode and anodes. For MFC, the cassette-electrodes were distributed to make a slalom course and inserted in a biological reactor tank. The group plans to scale up the technology and develop cheaper electrode production technology, and aims to commercialize a sewage treatment generation system. (The Chemical Daily, May 30, 2013; Fuji Sankei Business i, June 3, 2013; The Denki Shimbun, June 5, 2013)

6. Development & Business Plan of Business Use FC

On May 27th, Mitsubishi Heavy Industries announced its participation in an exhibition "Smart Community Japan 2013" in Tokyo Big Sight. The

energy and environment zone will have a display for their "Triple Combined Cycle Generation System" which is SOFC and gas turbine combined cycle generation to target at 70% high energy efficiency. (Nikkan Jidosha Shimbun, May 28, 2013)

7. Business Plans of Ene-Farm

(1) Mitsuuroko

Mitsuuroko Group Holdings tries to increase its sales of new field, electricity business and Ene-Farm. Their sales of Ene-Farm were 870 units for FY 2012, and 2000 units, over double of the last year, are targeted for FY 2013. For FY 2013, the sales target for a new energy product combining a photovoltaic generator and domestic storage battery are set at double that of the previous year. (The Nikkan Kogyo Shimbun, May 14, 2013)

(2) Hiroshima Gas

Hiroshima Gas will sell a new Ene-Farm product from late May. The product has a simpler system and fewer parts to reduce its price by ¥0.6 million and achieved price of around ¥2 million for the standard type, while keeping the performance level of the existing models and the function. Having started Ene-Farm sales in 2009, the firm has put more effort in sales activity for established houses since the end of last year. For FY 2013, the sales target is set at 370 units, 60% more than FY 2012. In the 370 units, 90 units are targeted for established houses to greatly increase the number from 8 units. (The Chugoku Shimbun, May 14, 2013; The Nikkei, The Chugoku Shimbun, May 25; The Nikkei Business Daily, May 28, 2013)

(3) Hokuriku Gas

On May 15th, Hokuriku Gas, Niigata City, revealed the consolidated result for FY 2012 ended this March. The sales were ¥48.647 billion, a 5% increase of the last year. Also, the Ene-Farm sales were increased by over 10% more than the target. The business profit roughly stayed at the same level, ¥2.236 billion, a 0.9% increase of the last year due to the price change of liquefied natural gas by the weakened yen. (The Niigata Nippo, May 16, 2013)

(4) Misawa Homes

Misawa Homes announced that 10 smart houses for cold regions were constructed for an experiment. Using highly efficient insulation building materials, these houses are equipped with 3kW photovoltaic generator system, FC, HEMS underfloor heating using hot water. Electricity consumption will be monitored for a year for design improvement of smart houses for cold regions. (The Nikkei Business Daily, May 20, 2013; Jutaku Shimpo, May 21, 2013)

(5) Seiwa Industrial Corporation

Seiwa Industrial Corporation, Itami City of Hyogo Prefecture, will reduce production cost of parts and components for domestic FC. ¥40 to 50 million will be invested to reduce 20% of the factory cost at the main plant within 2013. The firm manufactures reformers and hot water tanks. The facility will be scaled-up and streamlined to save the cost. (The Nikkan Kogyo Shimbun, May 28, 2013)

(6) EneFarm Partners

On May 30th, 59 businesses and five related organizations including gas and oil companies, electronics manufacturers and house makers started a new voluntary organization "Enefarm Partners" to promote Ene-Farm. Available from 2009, Ene-Farm has sold over 4 million units in Japan, and the organization aims to make it better known. (The Denki Shimbun, The Nikkan Kogyo Shimbun, The Nikkan Kensetsu Kogyo Shimbun, The Chemical Daily, May 31, 2013; Nikkan Gendai, June 4, 2013)

8. Portable FC for Emergencies and Disaster

(1) Rohm & Aquafairy

Rohm and Aquafairy, Kyoto City, will start an experiment of a portable hydrogen FC, which is small, lightweight and has high output, as an emergency power supply for disasters in FY 2013. With the cooperation of Prof. Kazuyuki Hirao of Graduate School of Engineering at Kyoto University, they developed a FC system technology which generates hydrogen by adding water to solidified calcium hydride. Their pocket-size weights 73 g, but charges a smartphone with a 5Wh capacity battery fully in approximately two hours. The experiment will use a higher output 200 Wh portable generator, and the dimensions are approximately 30 cm height, 30 cm long and 15 cm deep with 7 kg weight. With local governments' cooperation including Kyoto City, the generator will be tested in training in an emergency shelter to improve the technology for commercialization.

On June 4th, Rohm and Aquafairy announced that an alliance would be established for a parts and material supply chain and production technology development of a portable and lightweight FC system using solidified hydrogen under development with Kyoto University's support. To achieve earlier commercialization, Toyo Seikan and Toyo Aerosol Industry will cooperate for the fuel unit, and Kyoto Shisaku Net will help the prototype production. The external design and branding will be supported by Michio Akita, an industrial designer. Kyoto City, Akita Prefecture, Mie Prefecture, Shimane Prefecture and Kyoto Prefecture will participate for the experiment. They plan to make a prototype which outputs 100 W for around two hours, and to test it from next year. The generator is aimed to be commercialized in 2015. (The Kyoto Shimbun, May 23, 2013; The Denki Shimbun, Dempa Shimbun, The Nikkan Kogyo Shimbun, Fuji Sankei Business i, The Chemical Daily, June 5, 2013; The Nikkei Business Daily, June 6, 2013)

(2) Bio Coke Lab

Bio Coke Lab, an environment technology developer in Tokyo, developed a portable FC generator using hydrogen gas. With 33 W output, the generator can power smartphone and laptops. To start with, the firm sells it as an emergency power source for local governments, homes and offices. It will sell for approximately ¥450,000. The FC has a fuel cassette with uniquely developed alloy "magnesium hydride (MgH_2)" and water separately stored. Their MgH_2 is a hydrogen gas captured magnesium alloy and the volume is compressed to an 880th. With an ignition temperature of 300°C, the alloy is easily transported due to its solid state at normal temperature, increasing safety. One cassette of 30 g MgH_2 provides 50 L hydrogen. When the FC is switched on with a cassette, the MgH_2 starts activating and the FC generates power within three minutes. The system is insulated because it reaches around 100°C during the activation. (The Nikkei Business Daily, June 4, 2013)

9. Cutting Edge Technologies of FCV & EV

(1) Toyota Motor Kyushu

Toyota Motor Kyushu announced that an experiment would be carried out in Kitakyushu City with a FC bus jointly developed by Toyota Motor and Hino Motors for the second time from last year. The bus will carry Toyota Motor Kyushu's employees to the plants as well as test runs on an expressway. The travelling performance will be tested with the long range drive to promote FC buses. The round trip bus service will be operated from May 27th to June 7th twice a day on weekdays among JR Shimosone Station, Kokura Plant and Kanda Plant. Also, the bus is planned to have a test operation between Fukuoka to Kumamoto on the expressway. (The Nikkei Business Daily, May 14, 2013; Kumamoto Nichinichi Shimbun, May 15, 2013)

(2) Dengen

Dengen, which manufactures and sells automobile testing equipment in Osaka City, developed a movable small quick charger on wheels "DEV－10kW". The small capacity quick charger outputs 10 kW and does not require the high output contract with a utility firm and cubicle type transformer, which realizes a cheaper installation cost. The maximum moving range is 10 m which is the length of the input cable connected to the panel board in the charger. The details are 1067 mm height, 662 mm wide and 746 mm deep, and approximately 130 kg. The product is the first movable charger certified for the subsidy of the Next Generation Vehicle Promotion Center, and a half (two thirds for public use) of the purchase and installation cost will be subsidized. Osaka Prefecture has supported the development financially and technically with the Osaka Prefecture University as a made-in-Osaka EV projects. (The Nikkei, May 24, 2013)

(3) Mitsubishi Rayon

In September, Mitsubishi Rayon will start commercial production of carbon fiber material for Germany-based BMW. The annual 3 kiloton level production line will be prepared in the Otake Production Center, Otake City of Hiroshima Prefecture, by August, and the production is planned to be doubled to 6 kiloton. Being light and strong, carbon fibers help to reduce vehicle weight and extend driving range. BMW plans to use the product as a constructional material of "BMW i" to be available from this year. (The Nikkei, May 27, 2013)

(4) Contactless EV Charging Technology Development: Saitama University, Technova; Showa Aircraft Industry, Nissan, Tohoku University; The University of Tokyo

Contactless charging technologies for EVs are developing. Manufacturers are working hard to commercialize the technologies which are expected to be introduced around 2015.

① Saitama University and Technova, a member of Aisin Group, developed a technology to send and receive electricity both way between a car and home. A study group of Prof. Shigeru Abe at Saitama University developed the bidirectional electric transfer technology with coils in a car and home. Electricity goes to the car with the coils which adjust the current from home. Also the car to home transfer was achieved by working out on the receiving circuit of home side. 3 kW electricity was sent at 50 kHz frequency between a car and house with a 16 cm gap, and transfer efficiency was approximately 93 % for both ways. ② Showa Aircraft Industry, Nissan Motor and Tohoku University started an experiment to transfer electricity to a driving car. A wheeled platform ran on road with coil buried for a test. The group targets more than 80% transfer efficiency with a 20 cm plus gap between coils by working on electricity leakage. ③ A study group of Prof. Yoichi Hori has researched an electric transfer to relay the power using buried coils, and is studying how to supply multiple cars using the coils. When more than one coil exists between a car and the sending device, power does not go as targeted because the electromagnetic wave is easily changed. From the data of car voltage and current, the group developed a method to calculate an optimal current flow to the sending coils. Electricity can be distributed to meet demand. (The Nikkei, May 28, 2013)

(5) Mitsubishi Motors

Mitsubishi Motors has stopped to produce the re-chargeable vehicle at home "Outlander PHEV" since March due to a battery problem, and planned to restart the production in May. However, the restart is expected to be postponed to August or later to allow the production process to be revised, and because of repairs to recalled cars. Having over 8000 orders, they plan to double the production to 4000 vehicles a month at the Nagoya Plant, Okazaki City for early delivery. (The Nikkei, May 29, 2013)

(6) 6 German Auto Related firms

On May 28th, six Germany-based firms including BMW, Daimler and Siemens announced that a charging service for EVs would start from late December in Europe. By registering, the service will tell the drivers compatible charging stations irrespective of providers and countries. Infrastructure will be supported for promoting EVs by businesses. (The Nikkei, May 29, 2013)

(7) Tesla

On May 30th, US-based EV manufacturer Tesla Motors announced that free charging stations for its EV owners would be deployed to form a nationwide network. The number of the stations is planned to be tripled by the end of June, and the network would allow EVs to go trans-America travel in six months. (The Nikkei, May 31, 2013)

(8) Dana

A US-based FC parts manufacturer Dana will put more effort into its sales activity of FC separators to the Japanese automotive industry. Both carbon and metal separators are produced, and their Tennessee plant makes the carbon separators. The separators are used in forklifts which work round the clock at large supermarkets, which fully proves their performance. FC forklifts offer advantages of no exhaust gas in a closed area as well as the short time for hydrogen recharge. Although carbon separators have high conductivity and are less likely to corrode, they are sensitive to vibration due to their less stiff nature. To avoid the issue, the manufacturer supplies stainless steel separator developed and produced in Neu-Ulm, Germany, for FCVs. Because a FCV has 300 to 400 separators which are crucial in thickness, stainless steel separators, 0.1 mm thick, are advantageously thin over carbon separators which are a couple of millimeter thick. Supplying to a French auto giant, the firm also provides the separators to Japanese automakers and the samples have been assessed. (The Chemical Daily, June 3, 2013)

(9) Honda

On June 4th, Honda Motor revealed that a memorandum of understanding was signed for an experiment of its micro EVs between Kumamoto and Miyakojima City, Okinawa Prefecture. Currently, micro EVs can run only in the area permitted by the state. The micro EVs will be used for various purposes including tourism in the experiment for further improvement. Honda is currently developing a two-seater micro EV with a maximum speed of 60

km/h. The prototype revealed last year is 1250 mm wide, and drives approximately 60 km on a single charge. In FY 2013, 11 vehicles are planned to be in operation, and the number is expected to increase to 20 in FY 2014. (The Nikkei, June 5, 2013)

10. Experiment of Hydrogen Filling Station

On May 27, the Research Association of Hydrogen Supply/Utilization Technology (HySUT) prepared hydrogen filling facilities in Toyota City and Midori-ku of Nagoya City, Aichi Prefecture, and started their operation. Toho Gas and Iwatani operate "Toyota Ecoful Town Hydrogen Station" in Toyota City, and hydrogen is produced from natural gas on the premise. Liquefied petroleum gas (LPG) is reformed to extract hydrogen on site in "Kaminokura Hydrogen Station" operated by JX Nippon Oil & Energy. The both stations use packaged facilities which were developed to reduce size and cost. The station in Toyota is the first 70 MPa hydrogen filling equipment in the urban area in Japan. They are a part of NEDO projects for FCV promotion. (The Sankei Shimbun, The Denki Shimbun, The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun, The Chunichi Shimbun, Fuji Sankei Business i, The Chemical Daily, May 28, 2013)

11. Hydrogen Storage & Transport Technology Development

(1) Kyoto University

A study group of Prof. Hiroshi Kitagawa and Project Associate Prof. Hirokazu Kobayashi developed technology which allows nickel nanoparticles to store hydrogen much better. Nickel does not capture hydrogen much in a normal environment, but their nickel nanoparticles are improved the property by coordinating atoms. High pressure 600 atmospheres is required for ordinary nickel to capture and store hydrogen. The group dissolved a nickel compound in an organic solvent and reduced it to give it specially structured particles. Atoms of the particles are more concentrated than ordinary nickel particles. Capturing hydrogen under normal pressure, the particles realize the same or higher storage level than palladium. Nickel is half the weight of palladium, and costs approximately one thousandth, which gives it the potential to develop lightweight and cheaper hydrogen tanks. The group plans to coat nickel particles with organic compound to double the storage performance. (The Nikkei Business Daily, May 21, 2013)

(2) Chiyoda

Chiyoda Corporation developed a facility which allows it extract hydrogen efficiently. Hydrogen is often liquidized for easy storage and transport at normal temperature. An organic compound toluene is mixed to store hydrogen in a liquid form at normal temperature; however, it was hard to process it back to hydrogen. An original catalyst was developed for the technology to realize highly efficient over 98% extraction. The firm can supply hydrogen fuel to a small 100 MW class hydrogen power plant, and the expense is expected to be ¥10 billion level. According to their calculation, the generation is estimated lower than an oil power plant, but approximately 60 to 80% higher than coal and gas. Chiyoda is negotiating with energy firms including oil companies and electricity suppliers worldwide. Also, the technology is planned to supply FCVs. (The Nikkei, June 2, 2013)

12. Development of Hydrogen Detector

New Cosmos Electric will start commercial production of a hydrogen detector for hydrogen filling stations from FY 2013. In the gas sensor, the product uses a technology for a detector used in semiconductor plants. The main plant plans to produce about 200 units annually. Two types are prepared for the sensor, the important component. Reacting with very small amounts, the hot wire semiconductor type detects a change in electrical resistance when the metal-oxide semiconductor captures hydrogen. The catalytic combustion type detects a temperature increase when a catalyst contacts with the gas, but requires a certain level of gas concentration in the air to react. The firm also offers two sampling methods "diffusion type" and "suction type" depending on the purpose. The diffusion type has a thin detector body, and the sensor is fixed near the ceiling to efficiently detect gas which rises. The suction type sucks air through a hose to detect leaked gas from a dispenser. (The Nikkei Business Daily, May 17, 2013)

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