

FUEL CELL MONTHLY NEWS

CEATEC Japan 2005 Mobile Fuel Cells

Masaki Endo, Digital Research Institute, 30 Oct.2005

Translated by Michael Fletcher, JET Translations

Ceatec Japan 2005 was held at the Makuhari Messe exhibition hall from October 4th to 8th, 2005. This was the 6th annual exhibition and Ceatec is a general exhibition for digital home electronics, information communication systems and electronic components and devices that support these products. This year, there were 788 companies/groups participating (including 293 companies/groups from 28 foreign countries). NTT and KDDI presented current results concerning mobile fuel cells, which received a lot of attention from visitors. Over the 5 day period, there were over 200,000 visitors.

It appears Japan is becoming more and more familiar with the concept of an ubiquitous society. Development of technologies that support this type of society such as micro power generation, fuel cells, lithium ion batteries (LIB), lithium polymer rechargeable batteries (LPB), capacitors, and dye-sensitized solar cells is progressing. An ubiquitous society places higher importance on power supplies for devices than conventional requirements. One example is a cell phone designed to receive "one segment digital broadcasting" for mobile devices, scheduled to become available in April, 2006. This was another area of interest at this exhibition and one segment broadcasting reception experiments using testing waves at the NTT Docomo/ KDDI booth were being performed. NTT Docomo is performing testing on the "P901iTV" (Matsushita Electric) and KDDI is testing the "W33SA" (Sanyo Electric). These prototype devices provide a viewing/calling time of 2.5 hours and 2 hours respectively when using a Lithium ion battery. The "V801SH" announced by sharp also provides roughly 2 hours of viewing/calling. As reception of one segment broadcasting consumes a significant amount of power, the capacity of rechargeable batteries is not sufficient. The only apparent fundamental resolution is a rapid performance improvement with rechargeable batteries. One of the best advantages of micro fuel cells is that if fuel is supplied, telephone communication, viewing of digital reception, and data transfer can be performed continuously. If this is realized, we will no longer have to worry about batteries going dead and it will also enable further entertainment in the mobile environment. This type of micro fuel cell would be well received. The exhibition of the current mobile fuel cell led to the feeling that this type of fuel cell will likely be achieved.

NTT Docomo also exhibited the cradle type battery charger that they have jointly developed with Fujitsu, which they used to charge visitor's cell phones. The cradle uses a methanol injection system and can be used while talking on the phone. In 2005 the specification was changed to use 99% methanol solution enabling a power generation capacity of 9 Wh and a calling time of 6 hours. The micro fuel cell is designed such that it only feels slightly warm when held in the hand and "does not discharge water even while running" (engineer). The output of the fuel cell is 1 W and it is hybridized with a LIB. NTT also has plans for a more compact product to be released in mid 2007. They are expecting the sales price to be in the neighborhood of \$100.00. The cell phone with a fuel cell that was exhibited was just a mock-up; however, a representative stated that Docomo "wanted to announce the prototype in 2005". Technology for the cradle type charger can be used for this type of cell phone without modification. Docomo hopes to develop an integrated type with a voltage of roughly 3V and a power generation capacity of 6 Wh.

KDDI has entered and is moving forth with joint development contracts for cell phones that have built in fuel cells with both Toshiba and Hitachi Ltd. and these companies have both provided KDDI with prototype units that use different types of fuel cells. Toshiba's prototype uses a passive DMFC that is fueled by 99.9% methanol solution that enables 7 hours calling time (3.5 times previous fuel cell type, 2.5 times battery capacity). The methanol is replenished from a special cartridge. The fuel cell is hybridized with a LIB and as the power output is slightly insufficient, the extra power needed is supplied from the LIB; therefore, the fuel cell also charges the LIB. A representative stated that "the fuel cell is thick because it is following the design of the existing device and that if a separate design is used, it can be designed thinner". Toshiba exhibited a next generation device with a monocoque construction and a power output of 1 W and they are targeting announcing of a fuel cell only type in 2008.

Hitachi Ltd's cell phone uses a passive type DMFC; however, it is different in that it uses a methanol – water solution with less than 60% concentration for the fuel. A representative explained that the reasoning behind this is that "at this concentration it will not burn even if thrown in a fire and therefore is more safe. In addition, it lowers the cost of the cartridge". KDDI also says that while

Table: Specification for the cradle type charger developed by Fujitsu

	2005 specification	2004 specification
External dimensions	150×56×25(mm)	150×57×16(mm)
Weight	190g	190g
Fuel	Methanol (99%)	Methanol (30%)
Cartridge	18 cc	18 cc
Power generation capacity	9 Wh (enables 6 hours calling time)	3 Wh (enables 2 hours calling time)

the "output of the cell phone fuel cell from Hitachi is slightly lower and call time is shorter than the

device from Toshiba, methanol solution that is less than 60% is not a dangerous material". Therefore, it is getting closer to a specification for a consumer product. Replenishment of fuel for the Hitachi device uses a pen cartridge type announced for the first time, where the tip of a pen similar to a felt pen is pushed against the fill hole to replenish the supply of methanol. The methanol-water solution is sufficiently safe, even if it comes into contact with skin. In addition, while sacrificing interface with the LIB, the fuel cell is placed on the back surface of the liquid crystal, which is not held in the hands, in order to prevent heat generated by the fuel cell from being directly conducted to the skin. In the future, for cold starting, Hitachi is looking to develop a device for keeping the fuel cell warm so that it does not drop below freezing and incorporating heat control for optimized design of the case, and plan to move forward to reach a fully functional cell phone design. The representative showed confidence that "the product is ready for actual use". KDDI plans to perform actual field evaluation testing of the models that were developed.

Table: Picture and target specifications for cell phones with internal fuel cells

		Hitachi Ltd., KDDI joint development
	Appearance	
50 (W) ×98 (H) ×40 (D) mm	Size when closed	50 (W) ×98 (H) ×25 (D) mm
160g	Weight	150g
Methanol	Fuel type	Methanol-water solution
99.5%	Fuel concentration	Not yet announced (less than 60%)
300 mW	Output	Maximum 300 mW
DMFC	Fuel cell type	DMFC
Passive	Operational method	Passive
Internal tank, filled	Fuel supply method	Internal tank, filled
7 cc	Internal tank capacity	3 cc

Source: KDDI press release material

A large issue is the type of fuel to move forward with. Toshiba and Fujitsu are using 99.9%

concentrated methanol that meets the needs of long operating times, while on the other hand, Hitachi has taken the perspective that using a methanol-water solution of less than 60% concentration is more realistic in terms of marketability and safety and that the long operating time issue can be resolved by making it easy to replenish fuel. At the current stage, from a cost perspective and safety perspective, I feel that Hitachi's perspective is the better of the two.

Figure: Toshiba next generation cell phone with micro-fuel cell mock-up



Toyota Industries Develops a Fuel Cell Forklift

Press Release: October 11, 2005

Toyota Industries Corporation (TICO) has succeeded in independently developing a fuel cell hybrid system for forklift use, a first among forklift manufacturers. A prototype TOYOTA FCHV-F featuring the system will be displayed at CeMAT, the world's leading trade fair for intralogistics, in Hannover, October 11-15.

TICO's fuel cell hybrid system has been developed in cooperation with Toyota Motor Corporation (TMC), the leading company in fuel cell vehicle development. This allows TICO to make use of TMC's advanced technology and to share components in the automotive field. With these advantages, it aims to further development of high-performance, low-cost fuel cell systems.

The environment has been a central Toyota priority for many years, with the company setting out very clear commitments to environmental welfare in its worldwide environmental policy.

Fuel cell technology significantly reduces harmful environmental emissions. Using hydrogen as its main power source, a fuel cell forklift produces electricity without combustion and generates zero CO₂ emissions. Fuel cell forklifts have been gaining attention in recent years amidst a growing worldwide trend towards environmental conservation, as they make use of innovative technology.

Fuel cell forklifts also contribute to strengthened cost reduction. Although some technical issues

remain to be solved before the use of fuel cell forklifts becomes widespread, these issues are expected to be overcome.

Fuel cell forklifts require minimal refilling and significantly less maintenance than electric forklifts, whose batteries must be periodically charged, refilled with water, and replaced. In addition, the fuel cell hybrid system ensures constant power delivery and performance, eliminating the reduction in voltage output that occurs as batteries discharge. These and other features make fuel cell forklifts ideally suited to conditions such as those found at the large distribution centers, where forklifts often run continuous 24-hour shifts. Individual plants are able to establish their own hydrogen fueling stations. The adoption of fuel cell powered forklifts will result in effectively lowering total logistics costs.

Toyota Industries Corporation aims to further accumulate technological expertise and distinguish its products from its competitors. This expertise is being continually gained through TICO's forklift development, particularly the independent development of engines and AC power drive train systems.

With fuel cell technology as well, TICO has gained expertise through many years of developing power electronics technology for its electric forklifts, as well as through participation in TMC's automotive fuel cell development. These important skills are constantly put to use as the company continues to advance its FC technology.

The following are features and vehicle specifications for the newly-developed TOYOTA FCHV-F technology

Figure: Fuel Cell Forklift "TOYOTA FCHV-F"



Toyota Industries Corporation Website:

http://www.toyota-industries.com/news/release/2005/fchv_lift/index.html

Canon Exhibits Hydrogen Fuel Cells Mounted on Digital Cameras

Canon Inc. has exhibited fuel cells that run on hydrogen at the "Canon EXPO 2005." In addition to mockups on display at the exhibition site, fuel cells were mounted on Canon's digital cameras demonstrating actual operation. Although the fuel cells presently have a volume energy density equivalent to lithium ion secondary batteries of the same size, the company aims to realize densities three to five times larger in the future.

The fuel cell mockups on display include three types: "Type M" measuring about 5 x 6 x 3 cm and designed for use with digital cameras and the like; "Type S" measuring about 3 x 4 x 2 cm to be used with small size portable devices; and "Type L," a flat and slightly large fuel cell targeted for portable printers and so forth. Type S comes with a fuel cartridge integrated with a power generation unit.

The digital cameras used in the demonstration employed Type M fuel cells. The fuel cell was mounted on the battery grip of a digital SLR camera, and on the grip portion of a compact camera.

At academic conferences held in November 2004, Canon introduced a series of studies on elemental technologies required to constitute a fuel cell using hydrogen as a fuel. These technologies have been partially improved to be incorporated into the prototype fuel cells on display.

Nikkei BP Tech-on! Web site : http://techon.nikkeibp.co.jp/english/NEWS_EN/20051027/110167/

Kurita Develops Solid Methanol for Fuel Cells

Kurita Water Industries Ltd. has developed methanol solidification technology for direct methanol fuel cells (DMFC). The company has already prototyped an external DMFC system able to recharge a mobile phone battery using solid methanol as fuel, and will reveal it at the "New Earth 2005" international symposium to be held at INTEX Osaka, Japan, from October 26. Solid methanol is expected to be registered in mobile phone fuel cell-related safety international standard specifications. The company plans to start marketing it by the end of 2007.

The newly developed solid methanol discharges methanol when and where it touches water. The company said it has confirmed power generation by a DMFC using this methanol. Once solidified, methanol need not be specified as a hazardous material or dangerous substance and is permitted to be transported on an airplane. As liquid methanol is flammable and volatile at normal temperatures and pressures, it is specified as a hazardous material in Japan's Fire Defense Law and a dangerous substance in Japan's Poisonous Material Control Law and its transportation on an airplane is restricted.

Solid methanol can be formed into diverse shapes, such as sheets and pellets. The technology extracts methanol from a clathrate compound, which can be reused by inserting methanol again. To solidify liquid methanol, Kurita applied its expertise in clathrate compounds that it has used in water treatment chemicals for about 20 years. The company also intends to start developing technology aimed at storing hydrogen using clathrate compounds.

Kurita Water Industries Web site : <http://www.kurita.co.jp/english/information/press051020.html>

A Fleet of "Steer-by-wire" Concept Cars Exhibited at Tokyo Motor Show

Prototype cars employing "steer-by-wire" systems designed by Toyota Motor Corp., Nissan Motor Co., Ltd., Suzuki Motor Corp., and Fuji Heavy Industries Ltd (FHI) filled the site of the 39th Tokyo Motor Show. Steer-by-wire is a system in which a tire turning angle is controlled by a motor.

The system is used in Toyota's fuel cell concept car "Fine-X," Nissan's electric concept car "Pivo," Suzuki's fuel cell concept car "IONIS," and FHI's concept car "IVX-II" .

Japanese auto makers predict that as electrification of the powertrain advances, as seen in hybrid, electric and fuel cell cars, "by-wire" systems including steer-by-wire and brake-by-wire (braking control by electrical system) which utilize abundant electricity generated in the car will become more pervasive. Thus, auto makers are making a strong effort to develop such "by-wire" systems.

The steer-by-wire systems presented by Suzuki and FHI are designed to operate properly even when one motor malfunctions. For example, Suzuki deployed two motors to control a tire turning angle so that even when one of them breaks down, the other one can still be used for steering.

FHI procured parts for the system from aircraft parts manufacturers outside Japan. The company expressed its intention to address challenges in the commercialization process and carry forward R&D to improve the usability of the system, while relegating the task of cost reduction and quality improvement to the parts manufactures.

Nikkei BP Tech-on! Web site : http://techon.nikkeibp.co.jp/english/NEWS_EN/20051020/109895/

Toyota to Exhibit at 12th World Congress on ITS in U.S.

TOYOTA MOTOR CORPORATION (TMC) announced that it will exhibit at the 12th World Congress on ITS to be held from November 6 to November 10 in San Francisco, California, under the organization of the San Francisco Organizing Committee for the World Congress on ITS. TMC will be exhibiting under the theme "Drive ITS Dreams", to explain, in easy-to-understand terms, Toyota's ITS activities in the areas of "Safety", "Environment" and "Comfort".

In order to demonstrate ITS functions in a clear manner, the i-unit, a futuristic concept vehicle that drew much attention at the 2005 World Exposition in Aichi, Japan, will be exhibited, and a vision of a future ITS society will be presented via computer graphics images and other media. An ITS car fitted with the latest ITS technology developed by TMC will also be on display, in order to provide concrete examples of the links between vehicles and ITS.

TMC will also participate in the conference's planned addition of a large outdoor test drive event, the Innovative Mobility Showcase. At the event, TMC will demonstrate, for the first time in the United States: a brake-control version of its Pre-crash Safety System? a system that calculates in

advance when a collision is inevitable and minimizes damage, and Intelligent Parking Assist, which aids in adjacent and parallel parking. Participants will have the opportunity to ride in and experience vehicles outfitted with these technologies.

TMC has consistently worked energetically toward propelling the development of transport systems through ITS and fulfilling the goal of building advanced-function automobiles, and has participated in the ITS World Congress since its inception, displaying its latest ITS technology.

The World Congress on ITS is the world's largest and most influential ITS-related international conference, and is held every year in rotation in Europe, the Asia-Pacific region and the Americas. ITS-related groups (government and research bodies and commercial enterprises) use sessions (centered on research papers), exhibitions and technical tours from a wide range of countries and regions to present and display the latest in ITS research findings and products.

Last year, the 11th World Congress was held in Nagoya City, Aichi Prefecture and initiated the concepts of "public participation" and "experiential participation", as well as being a very well received event, bringing in around 61,000 visitors. By planning events such as the Innovative Mobility Showcase, this year's conference will incorporate those same concepts.

TOYOTA Web site : <http://www.toyota.co.jp/en/news/05/1027.html>

Capitalization of Panasonic EV Energy Co., Ltd. Increased

TOYOTA MOTOR CORPORATION (TMC), along with Matsushita Electric Industrial Co., Ltd. and Matsushita Battery Industrial Co., Ltd. (collectively, the Matsushita Group), announced October 5 that they have increased capitalization of their jointly funded company, Panasonic EV Energy Co., Ltd. (PEVE), from two billion yen to three billion yen. PEVE manufactures nickel metal hydride batteries for hybrid electric vehicles (HEVs). Following this increased capitalization, the equity participation ratio by Toyota and the Matsushita Group changes from 40/60 to 60/40.

Against the backdrop of increased environmental concern and the need to conserve natural resources, the HEV market has reached a phase of peak growth. In order to accelerate the development of HEVs, it has become necessary to develop comprehensive technologies that combine conventional batteries with onboard systems. TMC and the Matsushita Group decided a restructuring of the capitalization ratio of PEVE was necessary to ensure PEVE's ability to respond to these needs and to allow it to take advantage of TMC's and the Matsushita Group's technical expertise and marketing strength, enabling PEVE to continue its lead in the HEV battery market.

TOYOTA Web site: http://www.toyota.co.jp/en/news/05/1005_2.html

Toyota and Fuji Heavy Industries to Agreeon Business Collaboration

TOYOTA MOTOR CORPORATION (TMC) and FUJI HEAVY INDUSTRIES LTD. (FHI) announced October 5 that they have signed a memorandum of understanding stating they will start studying the synergic effects of business collaboration. In the collaboration, the two companies seek to mutually utilize their management resources in the fields of research & development and production, and to supplement each other's technological development. The two companies plan to set up a joint steering committee and to aim for reaching an agreement on concrete collaboration programs as soon as possible.

TMC and FHI initiated business ties in 2003, when they announced that FHI would feature TMC's "G-BOOK" network information service as "Subaru G-BOOK" in Subaru-brand vehicles for the Japanese market. TMC and FHI have come to view that, while they respect each other's independency in management, each side could prosper further by strengthening their business relationship, as global competition intensifies.

TOYOTA Web site :<http://www.toyota.co.jp/en/news/05/1005.html>

NISSAN AND ARTIST MURAKAMI TEAM UP TO UNVEIL PIVO

Nissan Motor Co., Ltd., unveiled Pivo (Nissan's electric car concept for the 39th Tokyo Motor Show) Sep.30, its imaginative electric car concept, in partnership with renowned Japanese artist Takashi Murakami at the company's Nissan Ginza Gallery in downtown Tokyo.

Pivo, which will be on display at this year's Tokyo Motor Show, features an innovative cabin that revolves 360 degrees, eliminating the need to reverse. Thanks to its compact body, the car is also exceptionally easy to maneuver.

The three-seater car comes with a number of user-friendly technologies, including Nissan's Around View Monitor which reduces blind spots by displaying the outside surroundings on screens mounted on the inside of the car's A-pillars located on either side of the windshield. A dash-mounted infrared (IR) commander allows the driver to operate the navigation and stereo systems with simple finger movements without letting go of the steering wheel.

Pivo is powered by Nissan's compact, high-performance lithium-ion battery and its unique Super Motor, resulting in zero emissions.

The gallery space for the Pivo event, which was designed by Murakami, features a futuristic vegetable garden installation, as well as large balloons and illustrations of "Pivo-chan," a character he designed based on the concept car's inspiring image.

Figure:Pivo:



Nissan Motor Web site:

<http://www.nissan-global.com/EN/NEWS/2005/STORY/050930-02-e.html>

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FUEL CELL JAPAN November 2005 issue is available

In addition to this free publication, I am also providing a monthly subscription based publication titled "Fuel Cell Japan". This newsletter provides up to date information concerning the fuel cell industry in Japan, where a lot of Fuel Cell research and development is being performed. Both the Japanese government and companies based in Japan are investing significant amounts of funding into this new and exciting technology. This level of funding is keeping Japan on the cutting edge of the Fuel Cell industry.

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"Table of contents for Fuel Cell Japan November 2005 Vol.2/No.2"

I. Report of the NEDO "Polymer Electrolyte Fuel Cell Long Term Durability"

Symposium (2) – continuation from report provided in October.

- A. Development of an MEA that can operate in a high humidity environment
- B. MEA structure that stays humid in low humidity conditions
- C. Placement of a reactive gas layer in the anode that prevents oxygen transmission
- D. Formation of a layer for entrapment of radicals on both sides of the MEA
- E. Deterioration factors are reduction of CO poisoning resistance at the anode and reduction of gas diffusion at the cathode
- F. Factors that cause deterioration for frequent starting and stopping, load fluctuation, and low load operation

II. Fuel Cell Articles

- A. Star Micronics, announcement of a new model micro pump for DMFCs
- B. Commercialization of Murata Compact Fuel Cell Methanol Concentration Sensor
- C. Olympus has outsourced hydrogen energy technology research for fuel cells to QinetiQ based in England.

III. Japan Energy Business Development (Interview)

A Status of commercialization of stationary fuel cells for Japan Energy and status of research and development of organic hydrides for which expectations are high for use as a hydrogen carrier

IV. NGK Insulators Hydrogen Separation Membrane Development Status

V. Report from CEATEC JAPAN 2005

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