



**Synthetic polymers enable** better alkaline fuel cells. See story on page 8.

## AROUND THE INDUSTRY

### **FuelCellsEtc Partners with Oak Ridge National Lab**

The U.S. Energy Department has four new research and development projects to accelerate next generation biofuels and drive down the cost of producing gasoline, diesel and jet fuels from biomass. These partnerships with private industry, universities and national labs represent a \$13 million Energy Department investment. One of the projects will be led by the Oak Ridge National Laboratory in Oak Ridge, Tennessee, who will partner with FuelCellsEtc., a company based in College Station, Texas, that specializes in manufacturing high performance custom fuel cell and electrolyzer components.

The Oak Ridge National Laboratory headed project will receive up to \$2.1 million in funding from the Energy Department to use a microbial electrolysis process to remove the hydrogen from the water found in bio-oil.

FuelCellsEtc. will be working closely with Oak Ridge National Laboratory to design and manufacture custom Gas Diffusion Electrodes (GDE) for the project. Playing an integral role in the project, the function of the GDE

is to provide an electrochemical reaction between the liquid and gaseous phases, converting the chemical bond energy into electrical energy inside of the fuel cell. The University of Tennessee-Knoxville, Georgia Institute of Technology, Pall Corp., and OmniTech International will also be participating in the project.

### **AFC Energy Electrode Lifetime Surpasses One Year**

AFC Energy, the U.K.-based developer of alkaline fuel cells, reports that its low-cost fuel cell electrode has delivered continuous electrical output for 12 months. The design and materials used in the test electrode have been validated for volume manufacturing and incorporation into AFC's first 250kW commercial fuel cell system, known as Kore.

AFC Energy is targeting its technology at stationary industrial applications where space is not at a premium and it is actively looking for partners in South Korea, where government incentives for fuel cells are strong.

"We have proven the robustness of our world class fuel cell technology for industrial and stationary applications with the aim of making it competitive with both renewable and fossil fuel technologies," says Ian Williamson chief executive of AFC Energy. "The next steps are to replicate this 12 month longevity in real world environments, continue improving our electrode power output and introduce our 'Kore' large scale system."

### **Greenlight Delivers Electrolyzer Test Stations**

Greenlight Innovation Corp. of Burnaby, British Columbia, Canada, has successfully completed and delivered three electrolyzer test stations commissioned by the Forschungszentrum Jülich energy research center in Jülich Germany. The Greenlight test stations are critical tools for the development and durability testing of Jülich's advanced electrolyzer technology.

FZ Jülich is developing PEM electrolysis technology for hydrogen gas production. The research facility required automated test rigs to prove their design concepts and

selected Greenlight based on their experience, reputation and history of strong customer service.



The Greenlight electrolyzer test rigs are designed to continuously operate under dynamic conditions, completely unattended by an operator. Greenlight's advanced control software allows automated cycling of the test articles, simulating the conditions that would be experienced if the electrolyzer were attached to a wind or solar farm.

**Parker Announces SOFC System Installation**

The Energy Systems Business Unit of Parker Hannifin Corp. of Cleveland, Ohio, reports the first field installation of its combined heat and power SOFC system. Running on propane, the Parker CHP system provides power independence and optional heating and hot water for customers in the recreational vehicle and marine markets. The system, co-developed with New York-based Watt Fuel Cell Corp., is being installed on a 36-foot sailboat.



“Society’s dependence on power continues to increase, creating a growing expectation that all the comforts and amenities of the home are also available in remote settings,” says Steve Knight, Energy Systems Business Unit Manager

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for Parker Hannifin. “Unlike generators, SOFC technology allows users to power up “off grid” silently and without vibration or fear of harmful emissions.”

According to Knight, initial installations will aid in refining the system ahead of an anticipated commercial product launch within the next year. Other installations are planned for RVs and trailers, while over-the-road trucking and home installations are envisioned in the future.

**Oorja Protonics Executes a \$4.2 Million Contract**

Oorja Protonics of Fremont, California, has executed a three-year reseller agreement with Genersys Energia Solar Sabre for marketing, sales and distribution of Oorja’s Direct Methanol Fuel Cells (DMFCs) in the Latin American telecom market. The agreement includes a committed revenue of \$4.2 million for the sale of the OorjaPac family of products through Genersys ESS to various leading telecom carriers in Latin America. The objective of the agreement is to have Genersys ESS integrate the Oorja DMFCs and conduct various levels of evaluation and demonstrations of Oorja’s DMFC systems to commercialize the OorjaPac in the telecom tower market in Latin America.



Genersys Energia Solar Sabre is strategically committed to the telecommunications and the back-up power systems domain and works with an extensive technology portfolio of products for its target market. Genersys ESS has an established track record with leading telecom carriers in installing and managing large turnkey managed services within the telecommunication domain.

**ClearEdge Sells Korean Fuel Cell**

South Windsor, Connecticut manufacturer ClearEdge Power has sold a fuel cell to a key financial center in Korea. ClearEdge will install one of its PureCell Model 400kW units at the Busan International Finance Center’s Landmark Tower, in a deal with Samsung Everland.

This is ClearEdge’s first installation in the city of Busan and the fourth deal with Samsung Everland, which has installed 21 ClearEdge fuel cells throughout Korea. Financial terms were not disclosed.

ClearEdge formerly was UTC Power, before the Oregon-based firm purchased the United Technologies Corp. subsidiary in February. The company now specializes in industrial-size 400kW fuel cells and resident and small business 5kW units.

**ITM Joins the CHBC as a New Board Representative**

U.K.-based ITM Power reports that the California Hydrogen Business Council (CHBC) has appointed two new members to its 2013 Board of Directors. During the July 25 Board Meeting at American Honda Motors in Torrance, California, Geoff Budd of ITM Power and Anca Faur of Johnson Matthey Fuel Cells were unanimously voted to join the board as directors at large.



Geoff Budd

ITM Power specializes in hydrogen refuellers, energy storage and fuel cell products, and is an active sponsor of CHBC’s recently launched Hydrogen Energy Storage Program.

**Unit Lowers Carbon Content In Fuel Cell Hydrogen**

JX Nippon Oil & Energy Corp. has developed refining equipment to purify hydrogen for automotive fuel cells.

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The new purifier consists of two membranes: one that allows only hydrogen to pass through and another that traps and eliminates carbon dioxide. It boosts the hydrogen recovery rate by about 20% compared to conventional technology, while lowering the production cost by 10%.

The JX Holdings Inc. unit will begin operational tests next month, aiming to commercialize the technology in 2016. The firm is modifying some gas stations in the Tokyo and Nagoya areas to offer hydrogen, with plans to establish 40 hydrogen stations by 2015.

#### Elcore in the European Project ene.field

Co-financed by the European Union, the ene.field project will deploy up to 1,000 residential fuel cell micro-CHP installations from nine manufacturers across 12 key member states. More than 30 utilities, research institutes, building construction companies and municipalities are working together in the project to attest the energy efficiency improvement realized through this cogeneration technology, based on the selected buildings across Europe. Elcore will install 135 fuel cell CHP systems, the Elcore 2400, within the scope of this project.

#### Bloom Energy Launches Lease Program

California's Bloom Energy will be offering a leasing program in conjunction with Bank of America Merrill Lynch for new customers that want to install its fuel cells at their buildings and operations. Some of the first customers to use the leasing program to pay for fuel cells farms are TaylorMade Adidas Golf, at its factory in Carlsbad, California, and the Honda Center in Anaheim.



Bloom Energy's refrigerator-sized boxes fuel cells take either natural gas or biogas and run it over plates lined with a catalyst metal, which produces electricity.

#### Fuel Cell Illuminates \$2 Billion Highway Project

The Connecticut Department of Transportation (CT DOT) is now using a Fuel Cell Mobile Light unit to

illuminate a major interchange construction project, the I-95 New Haven Harbor Crossing Corridor Improvement Program. The Fuel Cell Mobile Light is being deployed to reduce emissions and noise in the work zone and allow CT DOT to gain experience with fuel cells. It also helps promote the development of hydrogen refueling facilities in the area and demonstrates how fuel cells have a broad role in transportation energy.

"This is the first time the Fuel Cell Mobile Light has been used in a major construction project," says Lennie Klebanoff. "This is the largest federal Interstate Highway construction project in the country, so the Fuel Cell Mobile Light is in the construction big leagues now."



## FUEL CELL PATENTS

Compiled by Eddie T. Seo  
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## PRODUCT NEWS

### Portable Hydrogen Fuel Cell Unveiled by Brunton

Brunton has unveiled its Brunton Hydrogen Reactor, a portable charging system that leverages hydrogen fuel to generate electrical power. The company believes that its portable charger could be an effective replacement for conventional models because it offers more convenience to consumers through an extended lifetime. Like other Brunton products, the Hydrogen Reactor is designed to provide reliable power during various outdoor activities. It is also durable enough to withstand some natural disasters, making it a valuable power source.



Brunton's Hydrogen Reactor is based on a similar product designed by Horizon Fuel Cell Technologies. The product has been redesigned to appeal more to those that are interested in outdoor activities. The device makes use of small, battery-like hydrogen fuel containers. The hydrogen that these storage units contain is used to produce the electrical power needed to charge mobile devices. These battery-like units boast of 1,000 cycles each.

For more information, visit [www.brunton.com](http://www.brunton.com).

### Serial Production of Metallic Bipolar Plates

Dana Holding Corp. is one of the first companies to launch serial production of metallic bipolar plates. Dana's ultra-thin metallic bipolar plates incorporate the company's

patented integrated sealing technology, which provides best-in-class power density and superior reliability and durability. To manufacture these new metallic bipolar plates, Dana has established a fully integrated production process that combines precision high-speed stamping, laser welding, and in-line conductive coating technologies.

By utilizing a range of advanced processes specifically developed for metallic bipolar plates, Dana is able to streamline production to cost-effectively manufacture a high volume of plates at its facility in Neu-Ulm, Germany.

For more information, visit [www.dana.com](http://www.dana.com).

## RESEARCH AND DEVELOPMENT

### Synthetic Polymers Enable Better Alkaline Fuel Cells

A new cost-effective polymer membrane can decrease the cost of alkaline batteries and fuel cells by allowing the replacement of expensive platinum catalysts without sacrificing important aspects of performance, according to Penn State researchers. (See photo on page 1.)

“We have tried to break this paradigm of tradeoffs in materials (by improving) both the stability and the conductivity of this membrane at the same time, and that is what we were able to do with this unique polymeric materials design,” says Michael Hickner, associate professor of materials science and engineering.

In solid-state alkaline fuel cells, anion exchange membranes conduct negative charges between the device’s cathode and anode – the negative and positive connections of the cell – to create useable electric power. Most fuel cells currently use membranes that require platinum-based catalysts that are effective but expensive.

Hickner’s new polymer is a unique anion exchange membrane – a new type of fuel cell and battery membrane – that allows the use of much more cost-efficient non-precious metal catalysts and does not compromise either durability or efficiency like previous anion exchange membranes. In work spearheaded by Nanwen Li, a postdoctoral researcher in materials science and engineering, Hickner’s team created several variations of the membrane, each with slightly different chemical compositions. They then ran each variation under simulated conditions to predict which would be optimal in an actual fuel cell.

Based on these initial tests, the group predicted that the membranes with long 16-carbon structures in their chemical makeup would provide the best efficiency and durability, as measured respectively by conductivity and long-term stability.

### Fuel Cell Innovation by Korean Researchers

Research team of Ulsan National Institute of Science and Technology (UNIST), Georgia Institute of Technology, and Dong-Eui University developed a novel cathode material which has outstanding performance and robust reliability even at the intermediate temperature range.

A UNIST research team tried to co-dope Sr and Fe and succeeded in yielding remarkable out-performance to present materials at lower operating temperature. The optimized composition has facilitated excellent oxygen reduction reaction and the novel structure has created pore channels that dramatically enhance oxygen ion diffusion and surface oxygen exchange while maintaining excellent compatibility and stability under operating conditions.



“The hardest part of this research was finding optimum composition of Sr and Fe for the best performance and robustness,” says Professor Guntae Kim. “Previously various researches trying to dope Sr to perovskite structure had been made by many other groups. But none of them was successful for the better performance at the low operating temperature.” The new material developed by the UNIST research team led by Kim, could be used at significantly low temperature SOFC with higher efficiency and solid reliability than the previously reported materials.

This new novel cathode material allows fuel cell designers to have more flexible choices on the materials of fuel cell components, leading to lower cost and closer to highly efficient and reliable fuel cells.

### CU-Boulder Develops Water Splitting Technique

A University of Colorado Boulder (CU-Boulder) team has developed a new technique that uses the power of sunlight to efficiently split water into hydrogen and oxygen. The team has devised a solar-thermal system in which sunlight could be concentrated by a vast array of

mirrors onto a single point atop a central tower up to several hundred feet tall. The tower would gather heat generated by the mirror system to roughly 2,500F (1,350C), then deliver it into a reactor containing metal oxides, says CU-Boulder Professor Alan Weimer, research group leader.

As a metal oxide compound heats up, it releases oxygen atoms, changing its material composition and causing the newly formed compound to seek out new oxygen atoms, says Weimer. The team showed that the addition of steam to the system – which could be produced by boiling water in the reactor with the concentrated sunlight beamed to the tower – would cause oxygen from the water molecules to adhere to the surface of the metal oxide, freeing up hydrogen molecules for collection as hydrogen gas.

One of the key differences between the CU method and other methods developed to split water is the ability to conduct two chemical reactions at the same temperature. Conventional theory holds that producing hydrogen through the metal oxide process requires heating the reactor



to a high temperature to remove oxygen, then cooling it to a low temperature before injecting steam to re-oxidize the compound in order to release hydrogen gas for collection.

## UPCOMING EVENTS

### Call for Papers

**Deadline: January 15, 2014**

**Battcon**, May 5-7, Boca Raton Resort and Club, Boca Raton, Florida.

Submit a brief abstract describing the proposed paper’s main points, conclusion, title and contact information with

a biography as a Word file attachment to Michael Salokar at [michael.salokar@alber.com](mailto:michael.salokar@alber.com).

Contact Michael Salokar, Albercorp, 3103 N. Andrews Ave. Ext., Pompano Beach, FL 33064, (954) 623-6660, or visit [www.battcon.com](http://www.battcon.com).

## Meetings and Symposia

**September 1-4** – 4<sup>th</sup> International Microbial Fuel Cell Conference, Cairns, Queensland, Australia.

Organized by Pennsylvania State University (USA), Gwangju Institute of Science and Technology (Korea), and Wageningen University/WETSUS (The Netherlands) and includes all microbial electrochemical technologies.

**Info:** Visit [www.mfc4.com.au](http://www.mfc4.com.au).

**September 10-13** – 15<sup>th</sup> Asian Battery Conference, Shangri-La Hotel, Singapore, China.

Industry C-Level executives, marketers, technical staff and sales teams discuss new and emerging technologies, understand future directions, meet new suppliers, conduct business and network with industry peers.

**Info:** Visit [www.conferenceworks.com/au/15abc/](http://www.conferenceworks.com/au/15abc/).

**September 11-13** – 18<sup>th</sup> International Congress for Battery Recycling, Hotel Dubrovnik Palace, Dubrovnik, Croatia.

Includes worldwide battery legislation updates; safety issues and transportation regulations; recycling efficiency; the future of LEV, EHV, PEHV and EV battery systems; Li-ion batteries technologies successes; country reports on collection and recycling; and the best battery recycling technologies available.

**Info:** [www.icm.ch](http://www.icm.ch).

**September 17-19** – The Battery Show and Electric & Hybrid Vehicle Technology Conference, Suburban Collection Showplace, Novi, Michigan.

Topics include cost reduction of materials, manufacturing and delivery to market; battery safety; increasing energy density; end user perspectives in reliability, maintenance and real-world experience; and charging infrastructure.

**Info:** Visit [www.thebatteryshow.com](http://www.thebatteryshow.com).

**November 12-13** – Next Generation Batteries, Hyatt Mission Bay Resort & Marina, San Diego, California.

Includes chemistries and materials to increase power and decrease cost; lithium vs. non-lithium; technology to improve safety, reliability, and performance; OEM perspectives; materials for battery architectures; nanomaterials; new flow, thin film, paper, and highly flexible printed batteries; and fuel cell/ battery hybrid devices, development and applications.

**Info:** The Knowledge Foundation, 2193 Commonwealth Ave. #398, Boston, Massachusetts, MA 02135-3853, phone: (617) 232-7400, or visit [www.knowledgefoundation.com](http://www.knowledgefoundation.com).

**November 13-14** – Lithium Battery Power 2013, Hyatt Mission Bay Resort & Marina, San Diego, California.

In its 9<sup>th</sup> year, Includes chemistries and materials to increase energy and decrease cost; meeting cycle life, power

and energy, cost and safety for EVs; materials for improved electrode and electrolyte performance; application driven Li-ion development; safety, reliability and performance; materials and components to systems design and integration; and nanotechnology.

**Info:** The Knowledge Foundation, 2193 Commonwealth Ave. #398, Boston, Massachusetts, MA 02135-3853, phone: (617) 232-7400, or visit [www.knowledgefoundation.com](http://www.knowledgefoundation.com).

**November 14-15** – Battery Safety 2013: Advancements in systems Design, Integration and Testing for Safety and Reliability, Hyatt Mission Bay Resort & Marina, San Diego, California.

Includes application specific battery issues affecting performance; major battery degradation and reliability factors; battery management systems; commercial cells evaluation and failure analysis; advances in testing techniques and protocols; and high throughput testing, automation and modeling for better safety.

**Info:** The Knowledge Foundation, 2193 Commonwealth Ave. #398, Boston, Massachusetts, MA 02135-3853, phone: (617) 232-7400, or visit [www.knowledgefoundation.com](http://www.knowledgefoundation.com).

**November 17-20** – EVS27, Gran Via, Barcelona, Spain.

Includes planetary sessions, oral sessions in parallels, poster sessions, exhibition, Ride&Drive, and projects dissemination. See the latest battery, hybrid and fuel cell electric vehicles available on the market, prototypes and infrastructures for the electric vehicles as well as all types of components.

**Info:** Visit [www.evs27.org](http://www.evs27.org).

**December 11-13** – EFC13: European Fuel Cell Technology & Applications Piero Lunghi Conference (EFC13), Fontana di Trevi Conference Center, Rome, Italy.

Includes materials, modeling, lab tests, system design, approaching the market, polygeneration using fuel cells, fuels and decarbonizing society, new ideas and bad ideas in fuel cells, policy and cross-cutting fuel cell issues.

**Info:** Chiara Barchiesi, University of Perugia, phone: +39 075 585 3737, email: [info@europeanfuelcell.it](mailto:info@europeanfuelcell.it) or visit [www.europeanfuelcell.it](http://www.europeanfuelcell.it).

## 2014

**February 3-7** – 14<sup>th</sup> International Advanced Automotive Battery Conference and Symposia (AABC), Hyatt Regency, Atlanta, Georgia.

Automotive energy-storage experts discuss the technological progress and scenarios for the development of the market. The LLIBTA Symposium includes advances in materials, cell and pack designs, and analyzes battery performance, durability and safety in new applications.

**Info:** Carol Chambers, Advanced Automotive Batteries, phone: (530) 692-0140; fax: (530) 692-0142, or visit [www.advancedautobat.com](http://www.advancedautobat.com).

**March 10-13** – 31st International Battery Seminar & Exhibit, Broward County Convention Center, Ft. Lauderdale, Florida.

Ideal for battery and small fuel cell manufacturers, users, OEMs, product designers, component, equipment and material suppliers, applications engineers, marketing analysts, patent attorneys, investors and those interested in the battery and small fuel cell industries.

**Info:** Thomas M. Devita, Seminar Coordinator, Florida Educational Seminars Inc., 2300 Glades Road, Suite 260W, Boca Raton, FL 33431, phone: (561) 367-0193, fax: (561) 367-8429, or visit [www.powersources.net](http://www.powersources.net).

**May 5-7** – Battcon, Boca Raton Resort and Club, Boca Raton, Florida.

Noncommercial, technical event for storage battery users from the power, telecom, UPS and other industries. End-users, engineers, battery and battery test equipment manufacturers, installers, and standards and safety experts gather to discuss storage battery innovations and solutions for existing systems; everyday applications; technical advances; and industry concerns. A trade show features storage power related vendors.

**Info:** Jennifer Stryker, Albercorp, 3103 N. Andrews Ave. Ext., Pompano Beach, FL 33064, (954) 623-6660 ext 23806, or visit [www.battcon.com](http://www.battcon.com).

**May 19-23** – 1<sup>st</sup> Asian Advanced Automotive Battery Conference (AABC), International Conference Center, Kyoto, Japan.

Top energy-storage technologists from Asian carmakers assess the Asian xEV market and the battery technology which will power it. Dissecting the Asian and global xEV vehicle and battery markets by segment and reviewing recent advances in automotive battery systems technology.

**Info:** Carol Chambers, Advanced Automotive Batteries, phone: (530) 692-0140; fax: (530) 692-0142, or visit [www.advancedautobat.com](http://www.advancedautobat.com).

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# Announces Three New Journals

**W**ith the *Journal of The Electrochemical Society* at its helm, for close to 110 years ECS has recognized the need for researchers to publish technical content with a timely turnaround and have access to resources dedicated to their studies.

Now, to further enhance its mission to encourage research and dissemination of knowledge, ECS has developed two distinct publication channels for scholarly research: **Electrochemical Science & Technology** and **Solid State Science & Technology**, each to include a traditional and a rapid-publication journal.

### Electrochemical Science & Technology Journals

Fundamental and applied areas of electrochemistry, including experimental and theoretical aspects of electrodes, interfaces, and devices.

#### Journal of The Electrochemical Society (JES)

JES will continue to accept full length manuscripts at a new website: [ecs-journals.msubmit.net](http://ecs-journals.msubmit.net). Current lag time of 36 days to first review.

#### ECS Electrochemistry Letters (EEL)

EEL will accept short manuscripts requiring rapid publication at [ecs-journals.msubmit.net](http://ecs-journals.msubmit.net). Lag time of 16 days to first review, based on current ECS standards for rapid publication journals.

(EEL and *ECS Solid State Letters* will replace the current rapid publication title, *Electrochemical and Solid-State Letters*.)

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### Solid State Science & Technology Journals

Fundamental and applied areas of solid state science and technology, including experimental and theoretical aspects of the chemistry and physics of materials and devices.

#### ECS Journal of Solid State Science and Technology (JSS)

JSS will accept full-length manuscripts at [ecs-journals.msubmit.net](http://ecs-journals.msubmit.net). Lag time of 36 days to first review, based on current ECS standards for full-length article journals.

#### ECS Solid State Letters (SSL)

SSL will accept short manuscripts requiring rapid publication at [ecs-journals.msubmit.net](http://ecs-journals.msubmit.net). Lag time of 16 days to first review, based on current ECS standard for rapid publication journals.

(SSL and *ECS Electrochemistry Letters* will replace the current rapid-publication title, *Electrochemical and Solid-State Letters*.)

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