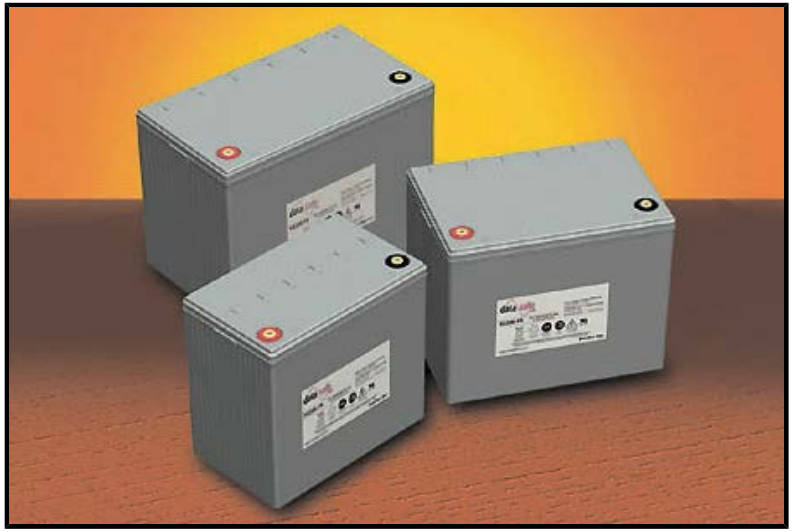
APRIL 2004



DataSafe HX VRLA batteries for UPS and other high energy density uses are new from Enersys. > story

AROUND THE INDUSTRY

EaglePicher Helps Power Mars Mission

Spirit and Opportunity, NASA's Mars exploration Rovers, used EaglePicher Technologies thermal batteries to successfully assist in the critical entry, descent, and landing sequences on Mars.

Each Rover had two thermal batteries manufactured at EPT's Joplin, Missouri facility, located on the back shell to provide high-current bursts for firing several pyros (firing mechanisms). These pyros enabled parachute deployment, heat shield release, transfer impulse reaction system (TIRS), and rocket assisted descent (RAD) rocket firing.

The batteries made the long trip to Mars in an inactive state. Upon entering the Mars atmosphere, a high-current pulse activated the batteries by generating a high temperature that melted electrolyte pellets and thus provided ionic contact between electrodes within the battery.

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Toronto, ONT
Canada

MEETING REPORT
28th International Battery Seminar And Exhibition - PART 2
Ft. Lauderdale, FL USA

PHOTO REPORT
28th Florida Battery Seminar
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TECH REPORT
Dry Rooms: Why They Are Needed

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Advanced Battery Technology

ISSN: 001-8627

The thermal batteries are designed to provide extremely high power over a short period of time. EaglePicher made similar batteries for NASA's earlier missions, Mars Pathfinder and Mars Odyssey.

In other news, the Defense and Space Power Division of EaglePicher Technologies LLC has received ISO 9001:2000 certification. Certificate of Registration No. 98-1124b is applicable to the design and manufacturing of batteries for commercial, military and space applications. Sites certified include ordnance systems, defense systems, product development, energetic devices, commercial power solutions, and space power business units located in Joplin.

Celgard Completes Expansion

Celgard Inc. has completed the second phase of a strategic manufacturing expansion, tripling supply capacity of its proprietary trilayer separators for rechargeable lithium batteries.

Headquartered in Charlotte, North Carolina, and with regional offices in Japan, Korea, and Germany, Celgard is a global leader in the development, manufacturing and marketing of microporous membrane products serving high energy battery markets.

For more information contact Tim Martin, director of marketing, phone: (704) 587-8440, fax: (704) 587-8749, email: tmartin@celgard.net.

Yuasa Receives Award from Bombardier

Yuasa Battery, Inc., earned the 2003 Quality and Delivery Service Excellence Award from Bombardier. The award was presented to eight out of 275 companies, less than 3% of Bombardier's suppliers. This is the third consecutive year Yuasa has earned this distinguished award.

Yuasa Battery, Inc., headquartered in Reading, Pennsylvania, has been manufacturing batteries for the powersports industry since 1979.

For more information about Yuasa products or to find a list of certified dealers, visit www.yuasabatteries.com.

Matsushita Develops New Dry-Cell Battery

Matsushita Electric Industrial Co. Ltd. of Tokyo unveiled its new AA-sized primary battery, the Oxyride dry-cell battery, which has a 1.5 to 2 times longer life than alkaline batteries. Matsushita is to start shipments of the battery this month, and will ship globally soon.

The new battery succeeds Matsushita's nickel-manganese dry battery designed

exclusively for digital cameras. The retail price of two Oxyride batteries is approximately 360 yen, while two conventional nic-kel-manganese batteries is about 380 yen. Matsushita's Primary Battery Co. plans to add a AAA-sized Oxyride to its battery portfolio in April 2005, and expects to ship 70,000,000 to 100,000,000 units of them in the first year.

Matsushita used zinc for the new battery's negative electrode, oxy-nickel hydroxide and the newly developed manganese oxide for its positive electrode, and potassium hydroxide for its electrolyte.

Battery Taps Water

A new type of battery uses the way water molecules line up when they come in contact with glass.

The electrokinetic micro-channel battery, developed by Larry Kostiuk and his colleagues at the University of Alberta, exploits water molecules having positive and negative ends. Glass takes on a positive charge wherever it touches water, explains Kostiuk. Conversely, the negative-charged ends of all the water molecules line up, faking the glass container. In the battery, water flows through glass channels, producing electricity along the channel walls.

"Each channel contributes less than a nanoamp," says Kostiuk. "But you can gang together as many as you need." The prototype cranks out 2 microamps.

Energizer Holdings, Inc. Elects Directors

John R. Roberts, John E. Klein, R. David Hoover and W. Patrick McGinnis were elected to the board of directors of Energizer Holdings, Inc. at its 2004 Annual Meeting of Shareholders.

Energizer also announced that Ward M. Klein, formerly its president, international, is now president and chief operating officer. He will report to Pat Mulcahy, chief executive officer, and will have direct supervisory responsibility over both the company's Energizer Battery operating division and its Schick-Wilkinson Sword operating division. Joseph W. McClanathan, formerly president, North America, will assume responsibility for the entire Energizer Battery operating division worldwide, and has been named president and CEO, Energizer Battery. Joseph E. Lynch will retain responsibility for the company's Schick-Wilkinson Sword operations, with the title president and CEO, Schick-Wilkinson Sword. Both McClanathan and Lynch will report to Klein.

Contact Jacqueline Burwitz, Energizer Holdings, Inc., (314) 985-2169.

Fiamm Wins Multi-Million Pound Contract

Finning Materials Handling has signed a battery supply agreement with Fiamm

UK potentially worth £25 million over five years, the largest single piece of business by Fiamm since it entered the UK market more than 15 years ago.

Fiamm will supply a complete range of traction batteries for over 130 types of material handling equipment distributed by Finning from its National Materials Handling Centre, in Cannock, Staffordshire.

The package includes a resident Fiamm battery engineer at the Cannock center working in a dedicated battery facility equipped and financed by Fiamm. It also includes a Fiamm customer service specialist permanently based at Cannock, providing expert advice and support to the Finning sales team and their customers.

Other features help Finning work more effectively with its customers. A cycle counter which also records the number of times a battery is over-discharged will be fitted to every battery. This will enable Finning to identify battery abuse and offer customers appropriate advice and support before it becomes a warranty issue.

B&K, HKUST Ink Technology Deal

Shenzhen B&K Technology Co. Ltd. and the Hong Kong University of Science and Technology (HKUST) have signed an agreement to develop production technology for the mass production of ultra-thin carbon nanotubes.

B&K hopes to improve the company's cathode material performance, since the adoption of nanotube technology is expected to raise the capacity of its lithium batteries to about 1Ah/g. Company engineers are also increasing R&D on electrode material for production of high-performance Li-ion and polymer Li-ion batteries.

Currently, B&K is constructing a 190,000 square-meter building located in Baoan Gongming High & New Industry Park in Shenzhen. With a total investment of US$36.23 million, the first phase of production operation is expected to begin by year end while the second phase will commence operation by the end of next year.

Contact Shenzhen B&K Technology Co. Ltd., phone: (86) 755- 28038081, fax: (86) 755-28030808.

BPL Merges Battery Units

BPL Ltd. of Bangalore, India, is merging its alkaline battery division with BPL Soft Energy Systems, reports Business Standard. The company is also increasing its authorized capital to Rs200 crore from Rs140 crore.

P V K Sundaram, vice president, finance, said, "The alkaline battery division is

currently a division of BPL Ltd. We are merging this division with our subsidiary BPL Soft Energy Systems, which manufactures dry cells. We are steamlining the battery business into a single entity to gain more scale."

The alkaline battery division contributes Rs40 crore while BPL Soft Energy Systems turns over Rs130 crore.

EaglePicher Launches New Web Site

The Commercial Power Solutions division of EaglePicher Technologies, LLC, in Phoenix, Arizona, has launched a Web site for evaluating its primary batteries, secondary batteries and advanced battery chargers. The site includes product line overviews, a full range of industry applications, a comprehensive product model search tool, product specifications, product news, and customer support information and contacts.

Visitors who access www.epcompower.com will find a search tool that allows them to select and view EaglePicher's products by industry application, chemistry, voltage, capacity, size and other criteria key to evaluating and specifying products.

Visitors also can use the site to find out more about becoming a distributor for EaglePicher or to submit resumes for job openings.

Valence Unveils Second Generation N-Charge

Valence Technology Inc. has introduced the N-Charge™ Power System, a universal battery that supports mobile electronic devices including notebook PCs, portable DVDs, cell phones, MP3 players, and digital cameras.

The system uses Valence's cylindrical Saphion lithium-ion technology and smart tip technology from Mobility Electronics. It offers a modular design for the utmost flexibility and includes a base system that provides up to five hours of additional notebook run-time, as well as a snap-on expansion pack to double the energy capacity. The system supports 90- and 120-watt notebook PCs and is lightweight, compact, and easy to transport.

The environmentally friendly N-Charge power system offers 5-10 hours of laptop power; uninterrupted power for a variety of mobile devices; innovative modular design with ungradable N-Charge expansion pack that doubles the run-time; rapid recharge; and long life cycle.

ZAP Names Pavelka National Sales Manager

Ron Pavelka has been named national sales manager for Zap's Santa Rosa, California-based Consumer Products Division, which includes electric bicycles, scooters, dive propulsion vehicles, and future products.

Pavelka started at ZAP the first of the year. He has worked in consumer products distribution for 25 years, with an extensive background in the sports and recreation industry. He has worked in operations, customer service, field sales, marketing, and management.

Pavelka has consulted for Reebok, Rollerblade, the Diving Equipment and Marketing Association, The Bicycle Council, The Inline Skating Association, and Seagate.

Delphi to Provide Electric Systems to Ford

Delphi will provide the electrical distribution system for Ford Motor Company's full-size, rear-wheel-drive vehicles: Ford Crown Victoria, Mercury Grand Marquis, and Lincoln Town Car.

Steve Duca, director of global engineering at Delphi Packard Electric, said that the ability to meet Ford's target of bringing refreshed and enhanced versions of the three luxury cars to consumers next year was critical for the automaker. Also key was Delphi's capability to provide robust electrical distribution system solutions to help ensure these vehicles' traditionally high levels of durability and reliability.

For more details, contact Doug Hoy, (330) 373-7647, or douglas.d.hoy@delphi.com

Wuhan Lixing Expanding Capacity, Lowering Prices

Mainland China's Wuhan Lixing (Torch) Power Sources Co. Ltd. is expanding its capacity, while its Japanese counterparts are keeping their production steady, discouraged by the continuing fall in prices. The company produced 150 million units last year; it expects to turn out 200 million units this year.

Wuhan Lixing makes disposable lithium batteries and rechargeable Li-ion batteries. It supplies disposable button-cell batteries to top computer makers, including Acer, ASUSTeK and Foxconn.

The company will lower prices of its disposable lithium batteries by 10%. Wuhan Lixing forecasts rising demand for lithium batteries and Li-ion batteries over the next two or three years.

Contact Wuhan Lixing (Torch) Power Sources Co Ltd, (86) 27-87561036 Fax: (86) 27-87414024.

Avista Announces Executive Changes

Malyn Malquist, senior vice president of Avista Corp. in Spokane, Washington,

has assumed responsibility for the treasury function of the company in addition to his role as chief financial officer. Vice President and Treasurer David Brukardt has left Avista, after helping to assure a smooth transition. The move combines the role of CFO and treasurer and eliminates one executive officer position.

"Dave has been an extremely valuable member of our company during financially challenging times," said Gary Ely, Avista's board chairman, president, and chief executive officer. "His contributions to our success have been substantial."

Arotech Acquires Epsilor Electronic Industries

Arotech Corp. of New York, New York, has acquired Epsilor Electronic Industries Ltd., a privately owned Israeli corporation.

Epsilor recently received a $2.17 million order for military rechargeable batteries and smart chargers from an Asian country. With them, Arotech's battery-related business is projected to increase profitability in 2004.

The company plans to introduce the acquired lithium-based battery technology to its Auburn, Alabama battery plant, as a base for broadening its U.S. military battery market. The acquired company has already developed European and Asian military markets for its batteries, which Arotech will use to expand the reach of its BA-8180/U zinc-air battery.

Maxwell to Supply Ultracapacitors for Buses

Maxwell Technologies Inc. of San Diego, California, will supply BOOSTCAP® ultracapacitors for 27 40-foot hybrid gasoline-electric transit buses being built by New Flyer Industries and ISE Research for Long Beach (California) Transit.

Maxwell is now supplying large-cell ultracapacitors for production, testing and prototyping for other transportation and industrial applications, including automobiles, trucks, electric rail vehicles and systems, forklifts, and backup power systems.

Maxwell President and CEO Richard Balanson says, "Ultracapacitors' ability to discharge and recharge rapidly makes them ideal for capturing and reusing energy generated by braking, which is critical to achieving the fuel economy and reduced emissions consumers are seeking from hybrid vehicles."

Wilson Greatbatch Completes Acquisition

Wilson Greatbatch Technologies Inc. of Clarence, New York, has completed the acquisition of NanoGram Devices Corp. of Fremont, California.

Under terms of the agreement, Wilson Greatbatch acquired all of the

outstanding stock of NanoGram Devices for $45 million in cash. The company expects the acquisition to result in a $6 to $7 million increase in operating expenses this year. Most of the increase will be directed toward R&D and product engineering.

NanoGram Devices Corp. is a materials research and development company focused on developing nanoscale materials for use in various battery and medical device applications.

LTC Ships Second Prototype

Lithium Technology Corp. of Plymouth Meeting, Pennsylvania, delivered a second prototype lithium-ion polymer battery to the European Astor consortium under terms of a firm purchase order. The 42V module, produced by the company's GAIA operating unit in Nordhausen, Germany, of which LTC's President and COO Franz Kruger is CEO, has a battery management system and is to be tested for use in a hybrid electric vehicle (HEV) propulsion system, as the first prototype has been doing for nearly two years.

The Astor Project is part of the European Union and the Astor consortium, which consists of seven European auto manufacturers: VW, BMW, DaimlerChrysler, Opel, Fiat, Volvo and Peugeot. The objective is to assess the suitability of lithium-ion polymer batteries for use in HEVs. BMW is responsible for procuring and testing the battery system at an independent testing institute.

Rholab Tests Lead Acid Battery Hybrid

The planned 50,000-mile test of a valve-regulated lead acid battery in a Honda Insight hybrid-electric car at the Millbrook Proving Ground in Bedfordshire, U.K., will culminate Rholab, the three-year European Advanced Lead Acid Battery Consortium project.

Rholab hopes to demonstrate that VRLA batteries can be a viable alternative to the more expensive nickel-metal hydride (NiMH) power packs used in the first generation hybrids from Honda and Toyota.

Rholab partners include Hawker Batteries, Provector, and the universities of Warwick and Sheffield. Rholab operated as part of the DTI-funded Foresight Vehicle Programme. A successor project to Rholab, called Isolab, will build on the Rholab developments.

Automotive Suppliers Order UQM Systems

UQM Technologies Inc. of Frederick, Colorado, has received orders from two international tier I automotive suppliers for UQM® permanent magnet propulsion systems for use in hybrid electric vehicles under development.

Applications of the systems include both series hybrid and parallel hybrid configurations. The series hybrid configuration incorporates the company's generator, driven by an internal combustion engine to provide on-board electric power, and its propulsion system, which provides primary propulsion and serves as a regenerative braking system to slow the vehicle and recharge the battery pack. The parallel hybrid configuration incorporates a propulsion system in the driveline to join the engine in propelling the vehicle and also slowing it and recharging the battery pack.

Space Age Power for British Armed Forces

A lightweight battery technology will power Britain's BOWMAN battlefield communications system.

The rechargeable lithium-ion batteries, supplied by AEA Battery Systems of the U.K., are currently powering the European Space Agency's Mars Express orbiter in its ongoing mission to look for evidence of life on Mars. AEA's batteries provide power to Mars Express when it is hidden from the sun and supports peak power demands.

AEA's lithium-ion batteries can operate effectively in temperatures ranging from -40oC to +70oC. Other rechargeables, such as nickel cadmium, do not operate effectively below 0oC. Li-ions are just one-third the size and weight of other rechargeable batteries, can be recharged over 1000 times, and have reliable fuel gauging, optimized charge and discharge regimes, and history monitoring to help maximize battery life.

ELECTRIC VEHICLES

Royals Go Electric

The Norway Times reports that Crown Prince Haakon and Crown Princess Mette-Marit found a way to save time for their move to Skaugum, a nearby Asker township. Commuting time from the countryside to official duties can be pared using an electric car, which is allowed in a speedy lane reserved for pubic transport. Royal information consultant Sven Gjeruldsen confirmed that an electric car has been added to the crown prince and princess' staff pool, but would not comment on whether it was purchased to avoid the daily traffic jams between Asker and Oslo. Previous monarchs, King Olav and King Harald, sat in traffic when duty called them to Oslo during their Skaugum years. The electric car, and its favorable promotional legal status, has never been used in a royal context before.

Toyota Hybrids to Roll out of U.S. Plants

Toyota Motor Corp. will produce hybrid cars in the United States following brisk sales of its Prius hybrid model in the U.S. market. Production is expected to begin as early as 2006 at one of Toyota's four stateside plants. President Fujio

Cho said initial production volume will be 50,000 to 100,000 units a year.

In addition to the Prius, Toyota is considering producing a larger hybrid model tailored for U.S. customers.

While Toyota and GM have teamed up to develop certain technologies for fuel-cell electric vehicles, they develop gas-electric hybrid cars separately. Cho denied the possibility of jointly producing hybrid cars with GM.

By year end,Toyota plans to roll out hybrid versions of two sports utility vehicles, the Highlander and the RX330, which are marketed in Japan under the names Kluger V and Harrier. Toyota is also considering marketing hybrid pickup trucks in the future.

Ballard Considering Hybrid Vehicle Strategy

Canadian fuel cell company Ballard Power Systems is rethinking its strategy in light of the emergence of hybrid electric vehicles as an accepted “bridging technology” between combustion engines and fuel cell vehicles.

Ballard President and Chief Executive Dennis Campbell said that Ballard and its automotive partners Ford and DaimlerChrysler are discussing a range of actions, including development of a light-duty fuel cell program.

The emergence of hybrid electric vehicles “has really changed the game ” said Campbell. Until recently, hybrids were viewed as a technological curiosity, he said, “but it’s now become apparent that the automakers are probably going to have to play in that space.”

However, the basic design platform for hybrids is essentially the same as that of fuel cell vehicles. The alliance partners want to join forces in this field so they’re not designing and developing separate engine architectures, and the automakers want to be more involved in integration, Campbell said. “The OEMs view it as very important that they link up the systems integration and the vehicle integration, and do it together”.

Pennsylvania May Require Hybrids in State Fleet

Pennsylvania would be required to introduce hybrid gas-electric cars to its vehicle fleet within the next two years under a bill being discussed by a legislative panel.

Rep. Daylin Leach, who is sponsoring the measure, touted several reasons to support the purchase or lease of hybrid vehicles, such as greater fuel efficiency and reduced air pollution, in testimony before the House State Government Committee.

Leach said the average hybrid vehicle gets 20 miles more per gallon than the vehicles the state is currently leasing, and that each additional 10 miles per gallon saves about $250 per year in gas, or 12 full tanks.

Pennsylvania does not currently have any hybrids in its 38,000-vehicle fleet because state law says the government can only procure vehicles made in North America, said Frank Kane, spokesman for the Department of General Services.

Leach has proposed requiring the state to launch a pilot program to buy hybrid-electric vehicles by Jan. 1, 2006.

Hybrid Engines Spark Hope for New Applications

According to Plastics News, the combination gasoline and electric motor systems making up the new hybrid range of vehicles are drawing increased interest from drivers and carmakers, and could mean increased plastics use on cars and trucks for automakers that must package several cubic feet of batteries on hybrids.

“Early on, (carmakers) were packaging them in metal, but that is moving forward into plastics now, with our expectation they’ll be all plastic soon,” said Ray Brown of Johnson Controls Inc. (JCI).

Hybrids fuel up on standard gasoline used in an internal combustion vehicle, but also have a supplemental electric motor that taps into batteries that store energy created during vehicle use, such as when brakes are applied.

Those batteries – currently nickel hydride, but expected to shift to lithium-ion eventually – hold about 4 volts of electricity per cell, Brown said. Hybrids need between 144 volts and 350 volts; the battery modules can be three to four feet in width and length and a few inches in depth.

Since their introduction in 2000, hybrids have been getting increased attention. The second generation of Toyota’s power system in the Prius won notice from car buyers and industry watchers in 2003. Honda has hybrid power available with its Insight and a version of the Civic.

Following on their heels are new offerings from a cross-range of vehicles. Toyota will introduce a Lexus hybrid SUV, the RX400H, later this year, focusing on hybrid technology in the advertising, and Ford will market a gas-electric version of its Escape SUV this summer.

Yoshio Ishizaka, executive vice president of Toyota Motor Corp., notes that experience in hybrid technology will carry over to future vehicle programs. “Hybrid technology is a key element in the advancement of fuel cell technology,” he said. “If you have an advantage with hybrids, you will have an advantage with fuel cells.”

Within 15 years, most cars and trucks will have some kind of hybrid system. JCI's automotive unit, based in Plymouth, Michigan, is in talks with automakers for future products. Its European battery unit, under the Varta name, already makes systems for hybrid buses there.

PRODUCT NEWS

EnerSys High Rate Discharge VRLA Batteries

EnerSys has a new line of high rate discharge batteries (pictured on page 1) ideal for uninterruptible power supplies (UPS) and other applications that require maximized space utilization combined with high energy density. The cases and covers of the new DataSafe HX line of valve-regulated lead-acid (VRLA) batteries use a polypropylene compound that improves high temperature performance and increases vibration resistance.

The new DataSafe HX 12V product family offers better performance in high temperature applications, such as cable TV, due to the container's lower deflection rate, which prevents the housing from expanding during high temperature operation, allowing the battery to maintain internal plate compression for increased battery life.

The polypropylene compound used for the DataSafe HX provides more resistance to vibration, making the batteries more tolerable to harsh shipping environments. This is an especially important consideration for UPS applications where batteries are typically shipped with the UPS system in pre-installed cabinets.

The DataSafe HX, which includes five models ranging from 204 watts/cell to 506 watts/cell (15 minute rate to 1.67V end voltage), is compatible with other similar products, making the HX batteries ideal for both new and replacement applications. The batteries feature high conductivity recessed brass terminals; high integrity, long life terminal seals; corrosion resistant lead-calcium-tin alloy positive and negative grids for efficient recharge and long life; and are available in standard or flame retardant (UL94-V0/L.O.I. > 28%) material. The HX series meets critical industry standards including UL, IATA certification for air transport, and US DOT non-spillable batteries requirements.

Nominal ratings for the five 12-volt models in the new DataSafe HX series, at the 15 minute rate to 1.67 V end voltage, are HX205: 204 watts/cell; HX300: 284 watts/cell; HX330: 336 watts/cell; HX400: 381 watts/cell; and HX500: 506 watts/cell.

Pricing for a new HX205 DataSafe battery starts at $89. Visit www.enersysreservepower.com.

The Development of the Fuel Cell

Batt-Tek Consulting has released The Development of the Fuel Cell, a database with more than 2,900 U.S. fuel cell patents in an easy to use format. Patents issued between January 1976 and December 2003 are available in a sortable MS-Excel format.

The database includes patent issue date; patent number (hot-linked to the full-text patent); fuel cell type, primary patent focus; secondary patent focus; and assignee company. Each patent is categorized by fuel cell type and technical focus by industry expert Dr. George Brilmyer.

The CD-ROM is available for $495. Contact Batt-Tek Consulting, phone/fax: (330) 638-1057 or email: Patentreview@neo.rr.com.

Report Predicts Increase in Materials Demand

The Freedonia Group's 245-page study, U.S. Battery & Fuel Cell Materials, predicts battery and fuel cell materials demand will increase 6.2% annually through 2007 to $3 billion. This report analyzes the market and presents detailed historical demand data.

Forecasts to 2007 and 2012 are broken out by application (e.g., alkaline batteries, lead-acid batteries); by function (e.g., anodes and cathodes, catalysts, electrolytes); and by material (e.g., carbon/graphite, metallic chemicals, steel). The study also examines the market environment, details industry structure, evaluates company market share, and profiles major competitors.

U.S. Battery & Fuel Cell Materials (Study #1722, October 2003) is available for $3,800 from the Battery Bookstore, P.O. Box 650, Boalsburg, PA 16827, phone: (814) 466-6559, fax: (814) 466-2777, or visit www.7ms.com.

Power ICs to Surpass $7 Billion in 2008

CIR's new report, "Power ICs in the Mobile Device Market: A Five-Year Forecast of OEM Requirements," says the semiconductor industry is emerging as a potentially hot growth area, reaching $4.3 billion in sales in 2004 and climbing to $7.2 billion in 2008. With more features and advanced display technologies being added to mobile devices, the processors used in them are more complex and are outpacing current lithium-chemistry batteries.

For details, visit www.cir-inc.com.

UP ↑

U. S. BATTERY AND FUEL CELL PATENTS

Compiled by Eddie T. Seo
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Official Gazette, Volume 1279 (February 2004)

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28th International Battery Seminar And Exhibition - PART 2
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Ft. Lauderdale, FL USA

TECH REPORT

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