

December 2004

MEETING REPORT

Portable Power Conference And Expo
 San Francisco, CA USA
 September 12-14, 2004
 By Dennis Sieminski

[Around The Industry](#)

[Patents](#)

[Product News](#)

[Previous Issue](#)

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MEETING REPORT

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29th Florida Battery Seminar Part 2
 Ft. Lauderdale, FL USA

PHOTO REPORT

29th Florida Battery Seminar Part 1
 Ft. Lauderdale, FL USA

MEETING REPORT

DECEMBER 2004



EaglePicher's new corporate headquarters in Phoenix opened in November and featured Gen. Hugh Shelton as keynote speaker at the grand opening gala. See story below.

AROUND THE INDUSTRY

EaglePicher Opens New Headquarters

EaglePicher Inc. has opened its new corporate headquarters in Phoenix, Arizona. The facility also serves as the headquarters of EaglePicher Technologies LLC, a wholly owned subsidiary of EaglePicher Inc.

The 100,000 square-foot building offers employee office space and amenities and enhanced service and technology to customers. Also housed there is the Defense and Space Power division of EaglePicher Technologies with a supplemental manufacturing operation for thermal batteries.

A grand opening gala on November 9 featured a keynote address by Gen. Hugh Shelton, 14th chairman of the Joint Chiefs of Staff, who praised the company for "providing the majority of power solutions for all U.S. government guided munitions."

EaglePicher also has announced a support program for Arizona math and science teachers who achieve National Board certification. The company will

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MEETING REPORT

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Ft. Lauderdale, FL USA

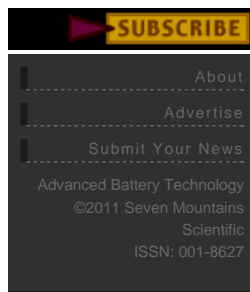
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**28th Florida Battery
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award \$1,500 to selected teachers who successfully complete the prestigious certification program, reimbursing them for fees not covered by a state Department of Education subsidy program and including an additional \$200 bonus.

Altair Works on Nano-structured Materials

Altair Nanotechnologies is working on a development project entitled "Carbon-Coated Nano-Structured Electrodes for Next-Generation Lithium-Ion Ultra Capacitors." The Small Business Innovation Research (SBIR) Phase I grant, initially for \$100,000, provides the opportunity to receive an additional \$500,000 Phase II grant which, if the development program is successful, leads to a Phase III commercialization.

Altair and Hosokawa Micron's Nano Particle Technology Center produced the first advanced carbon coated materials for this program, which were tested under a contract with the Energy Storage Research Group at Rutgers, the State University of New Jersey. Based on that work the final research testing protocol was determined. The Phase I grant work is scheduled for completion this month.

Nano-structured electrodes, using Altair's proprietary materials, combine the high-speed capabilities of capacitors with the energy storage features associated with batteries. The work is expected to lead to significant commercialization opportunities within the automotive industry for batteries using hybrid ultra capacitor/battery concepts and Altair's electrode materials. The potential for commercializing these technologies was first reported by Altair in its November 2001 news release in which Dr. K.M. Abraham, an independent consultant, confirmed that Altair's new nano-sized lithium titanate spinel could achieve lithium-ion charging and discharging rates 10 to 100 times higher than materials then available commercially.

This superior performance of Altair's lithium titanate spinel in a prototype battery was first reported by Telcordia (now Rutgers University's Energy Storage Research Group) in the Journal of Power Sources, published in March 2003. Telcordia's new thin film hybrid battery/ultra capacitor technology used Altair's advanced materials. This hybrid battery met the performance standards established by the U.S. Department of Energy (DOE) for the power assist batteries required for cars of the future using fuel cells or hybrid internal combustion engines/battery drives.

The advancement in charging and discharging capabilities of Altair's materials were published in the July 2003 issue of Journal of Electrochemistry through a joint collaboration with Altair, Switzerland-based Xoliox and Czechoslovakia-based J. Heyrovsky Institute. The report demonstrated that Altair's nanomaterials could be fully charged in only a few seconds and that Dr. Abraham's assessment proved to be correct. The Rutgers team utilized the technology in their unique prototype battery and is now participating in the current test work. Based upon the results of Rutgers' prototype battery, Altair has taken the necessary steps to improve both its technology and its ability to

supply commercial quantities of its nanomaterials to the marketplace.

For more information, visit www.altairnano.com.

Energys Recommended for TI9000 Standard

Energys has been recommended for registration to the Quality Excellence for Suppliers of Telecommunications (QuEST) Forum's TL 9000 Quality Management System Requirements and Measures standard in early November following a successful audit of its quality management system by its chosen registrar, National Standards Authority of Ireland (NSAI). Energys will be the first battery manufacturer registered to TL 9000.

TL 9000 is a quality standard developed by the worldwide telecommunications industry. It defines system requirements for the design, development, production, delivery, installation and maintenance of telecom products and services, and provides measurements that enable companies to track performance and improve results.

TL 9000 provides a telecommunications specific set of requirements and is based upon the ISO 9001:2000 standard. There are approximately 60 specific additional requirements to which Energys demonstrated compliance. This achievement follows Energys' 1993 registration of the first US industrial battery plant to ISO 9002:1994 and the 2001 registration to ISO 9001:2000.

Alkaline Battery Creator Dies

Lewis Urry, a chemical engineer who developed the first practical long-life alkaline battery that made countless portable electronic devices possible, died October 19. He was 77.

Early in his research, Urry decided to create a new battery type rather than try to improve on the existing version. "My 'eureka' moment came when I realized using powdered zinc would give more surface area," Urry told the *Washington Times*.

The first Eveready alkaline batteries went on the market in 1959; they were rebranded under the Energizer name in 1980.

Urry held 51 patents, including a number for the lithium battery. In 1999, he was inducted into the hall of fame at the Smithsonian Institution, where he presented the first prototype alkaline battery and the first manufactured cylindrical alkaline cell to the museum's collection. They were put on display in the same room as Thomas Edison's light bulb.

Arotech Receives CECOM Contract

Arotech Corp.'s battery and power systems division has received a research and development contract from the U.S. Army Communications and Electronics Command (CECOM). The 3-phase program will focus on developing a fourth-generation electric fuel zinc air cell for use in military batteries.

The battery pack will be 12V or 24V and have a total capacity of approximately 400Wh. Battery energy density will be above 300Wh/kg. The second and third phases of the program are optional.

The research program is aimed at the Future Force Warrior project, the U.S. Army's flagship science and technology initiative to develop and demonstrate revolutionary capabilities for Future Force soldier systems.

The third generation cells now in production for the electric fuel BA-8180/U military zinc air battery are mono-cells (single air cathode) with plastic casing encapsulating the anodic zinc reactant. The new fourth generation bi-cell (dual air cathode) will use a folded air cathode without plastic casing material, increasing the respective energy density. The power density is expected to double.

Saft Ships Large Li-ion to Army

The first production Li-ion batteries in support of the U.S. Army's upgraded Tube-Launched, Optically Tracked, Wire-Guided (TOW) Improved Target Acquisition System (ITAS) have been shipped by Saft. The company was awarded the battery contract by Raytheon Co. under a program managed by the U.S. Army's Close Combat Weapons Systems Office at Redstone Arsenal in Huntsville, Alabama. The shipment, to the 172nd Brigade at Fort Wainwright, Alaska, marks the first in a series of deliveries of Li-ion batteries for the ITAS.

"Saft's Li-ion batteries' improved performance will enable the U.S. Army to realize a multimillion dollar life-cycle cost savings over the previously installed silver-zinc battery," says Glen Bowling, director of defense sales at Saft's Space and Defense Division in Cockeysville, Maryland. "In addition, the batteries meet a demanding MIS-PRF specification and provide a reliable, long life power source for the Army's ITAS."

TOW ITAS is designed to defeat threat armored vehicles at extended ranges and provide a long-range surveillance system for the light infantry in all battlefield conditions.

Simplo Projects Shipping 10 Million Units in 2005

Simplo Technology, a Taiwan-based lithium-battery maker, forecasts that its shipments of notebook-use lithium batteries will grow from 7.5 million units this year to 10 million in 2005. They also project that consolidated revenues for next year will reach NT\$12-13 billion, up from about NT\$9.2 billion in 2004.

Simplo's second China plant was recently completed in Shanghai. Monthly capacity for notebook lithium batteries is currently 1.1 million units. Simplo will add one more foreign notebook vendor to its existing customer list, which includes Hewlett-Packard (HP), Dell and Quanta Computer, in 2005.

HP will remain Simplo's major client in 2005, with shipment proportions of 40%. Contributions from Dell will climb from 12% this year to 25% in 2005.

Energizer CEO Pat Mulcahy Retires

Pat Mulcahy will retire as CEO of Energizer Holdings, Inc. following the annual meeting of shareholders on January 25, 2005. Ward Klein will succeed him and has been nominated for election to the board of directors. Mulcahy will remain as a member of the board, and upon his retirement will become vice chairman.

"Pat is directly responsible for the strong position, worldwide, that the company is in today," said William P. Stiritz, chairman of the board.

Ward Klein obtained a BA in economics from St. Olaf College and a master's degree in management from the Kellogg Graduate School of Management at Northwestern University. He joined Energizer's former parent, Ralston Purina Co., in 1979, and transferred to its newly acquired battery division in 1986 as director of new products. He held numerous executive positions until reaching president and COO in January 2004.

The board of directors also nominated Bill G. Armstrong and John Hunter for election to the board. Armstrong recently retired from Cargill, Inc., prior to which he served as chief operating officer of Agribands International, Inc. Hunter recently retired as chairman, president and CEO of Solutia, Inc. after a career of 35 years with Solutia and former parent, Monsanto Co.

Solicore Joins TBTF

Solicore, Inc., a leading provider of ultra-thin, flexible, lithium polymer batteries, has joined the Tampa Bay Technology Forum, a not-for-profit trade association that serves 240 member companies in Tampa Bay's technology industry.

According to Dave Corey, Solicore's CEO, "The Tampa Bay Technology Forum is the perfect venue for Solicore to pursue. Solicore is committed to working with the other technology companies in our community."

Michelle Bauer, TBTF's executive director, added, "Solicore is a welcome addition to the technology forum. They have already established themselves as one of the true success stories in the local community and we look forward to their involvement with the other companies within our membership."

Chevy and Jayni Chase Purchase Hybrid

Actor Chevy Chase and his wife Jayni, longtime environmentalists and founders of the Center for Environmental Education, are among the first customers in the East to own an Escape Hybrid full-hybrid SUV. The Westchester natives received their vehicle at a special ceremony at Smith Cairns Ford in Mount Kisco, New York.

“Chevy and I have always done what we can to protect the earth and taking advantage of hybrid technology is a great step in that direction,” says Jayni Chase. “The Escape Hybrid offers many benefits, including increased fuel economy and low emissions, and does not require us to sacrifice comfort or space.”

Hyundai-Enova Completes Heavy-Duty GenSet

Hyundai-Enova Innovative Technology Center Inc. (HE-ITC) of Torrance, California, has completed development of a 60kW GenSet for heavy-duty series hybrid vehicles in conjunction with Enova Systems. The 60kW GenSet is an integral component of Enova’s HybridPower series hybrid. This is the HE-ITC’s first commercial product to be developed and produced by the joint research and development alliance between the two companies.

The 60kW GenSet mates an AC induction motor to a modern diesel that is used in Euro 3 emissions-compliant systems. The control is a variable speed variable frequency vector control that is mapped to the torque profile of the diesel engine.

The HE-ITC is also developing a parallel hybrid motor and motor controller for automotive OEMs for prototype delivery by the end of this year.

PRODUCT NEWS

Batteries and Power Management ICs

The Fifth Edition update of Darnell Group’s “Power Packs for Portable Electronic Devices – Worldwide Forecasts, Applications, Chemistries, Threats and Competitive Environment” will provide an in-depth analysis of the market for battery packs and related power management devices.

Wireless mobility is driving a wide variety of portable applications, including industrial equipment, medical devices, communications and computing. Radio frequency identification devices (RFID), portable medical equipment, mobile handsets, interoperable emergency radios and notebook computers are some of the applications that will drive sales of rechargeable batteries. Semiconductor companies are developing power management ICs with better charging algorithms, better LDOs and more integration of power management functions.

Sponsors are already receiving preliminary data and analysis.

Information on the Fifth Edition of "Power Packs for Portable Electronic Devices" is available at www.darnell.com.

Bi-stat Bi-Potentiostat/Galvanostat

Princeton Applied Research's BI-STAT Bi-Potentiostat is a two-channel multi-potentiostat capable of performing electrochemical experiments on each of its channels simultaneously and/or independently for applications in the sensor, research electrochemical and corrosion markets.

The BI-STAT bi-potentiostat channels can be configured to operate as a bi-potentiostat, the bi-stat mode using two working electrodes with a common counter and reference electrode. It can be used as two separate and complete three-electrode potentiostats. It also can be used with a ring-disk electrode to study kinetics, copper plating and hydrogen permeation.

The BI-STAT features simultaneous measurement of voltage and current using 16-bit A/Ds along with up to two independent auxiliary inputs (such as pH, temperature, etc.). TTL level input and output signals are available for synchronizing experiments with external devices. Its inherent 250mA current capability makes the BI-STAT suitable for most applications. Power amplifiers can be interfaced to the BI-STAT to achieve maximum currents on each channel up to 20A.

Its Windows-based control software features over 25 standard techniques, including corrosion experiments, voltammetry, pulse-plating techniques and testing protocols typically used in evaluating battery and fuel cell performance. Also available are Lab View drivers for many of the most popular techniques and a DLL library available for programmers interested in using the BI-STAT in their own control programs.

For more information, contact Bill Eggers, Princeton Applied Research, 801 S. Illinois Avenue, Oak Ridge, TN 37830, phone: (800) 366-2741, www.princetonappliedresearch.com.

East Penn HydraSaver™ Motive Power Batteries

East Penn Manufacturing's Deka HydraSaver™ line of batteries extends watering intervals from the typical 1-2 week period to 9-10 weeks, depending on the severity of the application. Unlike extended water products that rely primarily on the internal rearrangement of components to increase watering space above the plates, the HydraSaver uses different lead alloy combinations and separator material that results in less water



consumption.

The Deka HydraSaver line covers a wide range of applications and is available in 5 through 33 plate cell sizes, 80 and 120A.H. per positive plate ratings, and carries the same five full-year, 1500-cycle warranty as other Deka premium flat plate products.

The HydraSaver includes a water level indicator LED that warns when the battery needs to be watered and flip-top Water Miser™ vent caps that help extend watering intervals while being easy to open and close. The HydraSaver also features bolt-on positive and negative terminals and cables. It is available with optional factory installed or field retrofitted single point watering systems as specified by the user.

For more information contact East Penn Manufacturing Co., Inc., Lyon Station, PA 19536, www.dekabatteries.com.

Saft "Intensium" Li-ion in Rack-mount Format

Saft's Intensium Li-ion battery can deliver 3kW of backup power from a 1U high rack-mounted, hot-pluggable unit. The Intensium has been optimised to provide safe, reliable, zero-maintenance backup power for the new generation of Micro Base Transceiver Stations (Micro-BTS) in wireless telecom networks. Intensium batteries are also expected to find many other telecom applications such as Macro-BTS, Optical Node Units (ONU), hybrid fiber coax (HFC), and equipment on customer premises.

Micro-BTS installations, which are mainly located in urban areas with a range of hundreds of meters, represent a particularly demanding application for backup batteries due to the constraints on space and weight as well as elevated operating temperatures. Saft's battery delivers the same performance as conventional VRLA, but in a package one-quarter of the size and weight.

The compact nature of the Intensium battery has enabled it to be condensed into a self-contained rack-mounted unit, with a 3kW battery (Intensium 3000) occupying the height of a single rack unit (1U) within a standard 19" ETSI rack, while a 1.5kW (Intensium 1500) battery occupies a half-width unit. When installed, the battery can be handled just like any other plug and play rack-mount equipment, and offers unprecedented flexibility for plant design – with no need for a dedicated battery area in the cabinet, while its high temperature operating capability eliminates the need for an air conditioned environment. Unlike conventional batteries, the Intensium requires no maintenance.

Saft Medium Prismatic (MP) cells have a five-year life at a constant 40C, a 10-year life at a constant 30C, and can operate at temperatures up to 60C. Two strings of 14 MP 176065 HD cells (the largest size in the MP range) are connected in parallel to create a nominal 48V battery, providing a constant 3kW for five minutes.

For more information, visit www.saftbatteries.com

Lishen Battery 17650 Lithium-Ion Batteries

China's Tianjin Lishen Battery Joint-Stock Co. Ltd. has released its 17650 iron-cased, cylindrical, lithium-ion batteries rated at 3.7V with a nominal capacity of 1.3Ah. The devices have a charge voltage of 4.2V, a discharge current of 2.6A, an internal resistance of 70ohms, and an operating temperature range of -20°C to +60°C.



ZIRCAR Compositized 1800C Thermal Insulation

ZIRCAR Ceramics, Inc.'s Alumina Insulation Type AL-28/1800. AL-28/1800 was developed using a new process wherein precisely controlled raw materials are pyrotechnically treated, resulting in a compositized fiber/binder microstructure. This produces a strong, stable product for OEM furnace builders and other producers of ultra high temperature thermal process systems.

AL-28/1800 exhibits a bulk density of 0.44g/cc (28pcf) with a composition of 80% Al₂O₃, 20% SiO₂. At 1800C AL-28/1800 exhibits 3% linear shrinkage and a 1700C sag resistance of 0.2%. Its MOR is 1.82MPa (264psi) with a compressive strength of 1.38MPa (199psi).

AL-28/1800 is now produced in a variety of standard flat boards in sizes up to 18" x 24" x 2". It is easily fabricated into custom insulation components and is readily cemented into "butcher block" furnace roofs.

For more information, visit www.zircarceramics.com.

Exide GNB® DEC200 Charger

Exide Technologies® DEC200 charger is ideal for light-duty, single-shift applications. It automatically starts and stops charging, has simple user controls, and is pre-programmed to fully charge lead-acid batteries with a variety of capacities. The charger's advanced algorithm continuously monitors charge voltage and current, adjusting the charge accordingly. Recharge times can range from 10 to 14 hours depending on the battery capacity.

"The expansion of the 200 Series SCR charger line to include the DEC200 model is evidence of how Exide Technologies supports the continuously evolving needs of its motive power customers," said Neil Bright, president of the industrial energy global business unit.

The DEC200 chargers are designed for standard GNB and Pacific Chloride®

flooded flat plate products used in electric lift trucks. All 200 Series chargers have been tested and approved by UL and CSA.

For more information, including a free copy of the DEC200 technical data sheet (document number GB-4018), call (877) 462-4636.



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from December 2004 ABT

MEETING REPORT

Portable Power Conference and Expo

San Francisco, CA USA
September 12-14, 2004

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Background

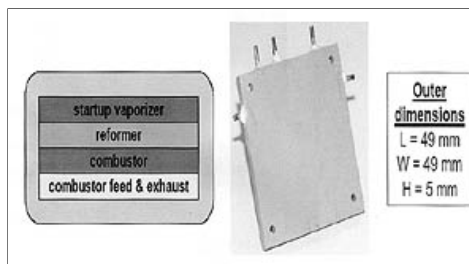
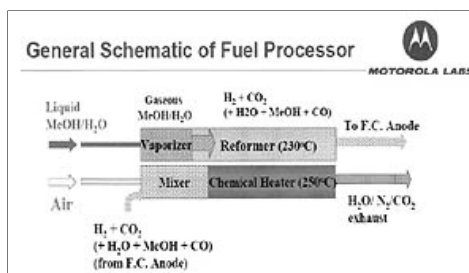
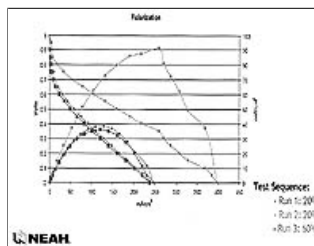
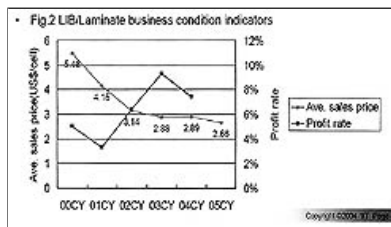
The Portable Power Conference, held this year in San Francisco, California, at the Argent Hotel, has been an annual event for the last ten years. It is produced by TIAX (www.tiax.biz) and IDG (www.idgworldexpo.com). A main objective is to bring together the people in several industries who determine the solutions to power in portable products. This conference continues to take on greater significance each year because increasingly the answer to portable power is becoming a much wider ranging, collective and collaborative problem. At the moment, the potential for new features, capabilities, and functionality in portable devices outstrips the ability to power them in consumer friendly ways. This puts a major obstacle in growth plans for portable device makers. The crux of the issue facing the industry is that energy demand is far greater than battery technology alone can provide, and beyond the best efforts of power management which has been able to make up for the shortfall the last few years.

The new solutions apparently are going to have to be much more widely based, multi-discipline, collaborative and very innovative. It will involve the full hierarchy that plays a part in bringing energy to the end product running from material technologies, components, products, systems and infrastructure.

Among the group of practitioners at this conference are battery manufacturers, fuel cell developers, engineers in power conversion devices, EE's in power management semiconductors, component designers, and portable product OEMs. This Conference is unique in this holistic approach to the issue of portable power, but this accurately reflects the reality of the main issue facing the portable product industry. So, it provides a timely and needed nexus.

From a historical perspective, the portable device market really took off and became an industry unto itself during the 1990s with the advent of portable computers and cellphones. Portable computers went from a separate, barely manageable, piece of luggage to a drop-in article for a brief case and backpack. The cellphone followed a similar path. In 1983 a brick-sized phone was used to make the first call, and when we see 1980 circa movies with these devices (typically used as a status symbol) they seem amusing relics. Both of these products owe a major portion of their success to radical improvements in battery technology. Today, portable products are again at a market juncture. Opportunities for new products, services and markets exist, but only if they can meet consumers raised sense of sensibilities on form factor, ergonomics and convenience. However, this time around, the solution to the energy problem is at a different order of complexity. There is no equivalent Li-ion waiting in the wings.

The conference consisted of presentations, panel discussions, and a vendor exhibition area. The planning of the conference, the venue, the logistics,



Status of the Rechargeable Battery Business

Hideo Takeshita, vice president of the Institute of Information Technology Japan, has established himself as an institution and utility for those who need to closely monitor the immediate pulse of the rechargeable battery business. He slices and dices his extensive data into myriad looks at the business. Sales by chemistry, size, manufacturer, and application are examined from all angles. Here are some key points to take away this year. The 8% increase in cobalt prices are making manufacturers take action to maintain margins, e.g., switching from LiCoO to lower cost alternatives. Sales for 2004 were good, continuing the 11% growth rate of the last four years. However, the projection for 2005 brings that trend to an end. Why? Fundamentals underlying the drop seem to be that high penetration rates have already been achieved in major portable product markets and improved battery performance and quality has reduced battery replacement frequency. With regard to company leadership, Sanyo maintains its top market share followed by Sony and then a cluster of followers — MBI, SDI, BYD, and LG Chemical. The average cell price is at ~\$2.66 leveling from the steeply declining curve of the past. There is still overcapacity in this market. The migration of production to China is still continuing and the contest remains among Japan, Korea, and China. The major OEM battery users are Nokia, Motorola, Samsung, Sony, Dell, and HP. The major applications are notebooks and phones. Digital video, audio, and PDAs represent the next largest device grouping. The best opportunity for major growth for the battery industry may be coming from an entirely different sector than portable products — transportation. Motor assisted bicycles, electric scooters and hybrid electric vehicles (HEVs) may offer the rechargeable battery industry a whole new sector to develop. Toyota is one auto company that is developing Li-ion batteries internally. Sanyo is heavily involved with NiMH for HEVs.

In factoring the long-term direction of the portable battery business, I think three salient forces need to be considered as main drivers: Japanese companies dominate the industry with several large consumer electronic companies vertically integrated in battery technology, a major boost in energy density for portable devices does not appear anywhere on the horizon so Li-ion technology looks like a safe manufacturing bet for a VERY long time to come, and Chinese manufacturing seems to offer the least cost globally for mature battery products.

Battery R&D

Li-ion energy density has shown a 2x improvement in the past decade. This has enabled dramatic developments in portable products. However, we are at the end of that cycle. More modest gains may be possible longer term with new materials such as LiFePO₄ and LiNiMnCoO₂ for cathodes, Sn-coated carbon and Si-based materials for anodes, or with alternate systems like Li-S as developed by Sion Power. Besides energy density, however, research efforts that can have a big influence on the market are lower cost materials, improved safety, and attributes needed for new applications, such as HEVs, e.g., high charge rate acceptance.

An interesting presentation was given by Dr. Steven Visco, V.P. of research, Polyplus Battery on the possibilities for Li/Air and Li/Water cells. Practical cells with 1500 Wh/kg and 3000 Wh/l may be thinkable using high conductivity polymer glass membranes to protect the Li, allowing ions to pass while isolating the Li surface from the runaway reactions typical with these cathode materials. Visco showed engaging videos of lab demonstrations of such cells yielding discharge rates around 1mW/cm².

Developments in Small Fuel Cells

The narrow prospects for energy density improvement in batteries and the seemingly insatiable power demand in portable products continue to drive interest in small fuel cells. MTI Microfuel Cells, Motorola Labs, Neah Power Systems, Sony, and Toshiba contributed to the conference.

Alan Soucy, COO of MTI MicroFuel Cells, limited his presentation to general statements for their passive, neat DMFC battery hybrid and a partnership with Gillette/Duracell for developing fuel cartridges for consumers.

Neah Power Systems' CTO, Leroy Ohlsen (www.neahpower.com), outlined the differentiating technical elements of Neah's small fuel cell technology

program and their marketing plan. A three-dimensional 350 micron thick porous silicon (Si) electrode, flowing electrolyte, form the basis of the system and there are open and closed system versions. The closed system uses an on-board oxidant (hydrogen peroxide) and captures the water for disposal. An open system uses regenerated nitric acid from oxygen. The 3-D porous Si is expected to provide more active catalyst sites than typical carbon-based membranes allowing them to get to their goal of 200 mW/cm² versus 20-50mW/cm². Flowing electrolyte through it eliminates methanol crossover. Carrying the oxidant onboard is definitely a distinguishing approach. While it gives up the weight savings of using oxygen from the air, the resulting closed system eliminates the very troublesome water management problem and confers the battery-like advantage of being able to operate in all kinds of environments without concern about contaminants whether airborne or liquid. With this approach, Neah believes they can still get a two-to-three-time improvement over standard Li-ion battery runtime. On the marketing side, Neah sees the military and select commercial applications as the early adopters. The consumer market follows much later as the technology matures, prices come down, and user behavior patterns are better understood.

— Jerry Hallmark, Motorola Labs' manager of energy technologies, provided an update on their MeOH steam reformer (Gen3) FC approach. The reformer is 5x5x0.5cm and will give their 2.5kg active system (including fuel) a projected gravimetric energy density of 700-1000Whr/kg based on delivering 25W. They have built pilot working models in an effort to get a practical handle on the advantages and problems associated with reformed fuel and direct fuel approaches. The balance of plant consists of air blowers and fuel pump.

Fumio Ueno of Display Devices & Component Control Center, gave an overview of Toshiba's active and passive DMFC programs. Active fuel cells are contemplated for low power wearable devices, e.g., MP3, wireless headsets. Toshiba has a 100mW prototype, 22x56x4.5mm, 8.5g (there is a 9.1mm thick version) which carries 2 ml (1.6g) of MeOH. This is sufficient to power an MP3 player for 20 hours. They have an active DMFC 13W, 270x70x55mm, 1200g with a 100ml fuel cartridge which provides 10 hours of operation of a notebook computer.

Yoshio Nishi, president of Sony's Materials Lab, led the team that commercialized Li-ion in 1991. He summarized the overall position of fuel cells versus batteries. A key starting point in the comparison is that fuel cells typically have poor power density. This is due to the diffusion characteristics of oxygen in the cathode and the high overpotential (a catalyst better than Pt will be needed). Also, low proton conductivity in polymer membrane electrolytes is crippling. So, a hybrid is the most likely technical outcome. The market question is whether the cost of such hybrids, like an FC charger, is acceptable, particularly if the design criteria in areas like safety testing will be equivalent to that imposed on cells.

Power Management

What makes power management difficult is that most piecemeal solutions have been applied and now a top down holistic design approach that incorporates power management in the architecture of the device is necessary. In this type of approach, there is opportunity to effect significant improvement but with that is significant difficulty in executing the full array of options. These include items such as: processors designed specifically for optimal energy usage, dynamic voltage and frequency management, reducing the number of voltages in the system to a minimum, integrated synchronous buck regulators, lowest voltage devices available, shutting down circuits not being used, smart batteries with accurate fuel gauging and low power displays. A breakdown of energy usage in portable computers has 33% going to the display (with 75% of that backlighting), 10% CPU and 10% power supply. The PC Extended Battery Life Working Group started in October 2002 (www.eblwg.org) and has four focus areas: user model research, suppliers recommendations, alternative power and power management.

Portable Product Developments

Portable products represent visions on how life changes when you can connect and disconnect from the information pool when and where you

want. For those of us who read Dick Tracy and have now experienced it, this is a place to look for the next icon of technology's possibilities.

Portable computers represent 27% of the PC market. And the projection is for this to be 50% by 2008. Lower prices, acceptable performance, small footprint are making them an alternative to desktops and playing an increasing role in personal use and entertainment. Tablets are taking hold with a segment of users dubbed "corridor warriors." The device is very similar to notebook computers but has a screen which also functions as an input device. This construction brings unique thermal issues because it has half the volume and surface area of a notebook. Since tablets are designed to be carried, weight and weight distribution are important; battery placement is key. The target is to have three to six hours of battery life.

Handhelds - PDAs and Phones

Cellular subscribers passed the 1 billion mark in 2002 and are projected to be 2 billion by 2006. That means that one-quarter of the world's population will have a phone, with North America and Western Europe accounting for 50% of the users. With many different models in the market today, we will be able to see the emergence of preferences for features and ergonomic form factors in this type of device. Colorful epitaphs of the customer base abound in the cellular marketing world — connected youth, technopreneurs, low mobility misers, and mobile safety netters are some examples. The titles do capture and convey a sense of the market complexity and the difficulty in providing differentiated features and services while maintaining a healthy business footing. The breakdown of market share by company reveals that 70% of the market is in the hands of five makers — Nokia 37%, Motorola 17%, Samsung 9.7%, Siemens 8.5%, Sony-Ericsson 5.2%.

Similarly, PDAs are growing. Sales increased 12% from last year. In portable gaming Sony Playstation and Microsoft PS X, see a doubling in five years. Providing the right content in the right format will be key to opening a number of new markets in handhelds. The success of Apple's iPod is what product designers are looking for. The Table from Strategy Analytics above provides a chronological and evolutionary taxonomy to the portable device world. Also, check Gizmodo.com as a resource for keeping up to date on gadgets, gizmos, and cutting-edge consumer portable electronics.



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Patents

Product News

Previous Issue

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EXCLUSIVES

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Compiled by Eddie T. Seo Littleton, CO, USA seoeddie@gmail.com

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