Extra May, 2008 Date of Issue: May 1, 2008
Superconductivity Web21
Published by International Superconductivity Technology Center
5-34-3, Shimbashi, Minato-ku, Tokyo 105-0004, Japan Tel:+81-3-3431-4002, Fax:+81-3-3431-4044

What's New in the World of Superconductivity (March, 2008)

Power

American Superconductor Corporation (March 4, 2008)

American Superconductor Corporation (AMSC) has received its first orders from the commercial marine market for its proprietary PowerModule-based electrical systems. The systems will be used to manage more than 30 MW of power onboard three mega-yachts and one river cruiser being built in Europe. The orders represent the first shipboard application of AMSC's PowerModule-based integrated electrical systems; the systems will be used to control power flows and regulate voltage while monitoring system performance to maximize efficiency. The electrical systems will be delivered in 2009.

AMSC also recently received an order for its PowerModule power converters and PowerModule System Developer Kit from a Canadian maritime engineering firm. This customer will use AMSC's development kit to interface the PowerModule converters with batteries used to power tugboats, thereby increasing ship efficiency and making them more environmentally friendly.

AMSC's PowerModule converter technology has been used in thousands of systems worldwide for various applications including wind turbines, hydroelectric generators, energy storage systems, fuel cells, utility-grade voltage regulation systems, and military pulsed-power systems. Chuck Stankiewicz, Executive Vice President and general manager of AMSC's Power Systems business unit, commented, "Our use of a proprietary printed circuit board design for power converters with ratings of hundreds of kilowatts is unique. This approach allows us to integrate a microprocessor into the converter, which enables us to program these systems to meet the needs of many end-use applications."

Source:

"AMSC Receives First PowerModule-Based Electrical System Orders for Commercial Marine Applications"

American Superconductor Corporation press release (March 4, 2008)

http://www.amsc.com/newsroom/pr.html?id=278

American Superconductor Corporation (March 19, 2008)

American Superconductor Corporation (AMSC) has received new orders for wind turbine core electrical components and full wind turbine electrical systems from companies in Canada and China. All of these customers are in the process of adopting and scaling up the manufacturing of wind turbines designed by AMSC Windtec. Dongfang Steam Turbine Works (China) placed its first order for the complete electrical systems for four 2.5-MW wind turbines, which the company plans to manufacture and test in early 2009. In addition, AAER, Inc. (Canada) placed an order for the core electrical components for an additional twenty 1.5-MW wind turbines. Finally, CSR Zhuzhou Electric Locomotive Research Institute Co., Ltd. (CSR-ZELRI; China) ordered an additional twenty sets of wind turbine core electrical components, which the company will use in the manufacture of a 1.65-MW wind turbine design

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previously licensed from AMSC Windtec. CSR-ZELRI expects to begin shipping wind turbines in mid-2008 and to manufacture more than 100 turbines in 2009.

These latest orders bring the total amount of wind power to be supported by AMSC products to 6.6 GW. Greg Yurek, AMSC founder and Chief Executive Officer, commented, "The sale of wind turbine core electrical components has, in fact, become a very large fraction of our business. With the customers we signed in 2007 now beginning to order core electrical components to meet their wind turbine manufacturing needs and new licensees and development partners on the near-term horizon, we expect our wind power business to continue to grow and diversify going forward." Approximately 65% of AMSC's revenues in fiscal 2007 (ending March 31, 2008) are expected to come from the global wind industry.

Source:
"AMSC Receives New Orders for Wind Turbine Electrical Components from Canada and China"
American Superconductor Corporation press release (March 19, 2008)
http://www.amsc.com/newsroom/documents/AAER-ZELRI%200108%20-%20Final.doc.pdf

Zenergy Power plc (March 6, 2008)

Zenergy Power plc has been granted an additional German patent related to its low-cost industrial manufacturing process for second-generation HTS materials and wires. This core patent covers the processes and structures used in the production of buffer layers for the second-generation wires; the patent follows an earlier grant for a core patent covering the processes and structures used in the production of the wires' active superconducting layers. These patents are key components of Zenergy's unique 'all-chemical' mass production technique. As the materials utilized in this second-generation-wire manufacturing process are considerably less expensive than those used in existing first-generation-wire manufacturing processes, Zenergy believes that the grant of this core patent is of particular significance to Zenergy's long-term commercial competitiveness.

Source:
"Core Patent for Low Cost 2G HTS Wire Production"
Zenergy Power plc press release (March 6, 2008)
http://www.trithor.com/pdf/press-en/2008-03-06-Core-Patent-2G.pdf

Zenergy Power plc (March 11, 2008)

Zenergy Power plc has received a second commercial order for a full-scale HTS induction heater only six months after its sale of the world's first HTS induction heater. Zenergy's proprietary HTS technology has been adapted and upgraded for this second unit, which will be used for the large-scale, volume-intensive industrial heating of a range of copper and copper alloy metal billets. The new machine will be capable of operating under very demanding and ongoing industrial conditions. The design of this induction heater was completed as a commercial project commissioned by a multibillion-euro global metals producer. Thus, Zenergy has received two commercial orders from two market leading global industrial metals suppliers, serving two separate multibillion euro markets, in just ten months since the completion of the development of the world's first HTS induction heater. Zenergy considers this continuing and rapid commercial adoption of its newly developed HTS induction heater to be a resounding endorsement of the

commercial, economic and environmental benefits enabled by Zenergy's core HTS technology. Initial feedback from the metals industry indicates that the reduced heating times, improved temperature distributions, and increased productivity levels enabled by Zenergy's patented HTS induction heaters make them significantly advantageous when compared to traditional induction heaters based on conventional components.
Source:
"Commercial Order for Full Scale HTS Induction Heater for Copper Processing"
Zenergy Power plc press release (March 11, 2008)
http://www.trithor.com/pdf/press-en/2008-03-11-Copper-IH-Sale.pdf

Magnet

Columbus Superconductors, S.p.A. (March 18, 2008)

Columbus Superconductors, S.p.A. (Italy) has reported the successful testing of a prototype superconducting MgB_2 dipole magnet. The magnet was designed, constructed, and tested as part of the "Marimbo" project supported by the Istituto Nazionale di Fisica Nucleare (INFN; Italy) and involving ASG Superconductors. Columbus Superconductor supplied the kilometer-class MgB_2 superconducting tape required to fabricate the magnet. The magnet was designed by INFN and was wound at ASG Superconductors (Italy). The magnet successfully reached its target of a magnetic field of at least 2 T at its center without the use of a cryogen. At 10 K, the magnetic field reached 2.35 T, with a critical current of 263 A. More informations are available at:
http://www.ge.infn.it/~musenich/marimbo.html
Source:
"Columbus Superconductors S.p.A. reports successful test of a prototype superconducting dipole magnet using long MgB_2 superconductors by INFN-Genoa"
Columbus Superconductors S.p.A. press release (March 18, 2008)
http://www.columbussuperconductors.com/press/Press%20release%2003-2008.pdf

Cryogenics

Eden Energy Ltd. (March 19, 2008)

Eden Energy Ltd. (Australia) has announced that its wholly owned U.S. subsidiary Hythane Company LLC has received a U.S. patent for its liquid hydrogen cryogenic storage vessel, the main application of which will advance the practicality of hydrogen cars by optimizing energy storage through the use of a SMES system (eliminating the need for bulky lithium ion batteries). The SMES system, which can also be applied to traditional hybrids and electric cars as well as hydrogen combustion engines, will be used to capture electrical energy during vehicle braking. Combining fuel storage and the battery into a single unit will enable the range and efficiency of alternative fuel vehicles to be increased, with a much smaller space devoted to fuel storage. For more information, please visit www.edenenergy.com.au or http://www.hythane.com.
Source:

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"Eden Energy Advances Practicality of Hydrogen Cars"
Eden Energy Ltd. press release (March 19, 2008)
http://www.edenenergy.com.au/pdfs/ASX_Announcement%2020080318%20SMES%20Patent.pdf

Fusion

Max Planck Institute of Plasma Physics (March 13, 2008)

The first milestone in the assembly of the Wendelstein 7-X fusion device at the Max Planck Institute of Plasma Physics (IPP), Germany, has been reached on schedule. The first two half-modules of the large-scale experiment have now been completed, and two-tenths of the inner core of the device is now ready and being assembled. While the industrial production of the essential components for the Wendelstein 7-X is almost complete, the actual construction of the complex device will require another six years. Upon completion, the Wendelstein 7-X will be the world's largest stellarator-type fusion device. The core of the stellarator will contain 50 superconducting magnet coils, each of which is about 3.5 meters high. These coils will provide a stable and thermally insulating magnetic cage for the plasma contained by the fusion device. The manufacture of the coils, which was completed in March, has been performed by a German-Italian consortium headed by Babcock Noell GmbH (Germany) and ASG Superconductors S.p.A. (Italy). Twenty planar superconducting coils that will be used to vary the magnetic field have also been completed and delivered (by Tesla, U.K.).
Source:
"Wendelstein 7-X reaches first milestone"
Max-Planck-Institute of Plasma Physics press release (March 13, 2008)
http://www.eurekalert.org/pub_releases/2008-03/haog-w7r031308.php

Basic

Brookhaven National Laboratory (March 13, 2008)

Researchers from the Brookhaven National Laboratory presented two talks at the American Physical Society meeting in New Orleans, Louisiana (March 10 – 14, 2008) on 1) the "pseudogap" phenomenon (the gap in the energy level of a superconductor's electronic spectrum) and 2) the discovery of a two-dimensional fluctuating state of superconductivity in a high-temperature superconductor.

Understanding pseudogap behavior is vital to understanding the mechanism of high-temperature superconductivity and could lead to the strategic design of superconductors for practical applications, such as high-capacity, highly efficient power lines. Brookhaven physicist Hongbo Yang presented results that show how the pseudogap changes at various temperatures and with various levels of doping. Yang summarized, "The results show that the underdoped system in the normal state behaves differently from all regions of the phase diagram in the superconducting state and point to potentially different origins for the pseudogap."

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In a second talk, the discovery of a state of two-dimensional fluctuating superconductivity in a high-temperature superconductor with a “striped” arrangement of electrical charges was reported. The discovery was made during studies on the directional dependence of the material’s electron transport and magnetic properties. In the two-dimensional plane, the material acts as a superconductor at a significantly higher temperature than it does in a three-dimensional state. Brookhaven physicist Qiang Li reported, "The results provide many insights into the interplay between the stripe order and superconductivity, which may shed light on the mechanism underlying high-temperature superconductivity."
Source:
“News From the March 2008 American Physical Society Meeting”
Brookhaven National Laboratory press release (March 13, 2008)
http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=08-20

University of Saskatchewan (March 14, 2008)

Researchers at the University of Saskatchewan (Canada) and the Max Plank Institute (Germany) have identified a new family of superconductors, providing the first experimental proof that superconductivity can occur in hydrogen compounds known as molecular hydrides under high pressures. John Tse, the Canada Research Chair at the University of Saskatchewan, commented, “Our research in this area is aimed at improving the critical temperature for superconductivity so that more efficient new superconductors can be designed operated at higher temperatures.” Researchers have long hypothesized that hydrogen might exhibit superconductive behavior if it could be compressed into a very dense solid form. However, all attempts using pure hydrogen failed. In the present research, the group compressed hydrogen-rich molecules (hydrides) and successfully reached the density required to achieve superconductivity at a much lower pressure than the pressure required to accomplish the same goal using pure hydrogen. This achievement is expected to have a large impact on our understanding of the fundamental nature of superconductivity. The group’s research was published in the March 14 issue of Science.
Source:
“U of S Researcher with International Team Discovers New Family of Superconductors”
University of Saskatchewan press release (March 14, 2008)
http://announcements.usask.ca/news/archive/2008/03/u_of_s_research_35.html

(Akihiko Tsutai, Director, International Affairs Department, ISTEC)

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