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What's New in the World of Superconductivity (October, 2009)

Akihiko Tsutai, Director
International Affairs Division, ISTEC

Power

American Superconductor Corporation (October 13, 2009)

American Superconductor Corporation (AMSC) has announced that the Superconductor Electricity Pipelines, a transmission-level DC superconductor power cable powered by AMSC's HTS wire and high-powered voltage-source AC/DC power converters, has been selected for The Tres Amigas Project. This project represents the first renewable energy market hub in the United States and will, for the first time, unite the three American power grids (or "Interconnections") presently in use. In doing so, the project will not only enable the faster adoption of renewable energy, it will also increase the reliability of the U.S. power grid. At present, power transmission within each of the Interconnections is mainly accomplished using AC power transmission lines. However, power transfer between any two of the Interconnections requires the use of special power electronic conversion stations: AC power in one grid is converted to DC power at a substation and then is reconverted back into AC power before it reaches the adjacent grid, effectively synchronizing the power flows. While several relatively small bilateral "DC Links" are in existence between two Interconnections, all three Interconnections have never been united in a single system.

The Tres Amigas renewable energy market hub will comprise a multi-mile, triangular electricity pathway made of Superconductor Electricity Pipelines capable of transferring and balancing several gigawatts of renewable power among the three Interconnections. Multiple power transmission lines from each of the Interconnections will feed power into the Tres Amigas SuperStation through multiple AC/DC converters, each connected by DC superconductor cables. The Tres Amigas hub will be a merchant transmission system and will charge a fee for the usage of the power hub. Tres Amigas, LLC has leased the land required for the power hub and is now in the process of filing with the Federal Energy Regulatory Commission for a declaratory order stating that the transmission lines will not fall under the jurisdiction of the FERC.

Upon the project's approval, AMSC will provide transmission planning services, superconductor wire, and the superconductor cable system required for the project. AMSC expects to partner with other superconductor power cable and system component companies to manufacture the cable system to AMSC's specifications. AMSC has a minority equity interest in Tres Amigas, LLC that was acquired for $1.75 million in cash and AMSC stock. It will also hold one of four seats on the Board of Directors of Tres Amigas, LLC.

Source:
"Superconductor Electricity Pipelines to be Adopted for America's First Renewable Energy Market Hub"

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American Superconductor Corporation press release (October 13, 2009)
http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1341168&highlight

American Superconductor Corporation (October 20, 2009)

American Superconductor Corporation (AMSC) has received two orders for its D-VAR® grid interconnection solution to be used in two separate wind farms presently under construction in Australia. The orders were received from Suzlon Energy Australia Pty. Ltd., a subsidiary of India's Suzlon Energy Limited, and Consolidated Power Projects Australia Pty Ltd. for a 132-MW and a 111-MW wind farm, respectively. Both D-VAR systems will be used to meet local grid interconnection requirements and will be delivered within the next six months. AMSC expects that Australia will continue to be a sizable market for its D-VAR solution, as the country recently set a target of deriving 20 % of its electricity needs from renewable sources by the year 2020.

Source:
"AMSC Signs Additional Power Grid Contracts in Australia"
American Superconductor Corporation press release (October 20, 2009)
http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1343855&highlight

CVD Equipment Corporation (October 21, 2009)

CVD Equipment Corporation has announced that SuperPower, Inc., a wholly owned subsidiary of Royal Philips Electronics N.V., has received a second Reel-to-Reel MOCVD deposition system for the production of its second-generation HTS wire. The customized system uses an advanced reel-to-reel material handling system and a precise metal organic chemical vapor deposition (MOCVD) chamber. John Dackow, SuperPower Director of Operations, stated, "After exhaustive review, CVD was selected to provide our first MOCVD system because we needed a partner who could both think creatively about overall system design, and provide the necessary MOCVD process and system know-how to deliver on our challenging specifications. After taking delivery of the first unit in 2004, it was clear that we had made the right choice. The selection of CVD to provide the follow-on unit was without question."

Source:
"SuperPower takes delivery of a second Reel-to-Reel MOCVD system from CVD Equipment Corporation"
CVD Equipment Corporation press release (October 21, 2009)
http://www.cvdequipment.com/investors/pressreleases/2009/1021/

Zenergy Power plc (October 26, 2009)

Zenergy Power plc and its industrial manufacturing and sales partner Bültmann GmbH have received another order for a low-energy/high-productivity superconductor induction heater. A major industrial producer of metal goods requiring the volume-intensive heating of copper alloy billets has purchased Zenergy's Magnetic Billet Heater, becoming the fourth industrial metals producer to consider the superconducting technology as being commercially favorable over conventional induction heater technology. Operating data from Zenergy's first induction heater customer, Weseralu GmbH, has confirmed that using the high-efficiency superconducting heater reduces the amount of electricity consumes during billet heating by 50 % while simultaneously increasing productivity levels by 25 %.

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Source:
"Induction Heater Order"
Zenergy Power plc press release (October 26, 2009)
http://www.zenergypower.com/images/press_releases/2009/2009-10-26-Induction-Heater-Order.pdf

American Superconductor Corporation (October 29, 2009)

American Superconductor Corporation (AMSC) has reported its financial results for its second fiscal quarter ending September 30, 2009. Revenues for the second quarter of fiscal 2009 were $74.7 million, an 85 % increase from the $40.4 million reported during the same period during the previous fiscal year. The gross margin was 38.9 %, compared with 26.5 % for the same period in the previous fiscal year. The GAAP net income for the quarter was $4.3 million, compared with a GAAP net loss of $4.1 million for the same period in the previous fiscal year. The non-GAAP income was $8.7 million, compared with a non-GAAP loss of $1.4 million for the same period in the previous fiscal year. As of September 30, 2009, AMSC had $141.1 million in cash, cash equivalents, marketable securities, and restricted cash and a reported backlog of approximately $587 million. Greg Yurek, AMSC's founder and chief executive officer, commented, "Our team executed extremely well on all fronts, and we exceeded all of our financial objectives for the second fiscal quarter. In addition to the 3 MW core electrical component contract we signed with Sinovel Wind Co., Ltd. valued at more than $100 million, our second-quarter bookings also included electrical system orders from several other wind turbine customers and a series of power grid sales in Australia, China, the United Kingdom and the United States. This positions us for continued strong growth in the second half of our fiscal year, and we have therefore increased our forecasts for revenues and net income for full year fiscal 2009." The company is increasing its full year revenue guidance from a range of $260 million – $270 million to a range of $300 million – $310 million.
Source:
"AMSC Reports Second Quarter Fiscal Year 2009 Financial Results"
American Superconductor Corporation press release (October 29, 2009)
http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1348198&highlight

Magnet

National High Magnetic Field Laboratory (October 13, 2009)

The Applied Superconductivity Center at the National High Magnetic Field Laboratory has received US $1.2 million in funding from the U.S. Department of Energy to understand and enhance the superconducting material known as BSCCO-2212; this material is expected to contribute to the fabrication of extremely powerful magnets for numerous research applications. BSCCO-2212 is unique among high-temperature superconductors in that it can be made into flexible round wires, simplifying the winding of superconducting magnets. The goal of the funded research will be to explore the performance limits of BSCCO-2212 and to construct superconducting research magnets that are much more powerful than those currently made from niobium-based materials. The funding is part of a larger $4 million award, administered over two years, to the Very High Field Superconducting Magnet Collaboration. Other institutions participating in this collaboration include Brookhaven National Laboratory, Fermilab, Lawrence Berkeley National Laboratory, the National

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Institute of Standards and Technology, and Texas A&M University.
Source:
"Magnet Lab Receives Funds to Investigate Promising Superconductor"
National High Magnetic Field Laboratory press release (October 13, 2009)
http://www.fsu.com/News/Magnet-Lab-Receives-Funds-to-Investigate-Promising-Superconductor

Sensor

Forschungszentrum Jülich (October 19, 2009)

Researchers at the research center Forschungszentrum Jülich in Germany have developed a prototype for a new device capable of detecting explosive liquids during airport security checks. Using this device, liquid explosives and liquid components of potential explosives can be identified in less than a second, making this technique much faster as well as much more reliable than existing methods. The device in question utilizes a special type of spectroscopy to analyze substances using electromagnetic radiation. Conventional spectrometers are limited to a narrow range of electromagnetic radiation frequencies and thus cannot reliably distinguish harmless liquids from potentially harmful liquids. The device developed at the Jülich research center, known as a "Hilbert spectrometer", uses Josephson contacts to perform measurements over a wide range of frequencies within only 200 ms. Thus, a detailed molecular fingerprint can be produced for each measurement, allowing immediate comparison with reference data on dangerous liquids. The prototype has been successfully tested, and the researchers are now working to miniaturize and optimize the equipment. The group's accomplishments to date were reported in the science journal *Superconductor Science and Technology*.
Source:
"New Detector for Dangerous Liquid"
Translated from a press release (in German) from Forschungszentrum Jülich (October 19, 2009)
http://www.fz-juelich.de/portal/index.php?cmd=show&mid=734&index=163

Medical

Manhattan Scientifics (October 20, 2009)

Manhattan Scientifics has entered into a non-binding letter of intent (LOI) with Dr. Edward R. Flynn and his company, Senior Scientific, LLC, to acquire all the manufacturing and marketing rights as well as the commercial rights associated with Dr. Flynn's patents and IP in the field of nanomedicine. Dr. Flynn's work focuses on the biomagnetic detection of cancer and other disease using sensors based on SQUIDs (superconducting quantum interference devices) and magnetic nanoparticles that specifically target cancer cells. This novel biomagnetic imaging technique can identify and image small clusters of cancer cells, substantially improving the detection of cancer at an early stage and without requiring ionizing radiation or large magnetic fields. This imaging method should be useful for the detection of breast, ovarian, leukemia, prostate, skin melanoma, and other forms of cancer. A definitive agreement between Dr. Flynn and Manhattan Scientifics is expected within 60 days.
Source:

"Manhattan Scientifics Signs LOI To Acquire Rights To Early Cancer Detection System Developed By Dr. Edward R. Flynn"
Manhattan Scientifics press release (October 20, 2009)
http://www.mhtx.com/releases/press-release-76.htm

Manhattan Scientifics (October 27, 2009)

Manhattan Scientifics and Senior Scientific, LLC, have begun cooperating to commercialize Senior Scientific's nanomedicine cancer detection technology. Together, the two companies have filed a patent application with the U.S. Patent Office and have begun to lay the groundwork for enhancing commercialization. Dr. Edward Flynn, President of Senior Scientific and inventor of the imaging system, commented, "Senior Scientific will maintain its full facilities and staff at the University of New Mexico Technology Park. We are fully funded through NIH research grants, and will continue to pursue and advance our novel technology in early cancer detection. Manhattan Scientifics will employ its own assets to commercialize our technology for the benefit of both our organizations."
Source:
"Manhattan Scientifics And Senior Scientific Collaborate To Enhance Early Cancer Detection System: Provisional Patent Filed"
Manhattan Scientifics press release (October 27, 2009)
http://www.mhtx.com/releases/press-release-77.htm

Electronics

Hypres Inc. (October 20, 2009)

Hypres Inc. has received five patents from the United States Patent and Trademark Office; each of the patents is related to advancements in digital and mixed signal superconductor circuits and applications. Hypres is presently using this technology to produce the world's fastest integrated circuits for applications including wireless communications and signal intelligence, advanced computing, metrology/instrumentation, and biomedical imaging. In fact, a series of Digital-RF™ prototypes have already been constructed for a variety of military and commercial applications. The superconducting properties of the niobium circuits have enabled the integrated circuits to operate at clock speeds of 40 GHz in fielded systems and speeds of over 100 GHz in the laboratory. Richard Hitt, Hypres CEO, commented, "In recent years, Hypres has aggressively pursued an IP growth strategy to enhance our value proposition and better serve new markets with new applications. The patents secure our position as the leading developer of digital superconductor solutions and broadens our licensing potential with partners." To date, Hypres has received more than 20 U.S. patents related to digital superconductor circuits, system architecture, and fabrication techniques and has approximately 40 U.S. and international patents pending and another 20 inventions in various stages of development.
Source:
"Hypres Receives Five Patents Related to Advancements in Digital and Mixed Signal Superconductor Circuits and Applications"
Hypres Inc. press release (October 20, 2009)

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http://www.hypres.com/

Fusion

Oxford Instruments (October 2, 2009)

Oxford Instruments has been selected to supply an additional 9 tonnes of superconducting wire, valued at approximately £5 million, for the International Thermonuclear Experimental Reactor (ITER) development, a joint international research and development project to investigate fusion power as an alternative energy source. The Oak Ridge National Laboratory and UT Battelle approved the order on behalf of the United States ITER project office. The first deliveries are scheduled to occur in the fiscal year beginning April 2010 and will be made over a two-year period. Oxford Superconducting Technology, USA, a wholly owned subsidiary of Oxford Instruments, will supply the actual wire. This order was made in addition to an order announced last July for 58 tonnes of superconducting wire, valued at £30 million, from the European procurement agency for ITER.

Source:
"Oxford Instruments wins second ITER contract"
Oxford Instruments press release (October 2, 2009)
http://www.oxinst.com/news/Pages/news.aspx

Luvata (October 5, 2009)

Luvata has received a $26 million contract for high-grade superconductive material from the U.S. Department of Energy for the supply of materials to be used in ITER. The contract represents 86 % of the US commitment for the superconductive wire and copper wire required to complete ITER. The technical requirements of the superconductors that will be used in ITER are extremely precise, requiring a customized alloy mix and ultra-high tolerance manufacturing. The actual wires will be delivered over the next two years. Luvata has also supplied superconductors for the KSTAR experimental nuclear fusion reactor in South Korea as well as superconductive wires for medical diagnostic systems, high-energy physics projects, and related applications.

Source:
"Luvata cements position as leading global superconductor specialist with third nuclear fusion win"
Luvata press release (October 5, 2009)
http://www.luvata.com/en/News-Room/Press-Releases/Luvata-cements-position-as-leading-global-superconductor-specialist-with-third-nuclear-fusion-win--a-26-million-contract-from-US-Dept-of-Energy/?backurl=/en/News-Room/Press-Releases/

Basic

University of Texas at Dallas (October 9, 2009)

Researchers at the University of Texas at Dallas, Clemson University, and Yale University are collaborating to develop superconducting wires made from nanotubes that are capable of superconducting at the temperature of liquid nitrogen or higher. The group has received a US $3

million research grant from the Air Force Office of Scientific Research for a 5-year project to develop these new superconducting wires using carbon nanotubes or other nanotubes enhanced with atoms such as boron, nitrogen, or sulfur. The project will also tackle the technical challenges associated with fabricating such wires at commercially viable rates. Dr. Myron Salamon, dean of the School of Natural Sciences and Mathematics at the University of Texas at Dallas, commented, “There’s always been a sense that we can enhance superconductivity by using lighter materials. Wires made from ultra-light nanotubes can allow atoms to vibrate easily, which helps with superconductivity. There’s good evidence that carbon-based materials, like dopant modified carbon nanotubes, might make good superconductors.”
Source:
“Race for New Superconductors Shrinks to Nanoscale”
University of Texas at Dallas press release (October 9, 2009)
http://www.utdallas.edu/news/2009/10/09-001.php

Brookhaven National Laboratory (October 29, 2009)

Researchers at the U.S. Department of Energy’s Brookhaven National Laboratory have used a precision technique for making superconducting thin films in a layer-by-layer manner to identify a single layer responsible for the origin of superconductivity in a copper oxide superconductor. Initially, the group set out to determine how thin a superconducting film could be and still retain its superconductivity. Thinner materials have greater application potentials in devices where the superconductivity is controlled by an external electric field. To explore how thin a superconductor could be and still retain its superconductivity, the group systematically synthesized a series of high-temperature superconducting cuprates with a small amount of zinc (which suppresses superconductivity in these materials) doped into some of the layers. In this manner, any layer where the presence of zinc suppressed the thin film’s superconductivity would be identified as being essential to the superconductivity in that film. The researchers observed that the zinc doping had no effect except when it was placed in a single, well-defined layer, in which case the thin film’s superconductivity was dramatically suppressed. The layer in question corresponded to the second copper-oxide layer away from a metallic/insulating interface. When zinc was included in this layer, the transition temperature dropped from about 32 K to 18 K, clearly indicating that this particular layer is responsible for the relatively high transition temperature of this material. This technique could potentially be used to engineer ultrathin films with “tunable” superconductivity for use in highly efficient electronic devices. The group’s results were published in the October 30, 2009, issue of *Science*.
Source:
“Pinning Down Superconductivity to a Single Layer”
Brookhaven National Laboratory press release (October 29, 2009)
http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=1020

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