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

Power

American Superconductor Corporation (September 9, 2008)

American Superconductor Corporation (AMSC) has launched its proprietary PowerModule PM3000W power converter. This highly scalable solution is designed for rapid integration into 750-kW to 6-MW wind turbines. Timothy Poor, AMSC's Vice President of Global Sales and Business Development, commented, "The PM3000W is the world's first power converter building block developed specifically for bridging the needs of both wind turbine generators and grid connection. This unique converter is a fully programmable, flexible and modular power converter platform that provides universal generator connectivity, and can be utilized within virtually any megawatt-class wind turbine. This revolutionary solution has also been designed to withstand the severe changes in climate and poor power grid conditions that are often encountered at remote wind farms." The PM3000W has passed extensive factory and field testing in operating wind farms, and pre-launch orders for more than 3,300 PM3000W converters have already been booked from customers in Canada (AAER Inc.), China (Sinovel Wind, CSR-ZELRI and Dongfang Steam Turbine Works), Germany (Fuhrlander AG) and India (Ghodawat Industries). The first PM3000W converter was shipped in September 2008.
Source:
"AMSC Launches PowerModule PM3000W Converter for the Wind Power Market"
American Superconductor Corporation press release (September 9, 2008)
http://phx.corporate-ir.net/phoenix.zhtml?c=86422&p=irol-newsArticle_Print&ID=1194966&highlight

Zenergy Power plc (September 29, 2008)

Zenergy Power plc has announced that its German subsidiary, Zenergy Power GmbH, has entered into a 5-year joint development agreement with Honeywell Specialty Products, a global leader in high-performance specialty material production. Together, the two companies will work to develop a range of chemical precursors to be used in Zenergy's unique industrial scale 'all-chemical' manufacturing process for the volume production of second-generation HTS wire. Honeywell's decision to partner with Zenergy endorses not only the Group's unique second-generation HTS wire production techniques, but also the potential scale of the overall second-generation wire market. Zenergy has already developed an innovative reel-to-reel 'all chemical' deposition process for the mass manufacture of second-generation HTS wire. Once finalized, the process is widely expected to become the most cost-effective and efficient manufacturing process available for second-generation HTS wire. By teaming with Honeywell, Zenergy will gain a strong collaborator from the chemical industry with complementary expertise to further develop superior methods of chemical processing as well as securing a supplier of high-quality and substantial quantities of the chemical precursors that will be needed for the predicted scale-up of second-generation HTS wire production. Michael Fitzgerald, Chairman of Zenergy Power, commented: "This agreement is another major step forward

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for us towards the industrialization of 2G HTS wire. With our two major industrial partners, ThyssenKrupp VDM and Honeywell, we are confident we will establish the secured industrial supply chain required for the large-scale renewable generator market."
Source:
"Zenergy Signs Joint Development Agreement with Honeywell"
Zenergy Power plc press release (September 29, 2008)
http://www.zenergypower.com/images/press_releases/2008-09-29-joint_development_agreement_with_honeywell.pdf

Accelerator

CERN (September 10, 2008)

The first beam to be produced in the Large Hadron Collider (LHC) at CERN has been successfully steered around the 27-km tunnel of the world's most powerful particle accelerator. This historic event marks a key moment in the 20-year history of the LHC's development and construction. Over the next few weeks, the machine's acceleration systems will be brought online and beam collision will begin, allowing four major research programs to finally be started. After a period of measurement and calibration, the LHC's research programs are expected to begin yielding new results in about a year. CERN Director General Robert Aymar commented, "The LHC is a discovery machine... its research program has the potential to change our view of the universe profoundly, continuing a tradition of human curiosity that's as old as mankind itself."
Source:
"First beam in the LHC – accelerating science"
CERN press release (September 10, 2008)
http://press.web.cern.ch/press/PressReleases/Releases2008/PR08.08E.html

Thomas Jefferson National Accelerator Facility (September 15, 2008)

The Thomas Jefferson National Accelerator Facility (Jefferson Lab) has received approval from the U.S. Department of Energy (DOE) to begin construction on a $310 million project to upgrade the 12-GeV Continuous Electron Beam Accelerator Facility (CEBAF). This upgrade has been a high priority for the DOE's Office of Science since it published a landmark report, "Facilities for the Future of Science: A Twenty Year Outlook" in 2003. The approval to proceed with construction concludes an exhaustive, multi-year review process that clearly established the scientific need, merit and quality of the 12-GeV CEBAF upgrade project. The project will involve doubling the energy of the facility's accelerated beam from 6 GeV to 12 GeV, the construction of a new experimental hall, and equipment upgrades in the three existing experimental halls. The construction funds have been requested in the President's Fiscal Year 2009 Budget Request, and the project should be completed in 2015.
Source:
"DOE's Jefferson Lab receives approval to start construction of $310M upgrade"
Thomas Jefferson National Accelerator Facility press release (September 15, 2008)
http://www.jlab.org/news/releases/2008/CD-3Approval.html

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CERN (September 20, 2008)

An incident resulting in a large helium leak has occurred during the high-current commissioning (without beam) of the Large Hadron Collider (LHC)'s final sector (sector 3-4) for operation at 5 TeV. Preliminary investigations suggest that the problem was likely caused by a faulty electrical connection between two magnets, which probably melted—causing a mechanical failure. The sector will need to be warmed to allow repairs to be made, resulting in a minimum downtime of two months in the LHC's operations. Further details will be made available as soon as they are known.

Source:
"Incident in LHC sector 3-4"
CERN press release (September 20, 2008)
http://press.web.cern.ch/press/PressReleases/Releases2008/PR09.08E.html

CERN (September 23, 2008)

Investigations at CERN have indicated that the most likely cause of the incident that led to a helium leak in a sector of the Large Hadron Collider (LHC) was a faulty electrical connection between two of the accelerator's magnets. Before a definite cause can be established, however, the sector will need to be warmed to room temperature, a process that will require three to four weeks. Further details will be made available once the magnets have been opened up for inspection. CERN Director General Robert Aymar commented, "Coming immediately after the very successful start of LHC operation on 10 September, this is undoubtedly a psychological blow. Nevertheless, the success of the LHC's first operation with beam is testimony to years of painstaking preparation and the skill of the teams involved in building and running CERN's accelerator complex. I have no doubt that we will overcome this setback with the same degree of rigor and application." The time required to investigate the incident and make repairs precludes a restart before CERN's obligatory winter maintenance period, bringing the restart date to early spring 2009. LHC beams will once again be produced at that time.

Source:
"LHC re-start scheduled for 2009"
CERN press release (September 23, 2008)
http://press.web.cern.ch/press/PressReleases/Releases2008/PR10.08E.html

Basic

Massachusetts Institute of Technology (September 3, 2008)

Researchers at the Massachusetts Institute of Technology (MIT) may have found a way to overcome a key barrier to the advent of super-fast quantum computers. The group has developed a technique called amplitude spectroscopy that can be used to characterize quantum entities over extraordinarily broad frequency ranges. This procedure is expected to be useful for studying the properties of superconducting artificial atoms, an important task in the development of quantum computers. By probing the response of a superconducting artificial atom to a single, fixed frequency strategically chosen to be "benign", amplitude spectroscopy can be used to characterize the resulting interference patterns, known as "spectroscopy diamonds", thereby revealing the artificial

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atom's energy spectrum. The group's research was published in the September 4 issue of *Nature*.
Source:
"MIT probe could aid quantum computing"
Massachusetts Institute of Technology press release (September 3, 2008)
http://web.mit.edu/newsoffice/2008/artificial-atom-0903.html

University of Montreal (September 11, 2008)

Researchers at the Paul-Scherrer Institute (PSI) in Switzerland and international colleagues have shown that, contrary to previous belief, superconductivity can induce magnetism. Using the Swiss spallation neutron source (SINQ) of the Paul-Scherrer Institute (PSI) in Villigen, Switzerland, an international research group has found a superconductor that displays two fascinating quantum properties: first, the material exhibits a magnetic order while it is in its superconducting state; and second, the SINQ's experiments show that the electron pairs that form in the superconducting state have a non-zero momentum, contrary to observations in all other known superconductors. Such a state has been theoretically predicted but has never before been microscopically detected. The superconductor in question is $CeCoIn_5$, a metal compound consisting of cerium, cobalt, and indium. When cooled to close to absolute zero, this material exhibited both magnetism and superconductivity simultaneously; furthermore, both of these phenomena disappeared at the same time when the sample was heated or the magnetic field was increased. This extraordinary discovery shows that, at least in this unique case, magnetism and superconductivity do not compete with each other and instead, superconductivity generates magnetic order. Michel Kenzelmann, a scientist at the Paul Scherrer Institute and a professor at the Swiss Federal Institute of Technology Zurich, commented, "Our work finally offers the possibility of understanding how superconducting pairs are formed in materials where this is caused by a magnetic interaction. We also hope that our results will allow the development of new technological applications in the near future." The group's results were published in the September 11 edition of *Science*.
Source:
"Superconductivity can induce magnetism"
University of Montreal press release (September 11, 2008)
http://nouvelles.umontreal.ca/content/view/1696/125/

Cornell University (September 19, 2008)

Researchers at Cornell University and colleagues at the Brookhaven National Laboratory and in Japan have, for the first time, described the activity of electrons in the mysterious "pseudogap" of high-temperature superconductors. The researchers experimentally observed that while electrons in the pseudogap state can form pairs, most of these pairs are locked into fixed locations in the crystal lattice, preventing superconductivity. Using an extremely precise scanning tunneling microscope, the researchers examined BSCCO superconductors doped at various levels; the pseudogap was observed at doping levels of between 5 – 15%. Within this doping range, some electron pairs became locked into fixed positions in the crystal lattice, while others continued to move freely. As the doping percentage decreased, the number of locked-in pairs increased. Breaking apart the locked pairs requires more energy than breaking apart the moving pairs. In theory, the more tightly bound the electron pairs are, the more they resist being pulled apart as the temperature rises. The group's experimental observations await further theoretical explanation. However, many researchers believe

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that understanding the pseudogap is a key step in achieving room-temperature superconductivity. The research was reported in the Aug. 28 issue of *Nature*.
Source:
“Atomic-scale structure of the 'pseudogap' revealed in high-temperature superconductors”
Cornell University press release (September 19, 2008)
http://www.news.cornell.edu/stories/Sept08/pseudogap.ws.html

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

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