Extra February, 2009 Date of Issue: February 2, 2009
Superconductivity Web21
Published by International Superconductivity Technology Center
1-10-13 Shinonome Koto-ku, Tokyo 135-0062, Japan Tel:+81-3-3536-7283, Fax:+81-3-3536-7318

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

Power

Superconductor Technologies Inc. (December 2, 2008)

Superconductor Technologies Inc. (STI) has signed a five-year Cooperative Research and Development Agreement (CRADA) with the U.S. Department of Energy (DOE)'s Los Alamos National Laboratory (LANL) for the joint development of a commercial production process for HTS power applications. A CRADA enables both participating parties to share knowledge, personnel, and facilities while conducting mutually beneficial research and development. Jeff Quiram, STI's president and chief executive officer, commented, "This CRADA with LANL is an important milestone in our collaboration to jointly develop technology intended to commercialize high-performance, low-cost HTS coated conductors. STI's proprietary deposition techniques may offer an accelerated route to cost effective improvements in second-generation HTS cable production, providing answers to both the technical challenges and reduced costs needed to accelerate the commercial deployment for HTS cable. We are excited to be utilizing our world class expertise in cryogenics and HTS materials development for solutions for power transmission."

Source:

"Superconductor Technologies and Los Alamos National Laboratory Sign Cooperative Research and Development Agreement"

Superconductor Technologies Inc. press release (December 2, 2008)

http://phx.corporate-ir.net/phoenix.zhtml?c=70847&p=irol-newsArticle&ID=1231586&highlight

Zenergy Power plc (December 8, 2008)

Zenergy Power plc and its collaborative partner for wind and hydropower applications, Converteam SAS, have announced that their first full-scale HTS coil for renewable power generation has been completed and successfully validated. The coil will be used in the construction of the world's first HTS-based hydroelectric power generator (rated at 1.7 MW), which has been ordered for commercial use by E.ON Wasserkraft GmbH.

Zenergy will now begin the construction of the 32 additional full-scale coils that are required for this application at their facilities in Germany. The HTS hydro-generator itself will be manufactured at Converteam's facilities in the United Kingdom and will then be installed in a commercial hydro-dam in Germany sometime in 2009. The improvement in energy efficiency enabled by the HTS technology is expected to increase the overall power output of the dam by 36 %. Once installed, the HTS generator will act as the hydro-dam's 'pole' generator and will be responsible for the constant delivery of base-load power to over 3,000 local homes.

Source:

"Successful Testing and Validation of the World's First Full-Scale HTS Coil for Renewable Power Generation"

Zenergy Power plc (December 8, 2008)

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http://www.zenergypower.com/images/press_releases/2008-12-08-Hydro-Coil.pdf

Zenergy Power plc (December 17, 2008)

Zenergy Power plc has announced its participation in POSEIDON, a €21.5 million maritime propulsion project funded by the European Commission. As part of its contribution to this project, Zenergy will receive funding to develop a range of HTS motors and generators for deployment in commercial all-electrical ships. The project will begin in January 2009 with the production of a land-based scaled demonstration of an integrated electrical ship; the demonstration will include a selection of HTS materials and components, as well as other advanced technologies. Together, Converteam SAS and Zenergy will supply the enabling second-generation HTS components and coils required for the demonstration's motors and generators. The project is expected to last four years and includes over 30 participants. Jens Müller, CEO of Zenergy, commented, "I am delighted that we are able to apply our technology to this project which sees our first move into the maritime market. In particular this demonstrates that by focusing on core HTS technology development we are able to enter into new global markets without having to make significant resource investments in research and development."

The European Commission believes that the wider deployment of all-electric ships would significantly reduce CO_2 emissions generated by the shipping industry (A United Nations report attributed 3.6 % of the world's total CO_2 emissions in 2008 to the shipping industry). The main barrier to the adoption of all-electric ships, as identified by the Commission, is the size of the electrical equipment required. HTS technology is expected to make a significant contribution to overcoming this obstacle and enabling the all-electric ship concept to be adopted by a wide range of merchant ships.

Source:
"HTS Ship Propulsion Grant European Commission Project"
Zenergy Power plc press release (December 17, 2008)
http://www.zenergypower.com/images/press_releases/2008-12-17-poseidon.pdf

Accelerator

CERN (December 5, 2008)

CERN has confirmed that the Large Hadron Collider (LHC) will be restarted in 2009, with new collision data expected by the summer of 2009. An updated report concerning the malfunction that occurred in September 2008, which led to the LHC's shutdown, confirmed that the initial malfunction was caused by a faulty electrical connection between two of the accelerator's magnets. This electrical fault subsequently led to mechanical damage and the release of helium from the magnet cold mass into the LHC's tunnel. Detailed studies of the malfunction have enabled engineers to identify a means of preventing similar incidents from occurring in the future. As a result of the incident, 53 magnets will need to be removed from the tunnel for cleaning or repair; 28 of these magnets have already been removed, and the first two replacement magnets have been installed. The present schedule foresees the installation of the final magnet by the end of March 2009, with the completion of the cool-down process by the end of June.

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Source:
"LHC to restart in 2009"
CERN press release (December 5, 2008)
http://press.web.cern.ch/press/PressReleases/Releases2008/PR17.08E.html

Science and Technology Facilities Council (December 16, 2008)

The Science and Technology Facilities Council (United Kingdom) has reported that UK scientists have successfully recovered energy from the ALICE advanced particle accelerator. This is a promising step toward new accelerators that use a fraction of the energy required by conventional methods. Using a superconducting linear accelerator, electrons were accelerated to 99.9 % of the speed of light; this created a beam with a total energy of 11 million electron volts. The event marked the first time that the ALICE beam had been successfully transported around its entire circuit.

ALICE is the first accelerator in Europe to use an energy recovery process, capturing and reusing the beam energy after each circuit. This energy recovery step enables either a huge energy savings or light sources and colliders of much larger power and intensity for the same power usage required by conventional accelerators. Further work to validate the design fully and to quantify the recovered energy is ongoing.
Source:
"A European first as ALICE achieves energy recovery at 11 million volts"
Science and Technology Facilities Council press release (December 16, 2008)
http://www.scitech.ac.uk/PMC/PRel/STFC/ALICErecovery.aspx

Basic

Brookhaven National Laboratory (December 1, 2008)

Researchers at the U.S. Brookhaven National Laboratory (BNL) and collaborators at the National Institute of Standards and Technology (NIST) and in Germany have observed two-dimensional (2-D) superconductivity in a material (LBCO with a barium to copper ratio of 1:8) where three-dimensional (3-D) superconductivity had disappeared. Importantly, the 2-D superconductivity emerged at a higher temperature (40 K) than ordinary 3-D superconductivity in other forms of the material. The presence of the 2-D superconductivity was suggested by the measurement of electrical resistance parallel and perpendicular to the planes of the layered LBCO material. At a particular temperature, a large drop in resistance was detected when the current was flowing parallel to the layers, but not when it was flowing perpendicular to them. In addition, the onset of weak "diamagnetism", or the Meissner effect, was also observed in 2-D, but not in 3-D. BNL physicist John Tranquada commented, "Our basic research goal is to understand why and how these materials act as superconductors. The ultimate practical goal would be to use that understanding to develop improved bulk superconductors—ones that operate at temperatures warm enough to make them useful for real-world applications such as high-efficiency power lines." The research was published in the November 2008 issue of *Physical Review B*.
Source:

"Disappearing Superconductivity Reappears—in 2-D"
Brookhaven National Laboratory press release (December 1, 2008)
http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=865

University of Bristol (December 11, 2008)

Researchers at the University of Bristol have performed an innovative experiment that has yielded new information concerning the metallic state from which high-temperature superconductivity emerges. Ultra-high pulsed magnetic fields were used to destroy the superconductivity in a material and then to "follow" the form of electrical resistance down to temperatures close to absolute zero. They found that as superconductivity becomes stronger, so does the scattering that causes the resistance in the metallic host from which superconductivity emerges. At a specific point, however, the interaction that promotes high-temperature superconductivity gets so strong that it ultimately destroys the electronic states from which the superconducting pairs form. These observations are expected to help theorists develop a more complete theory explaining the properties of high-temperature superconductors. The next challenge will be to identify the exact nature of the destructive interaction and to perhaps develop methods of avoiding this destructive behavior. Such knowledge could contribute importantly to the development of room-temperature superconductors. The group's results were published in *Science Express*, an online rapid access service for important publications in *Science*.
Source:
"Breakthrough experiment of high-temperature superconductors"
University of Bristol press release (December 11, 2008)
http://www.bris.ac.uk/news/2008/6060.html

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

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