

What's New in the World of Superconductivity (December, 2010)

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Power

Bruker Energy and Supercon Technologies, Inc. (December 1, 2010)

Bruker Advanced Supercon GmbH and Bruker HTS GmbH (both subsidiaries of Bruker Energy & Supercon Technologies, Inc. [BEST]), AREVA Energietechnik GmbH (a subsidiary of Schneider Electric/Alstom Grid) and Stadtwerke Augsburg Energie GmbH jointly announced the approval of a grant from the German Federal Ministry of Economics and Technology (BMWV) for the development and demonstration of a novel shielded inductive superconducting fault current limiter (iSFCL) in an electrical grid in Augsburg, Germany. The three-year project, which began in October 2010, has a total budget of €7.7 million (approximately US \$10 million); the BMWV will contribute approximately 50 % of this total. The medium-voltage shielded iSFCL that will be demonstrated in this project will be based on BEST's YBCO HTS tapes and know-how in superconducting devices and Schneider Electric/Alstom Grid's experience in designing transformers and their in-depth knowledge of the electric transmission and distribution market. The successful test results of a pre-prototype functional module for this device were released in November 2009. In the present project, the first two years will be used to develop, engineer, and produce a 3-phase full-scale iSFCL device. The device will then undergo extensive power testing prior to the start of a 9-month field trial to demonstrate the reliability of this technology. Dr. Hans-Udo Klein, Vice President of Business Development for BEST, commented, "We expect that this iSFCL design will be able to meet the requirements of critical power customers for high performance, reliability and durability in electrical distribution applications. The iSFCL has the potential to be a true 'smart grid' device with its ability to rapidly react, protect the electrical distribution network against damages, and then to recover quickly without external triggering or service calls."

Source:

"Bruker Energy & Supercon Technologies (BEST), Schneider Electric/Alstom Grid and Stadtwerke Augsburg Announce BMWV Grant for iSFCL Joint Demonstration Project"

Bruker Energy and Supercon Technologies, Inc. press release (December 1, 2010)

<http://www.bruker-est.com/pr101201.html>

American Superconductor Corporation (December 20, 2010)

American Superconductor Corporation (AMSC) has received a turnkey order for a D-VAR STATCOM reactive compensation solution from Ergon Energy Corporation Limited (Australia). The D-VAR STATCOM system will be installed in a Queensland substation to improve the quality of power in the region. The D-VAR STATCOM system will constantly monitor the power grid and automatically and instantly stabilize the voltage when necessary, enabling higher power transfer through existing power lines with increased reliability and efficiency. The system will have a continuous rating of 20 megavolt-amperes reactive (MVAR) capacitive and 5 MVAR inductive compensation. In addition to providing the D-VAR

STATCOM system, AMSC will also perform the installation and provide ongoing maintenance and support. The device is scheduled for commissioning early during calendar year 2012.

Source:

“Ergon to Utilize Advanced D-VAR® STATCOM Intelligent Grid Solutions”
American Superconductor Corporation press release (December 20, 2010)
<http://www.amsc.com/>

NMR & Spectrometer

Bruker Corporation (December 13, 2010)

Bruker Corporation has received an order from the University of Utrecht (the Netherlands) for a novel 527-GHz solid-state dynamic nuclear polarization (DNP) - nuclear magnetic resonance (NMR) system. The new device will double the field strength at which commercial DNP-NMR can be performed, providing the highest sensitivity in solid state NMR and opening new frontiers in structural biology and membrane protein research. An 18.8 T (800 MHz NMR frequency) superconducting 89-mm widebore magnet will be a key component of the device. Funds to purchase the device were received from a competitive award from the Dutch Science Foundation (NWO) with matching funds from the University of Utrecht.

Source:

“Bruker Receives Order from the University of Utrecht for a Novel 527 GHz Solid State DNP-NMR System for Research on Membrane Proteins and Protein Complexes”
Bruker Corporation press release (December 13, 2010)
<http://www.bruker-biospin.com/index.php?id=4287>

Bruker Corporation (December 15, 2010)

Bruker Corporation has received a major order from the University of British Columbia for an ultra-high field AVANCE™ 850 spectrometer. The 850-MHz NMR superconducting magnet and spectrometer will be used to study the mechanisms of microbial diseases. Funds to purchase the device were provided by the Canada Foundation for Innovation, the British Columbia Knowledge Development Fund, and the University of British Columbia.

Source:

“University of British Columbia Orders Canada’s First Compact 850 MHz NMR System from Bruker to Enable Research on Microbial Diseases”
Bruker Corporation press release (December 15, 2010)
<http://www.bruker-biospin.com/index.php?id=4291>
(Note) Please also refer to <http://www.bruker-biospin.com/pr231009.html> for details.

Accelerator

European Spallation Source AB (December 13, 2010)

The European Spallation Source (ESS) and the French research agencies CEA (Commissariat à l’Énergie Atomique et aux Énergies Alternatives) and CNRS (Centre National de la Recherche Scientifique) have begun collaborative work on the ESS Design Update, which is expected to be completed by the end of 2012. The research agreement covers essential R&D on the key ESS accelerator components (including

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superconducting cavities) as well as the development of instrumentation for the spallation sources and the exchange of scientists. Earlier in the month (Dec. 9), the ESS also signed a collaborative agreement with CERN to share key personnel and specialized project management technology as well as an agreement regarding the assembly of a cryomodule test facility at CERN.

Source:

“European Spallation Source AB: France Confirms Its Support for ESS with the Signing of MoUs in Stockholm”

European Spallation Source press release (December 13, 2010)

<http://www.cisionwire.com/european-spallation-source-ab/france-confirms-its-support-for-ess-with-the-signing-of-mous-in-stockholm66254>

Basic

Ruhr-Universität Bochum and Christian-Albrechts-Universität zu Kiel (December 1, 2010)

Researchers at Ruhr-Universität Bochum (RUB, Germany), Christian-Albrechts-Universität zu Kiel (CAU, Germany) and the University of Santa Barbara (USA) have experimentally proven, for the first time, the existence of Cooper pairs with a parallel spin direction. In such Cooper pairs, the parallel spin direction results in a spin with a finite value of 1. Since angular momentum can have three orientations in space, this state is also known as the triplet state. Only a small fraction of Cooper pairs exist in a triplet state, and these pairs quickly revert to the singlet state. To verify these triplet Cooper pairs experimentally, the researchers replaced part of the tunnel barrier in a SQUID with a ferromagnetic layer, causing the Cooper pairs to break up while they were within the barrier and preventing them from reaching the superconductor on the other side of the barrier. This caused the tunnel current to decrease drastically. However, the triplet Cooper pairs were able to tunnel through such a barrier much more easily. Thus, if a portion of the singlet Cooper pairs could be successfully converted to triplet Cooper pairs, the tunnel current would be significantly stronger. Using this experimental methodology, the researchers were able to verify the existence of triplet Cooper pairs as well as demonstrate that the tunnel current is greater for triplet Cooper pairs than it is for singlet Cooper pairs in conventional tunnel contacts. Prior to these results, the existence of triplet Cooper pairs had only been predicted theoretically. The group's results were reported in the American Physical Society's journal.

Source:

“Electron Pairing; Triplet superconductivity proven experientially for first time; Tracking down Cooper pairs: RUB researchers confirm theoretical hypothesis”

Ruhr-Universität Bochum press release (December 1, 2010)

<http://aktuell.ruhr-uni-bochum.de/pm2010/pm00405.html.de>

“Electron Pairing; Triplet superconductivity proven experientially for first time”

Christian-Albrechts-Universität zu Kiel press release (December 1, 2010)

<http://www.uni-kiel.de/aktuell/pm/2010/2010-176-cooper-paare-e.shtml>

Rice University (December 13, 2010)

Researchers at Rice University, in collaboration with the Max Planck Institute for Chemical Physics of Solids (MPI-CPFS; Germany) and other institutions, have provided the strongest evidence yet that magnetism is the driving force behind unconventional superconductivity. The researchers revisited the

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same heavy-fermion materials that were first discovered in 1979 and applied new experimental techniques and theoretical knowledge not available at the time of the materials' discovery. Heavy fermion samples were bombarded with neutrons, enabling the spin states of the electrons in the heavy fermion materials to be probed. Oliver Stockert, a neutron-scattering specialist from MPI-CPfS, explained, "Our neutron-scattering data provide convincing evidence that the cerium-based heavy fermion compound is located near a quantum critical point. Moreover, the data revealed how the magnetic spectrum changes as the material turns into a superconductor." Based on this data, theorists then determined that the amount of magnetic energy saved when the system entered a superconducting state was more than ten times that needed for the formation of Cooper pairs. The implications of this large energy savings remain to be explored but may be related to the phenomenon known as the "Kondo effect." The group's results were published online in *Nature Physics*.

Source:

"Study probes link between magnetism, superconductivity"

Rice University press release (December 13, 2010)

<http://www.media.rice.edu/media/NewsBot.asp?MODE=VIEW&ID=15181>

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