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What's New in the World of Superconductivity (March, 2012)

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★News sources in this issue

Wire

Superconductor Technologies Inc. (March 7, 2012)

Superconductor Technologies Inc. (STI) has reported its fourth quarter and year-end financial results for fiscal year ending December 31, 2011. The fourth quarter net revenues totaled US $284,000, compared with $789,000 for the same quarter in the previous year. This reduction reflects the ongoing weak demand for 3G data network products. The net loss for the quarter was $3.1 million, compared with $3.0 million for the same period in the previous fiscal year. For the full year, the total net revenues were $3.5 million, compared with $8.5 million for the previous fiscal year. The net loss was $13.4 million, compared with a net loss of $12.0 million for the previous fiscal year. As of December 31, 2011, STI had $6.2 million in cash and cash equivalents and a backlog of $13,000.

Looking toward the future, Jeff Quiram, STI's president and chief executive officer, commented, "STI continues to achieve technical milestones associated with the economic production of second generation HTS wire, and we expect to further improve on these industry leading achievements." STI expects to begin

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producing high performance wire templates using systems capable of producing 1-km lengths during the first half of 2012. During the second quarter, the installation of an HTS deposition system is expected to result in the production of 100-m lengths using these long-length templates, preparing STI for the planned deployment in 2013 of equipment enabling the delivery of 1-km lengths of HTS wire.

Source: “Superconductor Technologies Reports 2011 Fourth Quarter and Year-End Results”
Superconductor Technologies Inc. press release (March 7, 2012)

National Institute for Materials Science (March 19, 2012)
Researchers in the Strongly Correlated Materials Group of the Superconducting Properties Unit, National Institute for Materials Science (NIMS), and their collaborators have successfully developed a strong, tough high-temperature superconducting nanowire. Previously, whisker crystals of iron-based superconductors have been difficult to manufacture. The NIMS researchers have successfully produced such whisker crystals by mixing an additive that promotes crystal growth in with the raw materials; this mixed powder is then placed in a capsule-shaped metal reaction vessel, pressure is mechanically applied, and the material is then decompressed after an optimal densification has been achieved. The material is then subjected to an appropriate heat treatment. The resulting whisker crystals undergo a transition to the superconducting state at an absolute temperature of 33 K and have a rod-like needle shape with a diameter on the order of 1 micrometer or less. Unlike other nanowires, the properties of the iron-based superconductor whisker crystals are closer to those of alloys than to ceramics, making them relatively strong and resilient. They also have a larger aspect ratio, expanding the range of possible applications. The group’s work has been published in the *Journal of the American Chemical Society*.

Source: “Strong, Tough High Temperature Superconducting Nanowires”
National Institute for Materials Science press release (March 19, 2012)
http://www.nims.go.jp/eng/news/press/2012/03/p201203190.html

Superconductor Technologies Inc. (March 20, 2012)
Superconductor Technologies Inc. (STI) has completed acceptance testing for its new Ion Beam Assisted Deposition (IBAD) system, which will be used to deposit a magnesium oxide buffer layer on HTS wire templates that are up to one kilometer in length. The testing was completed successfully at the supplier’s location, and the IBAD system will now be shipped to STI’s Advanced Manufacturing Center of Excellence (Austin, Texas) for installation. Jeff Quiram, STI's president and chief executive officer, commented, "…we successfully demonstrated the growth of IBAD using the system with STI produced solution deposition planarization (SDP) material. With our new IBAD machine and current SDP machine up and operational, we will have the capacity to produce wire template for the Conductus 2G HTS wire as required for the high power demonstration cable planned for completion at the end of 2012. We are excited to complete this program milestone that now positions us to deliver wire to meet our customer commitments."

Source: “Superconductor Technologies Inc. Accepts IBAD System for Producing HTS Wire Templates”
Superconductor Technologies Inc. press release (March 20, 2012)

High Field Magnet

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Los Alamos National Laboratory (March 22, 2012)

Researchers at Los Alamos National Laboratory's Pulsed Field Facility have successfully produced magnetic fields in excess of 100 tesla as part of six different experiments. The achievements were made using a 100-tesla pulsed, multi-shot magnet designed to work nondestructively. Various institutions are presently engaged in research utilizing these high magnetic fields, including the identification of the upper critical fields of superconductors and the observation of magneto-quantum oscillations in high-temperature superconductors at unprecedented resolutions. The ability to create pulses of extremely high magnetic fields in a nondestructive manner will enable a wide range of scientific questions to be studied, including how materials behave in the presence of very high magnetic fields and the quantum behavior of phase transitions in solids.

Source: "Magnetic field researchers target 100-tesla goal"
Los Alamos National Laboratory press release (March 22, 2012)
http://www.lanl.gov/news/releases/magnetic_field_researchers_target_hundred_tesla_goal.html

Ultrafast Laser Measurement

University of British Columbia (March 29, 2012)

An international team including researchers from the University of British Columbia has used ultra-fast laser pulses to identify microscopic interactions that are responsible for driving high-temperature superconductivity. The researchers used an extremely short (100-femtosecond) laser pulse to excite the electrons in a prototypical copper-oxide superconductor. As the electrons relax back to an equilibrium state, excess energy is releases via a deformation in the superconductor's atomic lattice (phonons) or a perturbation in its magnetic correlations (spin fluctuations). Data regarding the speed of the relaxation process and its influence on the properties of the superconducting system has shown that the high-critical temperature of these compounds can be explained based on purely electronic (magnetic) processes. UBC Associate Professor Andrea Damascelli, Canada Research Chair in Electronic Structure of Solids with the Department of Physics and Astronomy and the UBC Quantum Matter Institute, commented, "This new technique offers us our best window yet on the interactions that govern the formation of these elusive superconducting properties—both across time and across a wide range of characteristic energies. We're now able to begin to disentangle the different interactions that contribute to this fascinating behavior." The group's work has been published in *Science*.

Source: "Ultrafast laser pulses shed light on elusive superconducting mechanism: U of British Columbia"
University of British Columbia press release (March 29, 2012)
http://science.ubc.ca/news/609

Fault Current Limiter

Bruker Energy & Supercon Technologies, Inc. (April 3, 2012)

Bruker Energy & Supercon Technologies, Inc. (BEST) and Schneider Electric Sachsenwerk GmbH have announced the successful completion of a major milestone in the development of a novel shielded,

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inductive superconducting fault current limiter (iSFCL), which is scheduled to begin field test operations in the grid of Stadtwerke Augsburg in 2013. The testing of a subscale device under the expected operating conditions was performed at the University of Braunschweig. The device, which was fabricated using BEST's 40-mm-wide second-generation HTS tapes, utilizes the same concept that underlies the full-size iSFCL system. The novel design of the superconducting modules enabled the system to withstand fault durations of up to 500 ms, which is thought to be the longest withstand time to be reported to date using a device based on HTS coated conductors. Dr. Hans-Udo Klein, Senior Vice President for Business Development of BEST, commented, "The positive results from these tests have further strengthened our confidence in the success of this project and the superior performance and market potential of the iSFCL design. We now expect a performance and safety test of the full-size single-phase prototype later this year as the final gate for our iSFCL product development before field tests and application in the Augsburg grid next year." The medium-voltage iSFCL project is being funded by the German Federal Ministry of Economics and Technology (BMWi).

Source: "Bruker and Schneider Electric Announce Successful Validation Test for the Inductive Superconducting Fault Current Limiter (iSFCL) for the 'Smart Grid'"
Bruker Energy & Supercon Technologies, Inc. (April 3, 2012)
http://www.bruker-est.com/pr120403.html

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