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超電導 Web21 Superconductivity

Superconductivity Web21

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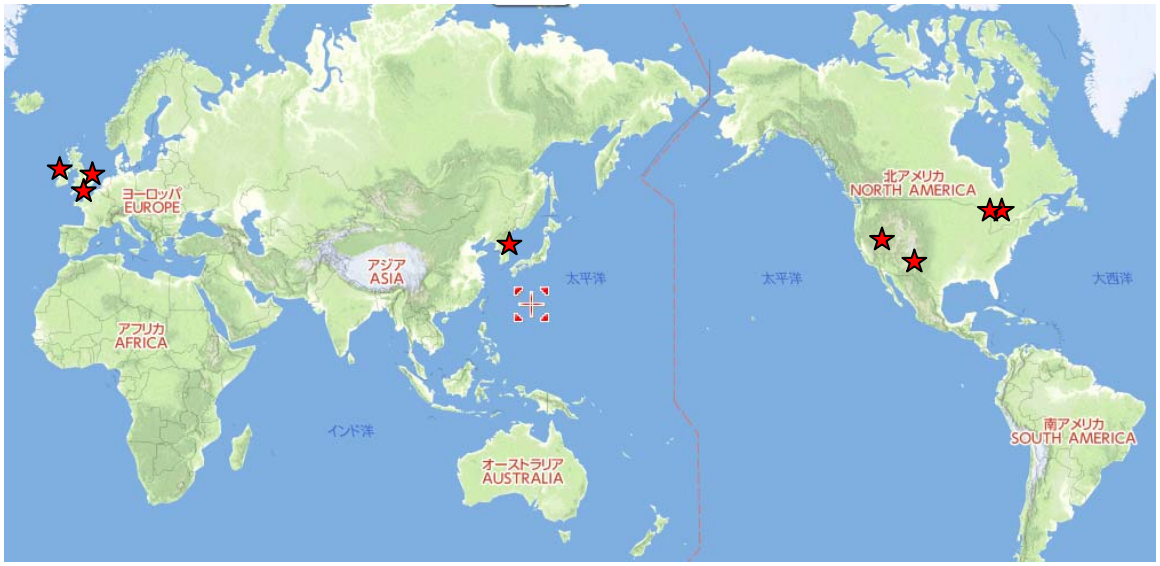
What's New in the World of Superconductivity (April, 2012)

Yutaka Yamada, Principal Research Fellow
Superconductivity Research Laboratory, ISTEC



★News sources in this issue

Wire

AMSC (April 10, 2012)

AMSC has filed an appeal with China's Supreme People's Court regarding the Hainan Higher Court's decision to uphold the Hainan Province No.1 Intermediate People's Court dismissal of AMSC's civil case against Sinovel Wind Group Co., Ltd. and Dalian Guotong Electric Co., Ltd. The case in question is the smallest of four legal actions that AMSC has brought against Sinovel. AMSC is seeking to recover, in total, more than $1.2 billion for contracted shipments and damages arising from contractual breaches and the discovery of intellectual property theft by Sinovel employees. The present case in question involves a copyright infringement lawsuit; AMSC is seeking a cease and desist order and damages totaling approximately US$ 200,000. The rationale for AMSC's appeal to the Supreme People's Court is that the case is a copyright infringement dispute, rather than a contractual matter, and therefore belongs within the

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civil court system. Furthermore, in another case, a ruling by the Beijing No. 1 Intermediate Court denied Sinovel's motion to dismiss a similar software copyright infringement dispute, indicating that the jurisdiction opposition raised by Sinovel in the present case lacks factual and legal basis and is inadmissible. Finally, the case against Guotong was dismissed despite the absence of a contractual relationship between AMSC and Guotong, making it impossible to solve the dispute through arbitration. John Powell, AMSC Vice President and General Counsel, commented, "We applaud the Beijing No. 1 Intermediate People's Court's decision and are disappointed that the Hainan courts have made inconsistent and, we strongly believe, improper rulings. While this case means little to us from a monetary perspective, we will continue to seek justice through the Chinese courts on this matter of global importance."

Source: "AMSC Submits Appeal to China's Supreme People's Court"
AMSC press release (April 10, 2012)
http://ir.amsc.com/releasedetail.cfm?ReleaseID=662919
Contact: Jason Fredette jason.fredette@amsc.com

Superconductor Technologies Inc. (April 11, 2012)

Superconductor Technologies Inc. (STI) has received notification from the NASDAQ Stock Market Listing Qualifications Department stating that STI's common stock bid price has fallen below $1.00 for a period of 30 consecutive business days and has therefore failed to meet NASDAQ's minimum bid price rule. The notification will have no effect on the listing of STI's common stock at this time. STI has been provided a 180-day grace period, until October 2, 2012, to regain compliance, which will require that the bid price for STI's common stock close at $1.00 or higher for a minimum of 10 consecutive days within the grace period. If STI fails to regain compliance, it may still be eligible for an additional 180-day grace period. STI plans to monitor the closing bid price of its common stock and may consider implementing available options to regain compliancy, if appropriate.

Source: "Superconductor Technologies Inc. Receives NASDAQ Bid Price Deficiency Letter"
Superconductor Technologies Inc. press release (April 11, 2012)

SuperPower (April 23, 2012)

SuperPower participated in the Hannover Messe SuperConducting City Exhibition (April 23-27, 2012), providing an exhibition that focused on the applications of its second-generation (2G) HTS wire, summarized below.

SuperPower's 2G HTS wire has been used by Nexans SuperConductors GmbH in the world's first resistive superconducting fault current limiter (SFCL) based on 2G HTS materials, which was recently installed at a power plant in Germany to provide short-circuit protection for the power supply feeding coal mills and crushers. The 2G HTS wires reduced the already low losses in the conductor material by around 90 %, lowering operating costs and providing a faster response time to short circuits.

Oswald Elektromotoren GmbH has also selected SuperPower's 2G HTS wires for a superconducting motor project. For this application, the 2G HTS wires enable the development of a smaller and lighter motor with an increased efficiency and an extended device lifetime. In addition, the use of SuperPower's Advanced Pinning (AP) wire, which exhibits an enhanced critical current performance at a range of operating conditions, will enable a reduction in AC losses (a major concern in motor applications).

Thirdly, a new world record in magnetic field generation—35.4 Tesla—was achieved in October 2011 at the

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National High Magnetic Field Laboratory at Florida State University. The record was achieved using a superconducting electromagnet with a 4.4-Tesla, layer-wound insert magnet constructed from a single piece of SuperPower's 2G HTS wire that was then "nested" inside a 31-Tesla resistive magnet.
Finally, the world's first use of HTS magnets in a tokamak was announced in October 2011 by the fusion research company Tokamak Solutions.
By collaborating with device manufacturers, SuperPower has been able to address customer price and performance expectations and obtain a much deeper understanding of mechanical and performance requirements for its 2G HTS wires. SuperPower now offers three varieties of 2G HTS wire, designed specifically for cable and cable-related applications; in-magnetic field applications such as motors, generators, and other high-field magnetics; and fault current limiter applications requiring a highly resistive substrate. Customization can be extended to include variations in the chemical formulation, wire dimensions, substrate and stabilizer layer thicknesses, insulation, and low-resistance joints to increase piece length.

Source: "SUPERPOWER'S HIGH PERFORMANCE SUPERCONDUCTOR WIRE IS SUCCESSFULLY INCOPORATED INTO A GROWING NUMBER OF DEMANDING APPLICATIONS"
SuperPower press release (April 23, 2012)
http://www.superpower-inc.com/content/superpower%E2%80%99s-high-performance-superconductor-wire-successfully-incorporated-growing-number-d
Contact: Traute F. Lehner, tlehner@superpower-inc.com

Accelerator

CERN (April 5, 2012)

CERN has announced that data collection by the LHC experiments has resumed for the first time in 2012. Two "stable" 4 TeV proton beams have been brought into collision at the LHC's four interaction points, generating a collision energy of 8 TeV—a new world record. The achievement will considerably increase the machine's discovery potential. While this increase in the collision energy is relatively modest, it will enable an increased discovery potential that is likely to be several times higher for certain hypothetical particles, such as those predicted by supersymmetry and Standard Model Higgs particles. The LHC is scheduled to run until the end of 2012, when it will enter a long shutdown period in preparation for operation at an energy level of 6.5 TeV per beam in late 2014.

Source: "LHC physics data taking gets underway at new record collision energy of 8 TeV"
CERN press release (April 5, 2012)
http://press.web.cern.ch/press/PressReleases/Releases2012/PR10.12E.html
Contact: CERN press office, press.office@cern.ch

Censor

National Institute of Standards and Technology (April 19, 2012)

A miniature atom-based magnetic sensor developed at the National Institute of Standards and Technology

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(NIST) has been successfully used to measure human brain activity, verifying the sensor's potential for biomedical applications such as studies on mental processes and neurological diseases. The mini-sensor consists of a container of about 100 billion rubidium atoms in a gas, a low-power infrared laser, and fiber optics to detect the light signals that register the magnetic field strength, with the atoms absorbing more light as the magnetic field increases. The sensor's results were verified by comparing them with signals recorded using SQUIDs. Magnetometers utilizing SQUIDs are presently regarded as the "gold standard" for such experiments. While the NIST mini-sensor is slightly less sensitive than a SQUID magnetometer at this point in its development, it has the potential to provide a comparable performance while offering advantages in size, portability, and cost. Unlike the SQUID arrays that must be mounted in heavy helmet-shaped flasks and cooled to only 4 degrees above absolute zero, the chip-scale NIST sensor is about the size of a sugar cube and can operate at room temperature; these features could be translated into lightweight, flexible, and relatively inexpensive magnetoencephalography helmets.

Source: "NIST mini-sensor measures magnetic activity in human brain"
National Institute of Standards and Technology (NIST) press release (April 19, 2012)
http://www.nist.gov/pml/div688/brain-041912.cfm
Contact: Laura Ost laura.ost@nist.gov

Device

RIKEN Advanced Science Institute (April 18, 2012)

Researchers at the RIKEN Advanced Science Institute and their collaborators have developed a new type of quantum bit called a "phase-slip qubit" that has enabled the world's first-ever experimental demonstration of coherent quantum phase slip (CQPS). In CQPS, magnetic flux quanta jump from one insulator to another across a superconducting layer (the reverse of what occurs in the Josephson effect). Instead of the quantum tunneling of electrons that occurs in a Josephson junction, a coherent "slip" of the phase occurs. Long theorized, the RIKEN researchers and their colleagues have now reported the first direct observation of CQPS in a narrow superconducting wire of indium-oxide (InOx). The wire was inserted into a larger superconducting loop to form a new device called a phase-slip qubit, with the superconducting thin wire sandwiched between two insulating layers of empty space. By tuning the magnetic flux penetrating the loop while scanning the microwave frequencies, the researchers were able to detect a band gap in the energy curves for the two flux states of the system, as predicted theoretically. In addition to demonstrating conclusively the existence of CQPS, the experiment is also expected to lead to a novel class of devices exploiting the unique functionality of quantum phase-slip. The group's work has been reported in *Nature*.

Source: "A new kind of quantum junction"
RIKEN Advanced Science Institute press release (April 18, 2012)
http://www.riken.jp/engn/r-world/info/release/press/2012/120419/index.html
Contact: RIKEN Global Relations Office koho@riken.jp

Quantum Simulator

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National Institute of Standards and Technology (April 25, 2012)

Physicists at the National Institute of Standards and Technology (NIST) have developed a quantum simulator capable of engineering interactions among hundreds of qubits, a capability that is 10 times greater than that of previous devices. The simulator consists of a tiny, single-plane crystal of hundreds of beryllium ions hovering inside a device called a Penning trap. The outermost electron of each ion acts as a tiny quantum magnet and is used as a qubit (the quantum equivalent of a '1' or a '0' in a conventional computer). The simulator successfully passed a series of important benchmarking tests, and scientists are now poised to study problems in material science that are impossible to model on conventional computers, such as the rational design of high-temperature superconductors, the properties of which are believed to depend on the collective quantum behavior of hundred of particles. Importantly, in addition to exploiting the quantum mechanic property of superposition, the NIST simulator can also engineer a second quantum property: entanglement between the qubits, in which even particles that are physically well separated can be tightly interconnected. The group's work has been reported in *Nature*.

Source: "NIST physicists benchmark quantum simulator with hundreds of qubits"
National Institute of Standards and Technology (NIST) press release (April 25, 2012)
http://www.nist.gov/pml/div688/qubits-042512.cfm
Contact: Laura Ost laura.ost@nist.gov

Physics, Device

University of Cambridge (April 5, 2012)

Scientists working in the Cavendish Laboratory at Cambridge have, for the first time, used light to control quantum tunnelling. Professor Jeremy Baumberg explained, "…the trick to telling electrons how to pass through walls, is to marry them with light." Research scientist Peter Cristofolini continued, "The offspring of this marriage are actually new indivisible particles, made of both light and matter, which disappear through the slab-like walls of semiconductor at will." These new particles have been named "dipolaritons"; one of their features is that they are stretched out in a specific direction, like a bar magnet, and are subject to extremely strong forces acting between each other. These strongly interacting particles have attracted considerable interest from semiconductor physicists trying to form condensates, the equivalent of superconductors and superfluids that travel without loss, in semiconductors. The group's research has been published in *Science*.

Source: "Controlling quantum tunneling with light"
University of Cambridge press release (April 5, 2012)
http://www.cam.ac.uk/research/news/controlling-quantum-tunnelling-with-light/
Contact: Gabriel Christmann gprmc2@cam.ac.uk

Physics

Carnegie Institution (April 12, 2012)

Carnegie scientists have succeeded in developing a new static compression technique that will enable

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hydrogen to be observed under pressures never before achievable—300 Gigapascals, or nearly 3 million times the normal atmospheric pressure—and at temperatures ranging from 12 K to close to room temperature. Under high pressures, hydrogen is speculated to transform into a metal, possibly even becoming a superconductor or a superfluid that never freezes, which would represent a completely new and exotic state of matter. The group found that the molecular state of hydrogen was stable up to remarkably high pressures, confirming the extraordinary stability of the chemical bond between the atoms. Evidence of a semi-metallic behavior in the dense molecular phase was found, but the material is likely to have an electrical conductivity that is well below that of a full metal. Evidence of another phase of molecular hydrogen occurring at a relatively high temperature of 300 K and at pressures above 220 Gigapascals was also seen; in this phase, the hydrogen formed a honeycomb composed of six-atom rings, similar to the carbon structure of graphene. The group's work has been published online in two separate papers in *Physical Review Letters*.

Source: "Probing hydrogen under extreme conditions"
Carnegie Institution press release (April 12, 2012)
http://carnegiescience.mobi/news/probing_hydrogen_under_extreme_conditions
Contact: Tina McDowell, tmcdowell@ciw.edu

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