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Superconductivity Web21

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

초전도 뉴스 –세계의 동향–

超导新闻 –世界的动向-

chāo dǎo xīnwén - shìjiè de dòngxiàng-

Yutaka Yamada, Principal Research Fellow
Superconductivity Research Laboratory, ISTEC

★News sources and related areas in this issue

▶Power Application 전력응용 电力应用 [diànlì yìngyòng]

Cryogenic R&D for EU Offshore Wind Turbine

Helmholtz Association of German Research Centres and the Karlsruhe Institute of Technology (January 4, 2013)

Researchers in the Cryogenic Engineering Division at the Karlsruhe Institute of Technology's Institute for Technical Physics (ITEP) have announced that they will be contributing a cooling system to the EU-supported SUPRAPOWER (SUPerconducting, Reliable, lightweight, And more POWERful offshore

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This work was subsidized by JKA using promotion funds from KEIRIN RACE.

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wind turbine) project. The 4-year project to develop a wind power plant utilizing a direct-drive superconducting generator has been undertaken by nine partners from industry and science, under the coordination of the Fundación Tecnalia Research & Innovation (Spain). For their part, the ITEP researchers will develop a rotating low-loss cryostat capable of cooling the necessary superconducting coils to 20 K using a small Gifford-McMahon cooler (provided by project partner Oerlikon Leybold Vacuum. Dr. Holger Neumann, head of the Cryogenic Engineering Division, commented, "Since the cooling performance of such coolers is limited, we must ensure that heat between them and the superconducting coils is conducted well. Besides, we must consider the influence of rotation on the heat pipes we may use. On the other hand, the cryostat needs a highly effective thermal insulation." The use of superconducting generators in wind turbines is expected to enable a performance increase to 10 MW while simultaneously reducing the size and weight of the generator—critical factors for offshore power plants.

Source: “Superconductors for efficient wind power plants”
Helmholtz Association of German Research Centres press release (January 4, 2013)
URL: http://www.kit.edu/visit/pi_2013_12442.php
Contact: Monika Landgraf, presse@kit.edu

UNIVERSITY of HOUSTON **DOE Funding For Windmill R&D**

University of Houston (December 19, 2012)

Researchers at the University of Houston have received additional funding consisting of an accelerated grant extension and an additional US $900,000 increase from the U.S. Department of Energy’s Advanced Research Project-Energy for a wind energy project involving the use of superconducting wire in turbines. The three-year project (total grant of $4 million) will seek to improve the performance of superconducting wire used in wind turbines by 400 %. The project initially received $2.1 million for the first 18 months of the grant period, ending June 2013; a review was then planned to determine whether the team would receive an additional $1 million. As of September 2012, however, the group had already attained a 65 % improvement, prompting the grant administrators to reach the final $1 million ahead of schedule and to award the additional $900,000 based on the group’s performance. The extra funding will enable an acceleration of the research and an expansion of the research team. Collaborators in the project include SuperPower Inc., the National Renewable Energy Laboratory, Tai-Yang Research, and TECO-Westinghouse Motor Company.

Source: “UH superconductivity researcher receives additional DOE funding for wind project”
University of Houston press release (December 19, 2012)
URL: http://www.eurekalert.org/pub_releases/2012-12/uoh-usr121912.php
http://www.uh.edu/news-events/stories/2012/december/1207SelvaWind.php
Contact: Laura Tolley, ljtolley@uh.edu

▶Basics 기초 基础[jīchǔ]

Discover a New Kind of Magnetism

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Massachusetts Institute of Technology (December 19, 2012)

Researchers at Massachusetts Institute of Technology have experimentally demonstrated the existence of a fundamentally new kind of magnetic behavior, adding a third state to the two previously known states of magnetism (ferromagnetism and antiferromagnetism). The new state, which has been called a quantum spin liquid (QSL), consists of a solid crystal with a "liquid" magnetic state. Unlike the other two magnetic states, the magnetic orientations of the individual particles in a QSL fluctuate constantly, resembling the constant motion of molecules within a true liquid. While there is no static order to the magnetic orientations, or magnetic moments, strong interactions do occur; however, the orientations do not lock in place because of quantum effects.

The concept of a QSL was first proposed in 1987, at which time the idea was first speculated to be relevant to high-temperature superconductors. The MIT data provides some of the strongest experimental evidence to date that QSLs represent an actual physical system. The actual material used in the experiment was a mineral crystal known as herbetsmithite, the growth of which took 10 months. When the crystal was studied using advanced physics techniques (such as neutron scattering), the researchers found that it exhibited fractionalized excitations: while most matter has discrete quantum states with changes expressed as whole numbers, the QSL exhibited fractional quantum states, with the excited states, called spinons, forming a continuum. This observation has been called a "remarkable first". The group's work has been reported in Nature.

Source: "MIT researchers discover a new kind of magnetism"
Massachusetts Institute of Technology press release (December 20, 2012)
URL: http://www.eurekalert.org/pub_releases/2012-12/miot-mrd122012.php
http://web.mit.edu/newsoffice/2012/mit-researchers-discover-a-new-kind-of-magnetism-1219.html
Contact: Caroline McCall, cmccall5@mit.edu

A New Superconductor, Bismuth Oxysulphide ($Bi_4O_4S_3$) and Ag Impurity's Role reported by Springer (December 20, 2012)

Chinese Scientists from the Institute of Solid State Physics, Chinese Academy of Sciences, Hefei, studying chemical substitution using silver atoms in a new class of superconductor, bismuth oxysulphide ($Bi_4O_4S_3$), have discovered that the superconductivity in a sandwich-style layered structure made of $Bi_4O_4S_3$ is intrinsic, rather than created by the impurities. All the superconducting samples of $Bi_4O_4S_3$ fabricated to date consist of a mixture of $Bi_4O_4S_3$ and impurities, and pure samples without impurities are not superconducting. These findings have raised the question of whether the observed superconductivity arises from the presence of the impurities. The Hefei team has examined this material's characteristics by performing systematic measurements using x-ray diffraction, magnetic susceptibility, electrical transport, and thermal transport. By comparing x-ray diffraction patterns, they discovered that the silver impurities partially replace the bismuth sites in the bismuth oxysulphide lattice. By controlling the composition of the material using various levels of silver doping, the researchers found that the superconductivity was suppressed as the silver content was increased, eventually disappearing above a specific doping threshold. The modification of the electronic structure upon doping was suspected to suppress the superconductivity. Based on these observations, the researchers concluded that the observed superconductivity originates from the bismuth oxysulphide lattice, rather than the silver impurities. The group's work has been published in European Physical Journal B.
Source: "Silver sheds light on superconductor secrets"

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Springer press release (December 20, 2012)
URL: http://www.eurekalert.org/pub_releases/2012-12/s-ssl122012.php
http://www.springer.com/about+springer/media/springer+select?SGWID=0-11001-6-1399741-0
Contact: Ann Koebler, ann.koebler@springer.com

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

Superconductors Which Work by Themselves

University of Tübingen (December 3, 2012)

Researchers at the University of Tübingen (Germany), Tel Aviv University (Israel), and Kiel University (Germany) have proposed and experimentally demonstrated a new type of superconducting element that they have named the φ-Josephson junction. The element will enable superconducting electronic circuits to work practically "by themselves" and will improve functionality. The new element combines conventional Josephson junctions (in-phase synchronization of electron motion) with π Josephson junction (anti-phase synchronization) to produce a Josephson junction with an arbitrary phase shift (φ) between the electrons in the two superconductors forming the junction. The value of φ ($0<\varphi\leq\pi$) can be selected according to the design requirements. Such φ Josephson junctions could be used as devices capable of maintaining a constant phase shift between two superconducting electrodes.

One of the co-authors of the study, Prof. Roman Mints (Tel Aviv University), further explained the concept as follows: "One can think about the φ-junction as a battery, which provides a given phase shift φ (instead of a voltage like in the usual battery) for an attached superconducting electronic circuit. This phase battery, unlike the usual battery, never discharges as it causes the flow of superconducting dissipationless currents." Dr. Edward Goldobin (University of Tübingen), the lead scientist for the project, added, "Further, we discovered that this φ Josephson junction may actually be in two states – it may "synchronize" the superconductors with the phase shift being either +φ or -φ and, thus, one can use it as a bistable system or, in the future, as a quantum bit." The value of the phase shift φ can be controlled by the sample's parameters, such as the film thickness. Previously, scientists thought that the ground state could not be modified at will. The group's present findings have been published in Physical Review Letters.

Source: "Superconductors Which Work by Themselves"
University of Tübingen press release (December 3, 2012)
URL:
http://www.uni-tuebingen.de/en/news/pressemitteilungen/archiv/archivfullview-pressemitteilungen/article/supraleiter-die-von-selbst-arbeiten.html
Contact: Dr. Edward Goldobin, gold@uni-tuebingen.de

▶Management and Finance 경영정보 经营信息[jīngyíng xìnxī]

A Hike in Liquid He

Air Products (December 17, 2012)

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Air Products has announced a dramatic increase in its price for liquid and bulk helium in North America. This increase has been necessitated by the ongoing global helium shortage and the extraordinary costs that are being incurred by Air Products so as to maintain a reliable supply and secure new helium sources. The new pricing actions will become effective January 1, 2013, or as contracts permit.

Source: "Air Products Announces North America Price Increase for Liquid and Bulk Helium Gases"
Air Products press release (December 17, 2012)
URL:
http://www.airproducts.com/company/news-center/2012/12/1217-air-products-announces-north-american-price-increase-for-liquid-and-bulk-helium-gases.aspx
Contact: Art George, georgeaf@airproducts.com

Windmill Litigation Update

AMSC (December 17, 2012)

AMSC has announced its expectation that China's Supreme People's Court will hold an additional hearing regarding AMSC's copyright infringement case against Sinovel Wind Group Co., Ltd., at an as yet undetermined date. Among the cases that AMSC has filed against Sinovel is a civil action for software copyright infringement. In this case, AMSC is seeking a cease and desist order and damages totaling US $6 million. At present, the Supreme People's Court has ruled that it will hold a hearing to review jurisdictional issues that AMSC and Sinovel have raised, with the lower court proceedings being stayed pending the Supreme Court outcome. This case is one of four legal cases that AMSC filed against Sinovel in late 2011 regarding Sinovel's contractual breaches and AMSC's discovery of intellectual property theft by Sinovel.

Source: "AMSC Provides Litigation Update"
AMSC press release (December 17, 2012)
URL:
http://files.shareholder.com/downloads/AMSC/2165855216x0x622101/29090ccc-2480-41e8-a9a4-dd848b6d6b11/AMSC_News_2012_12_17_Commercial.pdf
Contact: Jason Fredette, jason.fredette@amsc.com

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