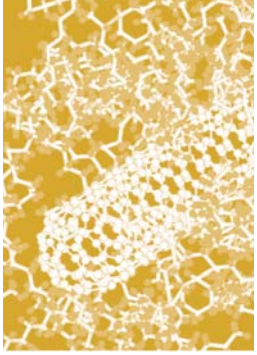
EMERGING TECHNOLOGY



Iron-based superconductors reinforce link to magnetism

A new class of iron-oxyarsenide-based superconductors discovered earlier this year shares similar unusual magnetic properties with previously known high-temperature superconductors based on copper-oxide materials, report researchers at the National Institute of Standards and Technology, Gaithersburg, Md. The work emphasizes a critical but as yet unexplained link between magnetism and high-temperature superconductors.

The importance of magnetism to high-temperature superconductors is remarkable because magnetism strongly interferes with conventional, low-temperature superconductors, but now may prove to be an integral element of such materials.

The team used neutron beams to demonstrate that, like copper-oxide superconductors, the new iron-oxyarsenide HTc materials discovered by Japanese researchers share an unusual magnetic structure with magnetically active layers interspersed with layers of nonmagnetic material.

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Copper nanowire arrays grown on different surfaces

A simple process to grow upright copper nanowires on a variety of materials is under development by researchers at the University of Illinois in Urbana Champaign. The nanowire arrays could be suitable for field-emission displays, a new type of display technology that promises to provide brighter, more vivid pictures than existing flat-panel displays. In such an application, the nanowires would fire electrons at phosphor particles on a screen, lighting them up. These field-emission displays would work on a similar principle as cathode ray tubes, but instead of a single electron gun, millions of tiny electron emitters shoot electrons at red, green, and blue phosphors coated on a screen.

The new method is based on chemical vapor deposition. The substrate, which could be silicon, glass, metal, or plastic, is exposed to vapors of a copper-containing compound at 200 to 300°Celsius. The resulting copper nanowires that grow on the substrate are between 70 and 250 nm wide, and are five-sided, with a sharp pentagonal tip.

The copper nanowires are suitable for FEDs because they are uniform and have a very pointed tip. The smaller the tip, the stronger the electric field, making them very efficient electron emitters even with a very small voltage. The nanowires emit electrons at 100 volts, versus many kilovolts needed for the tungsten filament of a cathode-ray tube.

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Potassium manganese oxide nano-wire builds oil-absorbing paper

A mat of potassium manganese oxide nanowires with the touch and feel of paper that can absorb up to 20 times its weight in oil, and can be recycled many times, has reportedly been developed by researchers at the Massachusetts Institute of Technology, Cambridge. "What we found is that we can make 'paper' from an interwoven mesh of nanowires that is able to selectively absorb hydrophobic liquids from water," says Prof. Francesco Stellacci.

The nanowires are stable at high temperatures. As a result, oil within a loaded membrane can be removed by heating above the boiling point of oil. The oil evaporates, and can be condensed back into a liquid. The membrane — and oil — can be used again.

Two key properties make the system work. First, the nanowires form a spaghetti-like mat with many tiny pores that make for good capillarity, or the ability to absorb liquids. Second, a water- repelling coating keeps water from penetrating into the membrane. Oil, however, isn't affected, and seeps into the membrane.

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BRIEFS

IDES Inc., a plastic materials information management company, and **Firehole Technologies Inc.**, a developer of innovative simulation technologies for composite materials and structures, have entered into a strategic partnership to develop a searchable composite materials database. www.ides.com

Intel Corp., **Samsung Electronics**, and **Taiwan Semiconductor Manufacturing Company** (**TSMC**) have reached agreement on the need for industry-wide collaboration to target a transition to larger, 450-mm size wafers starting in 2012. www.intel.com

Leica Microsystems announces that it has acquired **Bal-Tec AG,** Liechtenstein**,** a manufacturer of both mechanical and cryo sample preparation equipment for scanning electron microscopy and transmission electron microscopy. Products such as the EM VCT100 Vacuum Cryo Transfer system for SEM, and the EM HPM100 High Pressure Freezing unit, are now available from Leica Microsystems. www.leica-microsystems.com

Stanford University chemists have developed a new way to make transistors out of carbon nanoribbons. Graphene nanoribbons less than ten nanometers wide can operate at higher temperatures. A chemical process developed by the researchers has made the nanoribbons smoother and narrower than those made by other techniques. Hongjie Dai, hdai@stanford.edu.

SUSS MicroTec, a leading supplier of process and test solutions for the semiconductor industry, announces that u-ITC, Korea, has selected the advanced wafer bonding equipment of SUSS for its MEMS foundry. www.suss.com

NASA Ames Research Center is developing durable, oxidation-resistant, foam thermal protection systems (TPSs) that would be suitable for covering large exterior spacecraft surfaces. The TPSs would have low to moderate densities, and temperature capabilities comparable to those of carbon-based TPSs, which are reusable at 1650°C (3000°F). These foams might be useful as catalyst supports and filters on Earth and in outer space. http://link.abpi.net/l.php?20080612A8

Purdue University has established a center focused on the development of analytical instruments critical to a wide range of fields including health care and national security. **The Center for Analytical Instrumentation Development** will foster collaborations among the leading institutions in the field, including Purdue, the University of Illinois, Indiana University, and the University of Notre Dame. www.purdue.edu

Carbon nanotubes make complete microcircuit

Carbon nanotubes that deposit themselves flat on a surface in a random but relatively even manner to create a single complete metallic micro-circuit have reportedly been made by University of Warwick researchers Ioana Dumitrescu, Professor Julie Macpherson, Professor Patrick Unwin, and Neil Wilson. The researchers used a form of chemical vapor deposition and lithography to create the ready made disc shaped single walled carbon nanotube based ultramicroelectrodes.

The low surface area of the conducting part of the disc means that they can be used to screen out background "noise" and cope with low signal to noise ratios, making them up to 1000 times more sensitive than conventional ultramicroelectrodes sensors. This property also produces very fast response times allowing them to respond ten times faster than conventional ultramicroelectrodes.

The new ultramicroelectrodes also open up interesting possibilities for catalysis in fuel cells. Up till now researchers had been aware that this form of carbon nanotubes appeared to be particularly useful in the area of catalysis but there was uncertainty as to whether it was the properties of the carbon nanotubes per se that provide this benefit.

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Porous glass microspheres store hydrogen, filter gases

Porous wall-hollow glass microspheres that consist of porous glass microballoons that are 2 to 100 μm in diameter have reportedly been developed at the Savannah River National Laboratory, Aiken, S.C. The key characteristic of these spheres is an interconnected porosity in their thin outer walls that can be produced and varied on a scale of 100 to 3000 Ångstroms.

Researchers G.G. Wicks, L.K. Heung, and R.F. Schumacher have been able to use these open channels to fill the microballons with gas absorbents and other materials. Hydrogen or other reactive gases can then enter the microspheres through the pores, creating a relatively safe, contained, solid-state storage system. Photographs of these glass-absorbent composites also reveal that the wall porosity generates entirely new nanostructures.

The porosity can be altered and controlled in various ways that allow the spheres to filter mixed gas streams within a system. Another feature of the microballoons is that their mechanical properties can be altered so they can be made to flow like a liquid. This suggests that an existing infrastructure that currently transports, stores, and distributes liquids such as the existing gasoline distribution and retail network can be used. This property and their relative strength also make them suitable for reuse and recycling.

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Phosphate cement stabilizes radioactive waste streams

A phosphate cement with added boron and iron efficiently blocks neutrons and gamma rays emitted by nuclear materials, enabling safer nuclear storage, report materials scientists at Argonne National Laboratory, Argonne, Ill. The material was developed in a collaboration between Argonne, the Russian Federal Nuclear Center, and Ceradyne Boron Products LLC.

Ceramicrete was developed several years ago at Argonne, but the collaborators modified the original Ceramicrete by adding boron to block neutrons, and iron-containing materials to block gamma rays, making it one of the few materials that provides a shield against both forms of radiation. Other materials, such as stainless steel, provide a viable shield from gamma rays but fail to insulate neutrons.

After the scientists determined that the cement successfully absorbed neutron radiation, Ceradyne built and tested prototype shields, then marketed the material under the name BoroBond. Working with Department of Energy contractors, Ceradyne has introduced the BoroBond shields for storage of nuclear materials in Oak Ridge, Tenn. These contractors have built several hundred BoroBond-based casks that now house nuclear material.

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