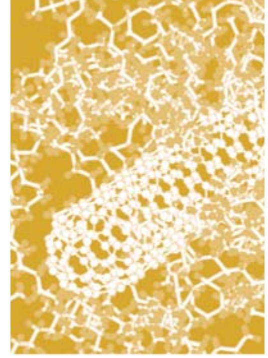
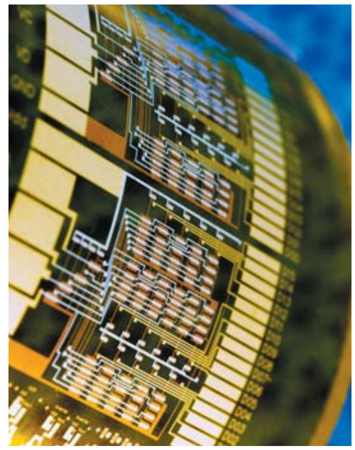


EMERGING TECHNOLOGY

Nanonet transistors made of carbon nanotube networks



Transistors made of networks of carbon nanotubes have reportedly been built by researchers at Purdue University, West Lafayette, Ind.; and the University of Illinois at Urbana-Champaign. Potential applications include flexible displays and an electronic skin to cover an entire aircraft to monitor crack formation.

Nanonet circuits are made of carbon nanotubes randomly overlapping in a fishnet-like structure. However, metallic nanotubes form unavoidably during the process of making carbon nanotubes. These metal tubes then link together in meandering threads that eventually stretch across the width of the transistor, causing a short circuit. The researchers solved this problem by cutting the nanonet into strips, preventing short circuits by breaking the path of metallic nanotubes.

They created a flexible circuit containing more than 100 transistors, the largest nanonet ever produced and the first demonstration of a working nanonet circuit. A key advantage of the nanonet technology is that it can be produced at low temperatures, enabling the transistors to be placed on flexible plastic sheets that would melt under the high temperatures needed for silicon circuits. Researchers at the University of Illinois at Urbana-Champaign led experimental laboratory research to build the circuits, and Purdue led research to develop and use simulations and mathematical models

For more information: Ashraf Alam, Purdue University, West Lafayette, IN 47907; tel: 765/494-5988; alam@purdue.edu; www.purdue.edu; ttp://news.uns.purdue.edu/x/2008b/080723AlamFlexible.html.

Single-crystal bismuth telluride nanorods grown in one step

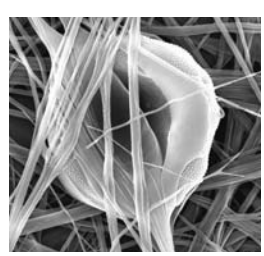
A technique for growing single-crystal bismuth telluride nanorods and controlling their shape with biomolecules could enable the development of smaller, more powerful heat pumps and devices that harvest electricity from heat, say researchers at Rensselaer Polytechnic Institute, Troy, N.Y. They have discovered how to direct the growth of nanorods made up of two single-crystals. The researchers were also able to create branched structures by carefully controlling the temperature, time, and amount of surfactant added during synthesis. Most nanostructures comprised of a core and a shell generally require more than one step to synthesize, but the new method requires only one step.

"Our work is the first to demonstrate the synthesis of composite nanorods with branching, wherein each nanorod consists of two materials—a single-crystal bismuth telluride nanorod core, encased in a hollow cylindrical shell of single-crystal bismuth sulfide," says Prof. G. Ramanath. The core-shell junctions in the nanorods enable heat removal upon application of an electrical voltage. Or they could generate electrical power when heated. The branched structures open up the possibility of fabricating miniaturized conduits for heat removal alongside nanowire interconnects in future device architectures.

For more information: G. Ramanath, Rensselaer Polytechnic Institute, Center for Future Energy Systems, Troy, NY 12180; tel: 518/276-6844; ramanath@rpi.edu; www.rpi.edu/cfes.

Nanostructured nonwoven fiber incorporates nanoparticles

A nanostructured nonwoven fiber in which nanoparticles are incorporated into the matrix has been developed by SNS Nano Fiber Technology, Uniontown, Ohio, a partnership between Struktol Company of America, Stow, Ohio; and Akron University, Ohio. Called Nanosan, the fiber can incorporate a range of different particles or additives to produce nanofibers with almost any characteristic.



According to Dr. Laura Frazier of SNS, "Nanosan nonwovens are suitable for many diverse applications.

BRIEFS

Capstone Turbine Corp. has received an order from HelioFocus for the development and modification of Capstone Turbine's C65 MicroTurbine to operate on solar energy. HelioFocus systems will convert sunlight to grid electricity with a parabolic solar concentrator that provides enough heat energy to drive Capstone's modified turbine and power electronics. www.microturbine.com

CN Probes has signed an agreement with a leading MEMS foundry that puts CN Probes closer to ramping up full-scale production and launch of its carbon nanotube probe tip for the atomic force microscope. www.cn-probes.com

European Precursor GmbH in Kelheim, a joint venture between **SGL Group** and **Lenzing Group**, will receive a grant totaling $8.9 million for the development of a carbon-fiber precursor under the "Bavaria FIT" program for the promotion of research, innovation, and technology. www.sglcarbon.com

Michigan State University researchers have discovered that exposure to light changes the chemical bonding in graphite to a form similar to that of diamond. This could lead to new nanoscale techniques in which a laser builds structures of diamond and graphite on a surface of a carbon thin film. It could "write" a nanoscale electronic circuit in a thin graphite layer. David Tománek, tomanek@msu.edu

NanoMarkets reports that the thin-film photovoltaics (TFPV) market will produce the equivalent of 26 gigawatts by 2015 and will generate well over $20 billion in revenues in that same time frame. The growth is due to the low cost, flexibility, and manufacturing advantages associated with TFPV compared with the now-dominant crystalline silicon PV. www.nanomarkets.net

For instance, SAPs can be incorporated into the web of polymer nanofibers resulting in a structured hydrogel, which is capable of absorbing copious amounts of liquid while retaining its strength and elasticity. The other notable benefit is that Nanosan can be produced in larger quantities at a substantially lower cost than conventional nanofibers, making it the first commercially viable material of its kind on the market."

For more information: Laura Frazier, SNS Nano Fiber Technology LLC, 1505 Corporate Woods Parkway – Suite 300, Uniontown, OH 44685; tel: 330/899-1298; www.snsnano.com.

Method sorts carbon nanotubes, arranges them over large area

A method for sorting single-walled carbon nanotubes by electronic type and arranging them over a large area could be useful for manufacturing high-performance displays and other electronic devices, say researchers at Stanford University and Samsung Advanced Institute of Technology. Every batch of carbon nanotubes has both semiconducting and metallic varieties, but transistors need to switch on and off to control current flow, which only semiconducting nanotubes can do. As a result, techniques are needed to sort the different types of nanotubes. In addition, the nanotubes must be carefully aligned to make working transistors.

To make carbon-nanotube transistors, the group refined what is called a random nanotube network, which involves depositing a carbon-nanotube solution onto a silicon wafer and spinning it rapidly to form a thin film of nanotubes. By chemically modifying the silicon wafer with either amine or phenyl groups, the researchers ensured that only one type of nanotube would be absorbed onto the surface. They showed that the process results in a film of carbon nanotubes with 90% of one or the other electronic type. They then added electrodes to the wafer to form transistors.

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New temperature measurement system based on noisy electrons

A system that relies on the "noise" of jiggling electrons as a basis for measuring temperatures with extreme precision has reportedly been developed at the National Institute of Standards and Technology, Gaithersburg, Md. The system is nearly precise enough now to help update some of the crucial underpinnings of science, including the 54-year-old definition of the Kelvin, the international unit of temperature.

NIST's Johnson noise thermometry (JNT) system represents a five-fold advance in the state of the art in noise thermometry thanks to its use of a unique quantum voltage source combined with recent reductions in systematic errors and uncertainty. It is also simpler and more compact than other leading systems for measuring high temperatures, such as those based on the pressure and volume of gases.

The NIST system measures very small electrical noise in resistors when they are cooled to the water triple point. This "Johnson noise" is caused by the random motion of electrons and is directly proportional to temperature. The unique aspect of the system is that precision waveforms — electrical signals — are synthesized with a superconducting alternating current voltage source to calibrate the electronic devices measuring the noise power.

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Integrated sensor circuit based on nanowire arrays

The world's first all-integrated sensor circuit based on nanowire arrays has reportedly been developed at the U.S. Department of Energy's Lawrence Berkeley National Laboratory and the University of California at Berkeley. The circuit was built by combining light sensors and electronics made of different crystalline materials. Nanostructures made with specific chemical, electronic, and other properties have a number of advantages over the same materials in bulk. For example, a nanowire is an ideal shape for a light detector. Because it is virtually one-dimensional, practically "all surface," a nanowire is not only highly sensitive to light energy, but also highly responsive.

However, to be practical the photo-sensors must be integrated with electronics on the same chip. And the materials that make an ideal photosensor are necessarily different from those that make a good transistor. Therefore, the nanowire arrays are made of combinations of materials, and are fabricated by processes that can be reproduced on a large scale in a controlled way.

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