Technology News Daily

TECHNEWS

Nanotube Technology, Nanotube Transistor Radios

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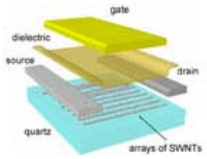

Carbon nanotubes have a sound future in the electronics industry, say researchers who built the world's first all-nanotube transistor radios to prove it.

The nanotube radios, in which nanotube devices provide all of the active functionality in the devices, represent "important first steps toward the practical implementation of carbon-nanotube materials into high-speed analog electronics and other related applications," said John Rogers, a Founder Professor of Materials Science and Engineering at the University of Illinois.

Rogers is a corresponding author of a paper that describes the design, fabrication and performance of the nanotube-transistor radios, which were achieved in a close collaboration with radio frequency electronics engineers at Northrop Grumman Electronics Systems in Linthicum, Md.

The paper has been accepted for publication in the Proceedings of the National Academy of Sciences, and is to be published in PNAS Online Early Edition next week. "These results indicate that nanotubes might have an important role to play in high-speed analog electronics, where benchmarking studies against silicon indicate significant advantages in comparably scaled devices, together with capabilities that might complement compound semiconductors," said Rogers, who also is a researcher at the Beckman Institute and at the university's Frederick Seitz Materials Research Laboratory.

Practical nanotube devices and circuits are now possible, thanks to a novel growth technique developed by Rogers and colleagues at the U. of I., Lehigh and Purdue universities, and described last year in the journal Nature Nanotechnology.

The growth technique produces linear, horizontally aligned arrays of hundreds of thousands of carbon nanotubes that function collectively as a thin-film semiconductor material in which charge moves independently through each of the nanotubes. The arrays can be integrated into electronic devices and circuits by conventional chip-processing techniques.

"The ability to grow these densely packed horizontal arrays of nanotubes to produce high current outputs, and the ability to manufacture the arrays reliably and in large quantities, allows us to build circuits and transistors with high performance and ask the next question," Rogers said. "That question is: 'What type of electronics is the most sensible place to explore applications of nanotubes?' Our results suggest that analog RF (radio frequency) represents one such area."

As a demonstration of the growth technique and today's nanotube analog potential, Rogers and collaborators at the U. of I. and Northrop Grumman fabricated nanotube transistor radios, in which nanotube devices provided all of the key functions.

The radios were based on a heterodyne receiver design consisting of four capacitively coupled stages: an active resonant antenna, two radio-frequency amplifiers, and an audio amplifier, all based on nanotube devices. Headphones plugged directly into the output of a nanotube transistor. In all, seven nanotube transistors were incorporated into the design of each radio.

In one test, the researchers tuned one of the nanotube-transistor radios to WBAL-AM (1090) in Baltimore, to pick up a traffic report.

"We were not trying to make the world's tiniest radios," Rogers said. "The nanotube radios are a demonstration, an important milestone toward building the technology into a form that ultimately would be commercially competitive with entrenched approaches."

The work was funded by the National Science Foundation and the U.S. Department of Energy.

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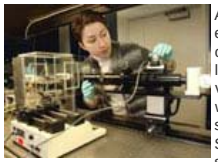
Microscopic Electronics Printing, Nanotechnology



A new technique for printing extraordinarily thin lines quickly over wide areas could lead to larger, less expensive and more versatile electronic displays as well new medical devices, sensors and other technologies. Solving a fundamental and long-standing quandary, chemical engineers at Princeton developed a method for shooting stable jets of electrically charged liquids from a wide nozzle. The technique, which produced lines just 100 nanometers wide (about one ten-thousandth of a millimeter), offers at least 10 times better resolution than ink-jet printing and far more speed and ease than conventional nanotechnology.

Future City Competition

The bright and fertile minds of middle school students across the country have cultivated their visions of what future cities must look like in order to support humankind's growing infrastructure needs. Soon they will put their concepts to the test by participating in the 16th annual National Engineers Week **Future City Competition**. The focus of this year's competition is nanotechnology. More than 30,000 students from 1,000 schools in 40 regions in the United States are participating in the competition. Students have developed concepts for the practical application of built-in nanotechnologies to monitor parts of a city's infrastructure. NASA's Ames Research Center, Moffett Field, Calif., will host the Northern California regional competition on Saturday, Jan. 26, from 8:30 a.m. to 4:30 p.m. PST. Admission is free, and open to the public.

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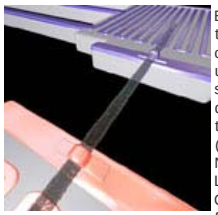
Dark-Field X-Ray Technology

Researchers at the Paul Scherrer Institute (PSI) and the EPFL in Switzerland have developed a novel method for producing dark-field x-ray images at wavelengths used in typical medical and industrial imaging equipment. Dark-field images provide more detail than ordinary x-ray radiographs and could be used to diagnose the onset of osteoporosis, breast cancer or Alzheimer's disease, to identify explosives in hand luggage, or to pinpoint hairline cracks or corrosion in functional structures.

Observing Interactions In Nanoscale Systems

Scientists have used new optical technologies to observe interactions in nanoscale systems that Heisenberg's uncertainty principle usually would prohibit, according to a study published Jan. 17 in the journal Nature. Researchers conducted experiments with high-powered lasers and quantum dots —artificial atoms that could be the building blocks of nanoscale devices for quantum communication and computing — to learn more about physics at the nanoscale.

Thermoelectric Breakthrough, Silicon Nanowires



Energy now lost as heat during the production of electricity could be harnessed through the use of silicon nanowires synthesized via a technique developed by researchers with the U.S. Department of Energy's (DOE) Lawrence Berkeley National Laboratory (Berkeley Lab) and the University of California (UC) at Berkeley. The far-ranging potential applications of this technology include DOE's hydrogen fuel cell-powered "Freedom CAR," and personal power-jackets that could use heat from the human body to recharge cell-phones and other electronic devices.

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