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Red wine mends solar cells


Source: TRN

Generating electricity from sunlight is still relatively expensive after decades of research and development, but advances in thin film semiconductor materials are opening new avenues to generating cheap, clean energy. Adding a bath to the solar cell manufacturing process could lead to a dramatic boost in efficiency. And it even works with red wine.
Full story

Search tool aids browsing

When you're looking for something on the Internet, search engine results give you many trails to follow. But when a trail goes cold you have to backtrack to the search page and try another. A tool that uses your query to rank the relevance of links on every page could help you zero in on your target.

Tiny pumps drive liquid circuits

Electrical circuits are all about the flow of electricity. With the marriage of microfluidics and plastic electronics, electrical circuits can also be about the flow of fluids. Think tiny pumps that start themselves.

X-shape pulses hold together

Light pulses spread out and eventually disappear, an effect that scientists and engineers have been struggling to overcome for decades. It turns out that under certain conditions nature has the solution. Short, intense light pulses fired through certain types of crystal spontaneously take on an X shape and don't spread out. The unusual shape provides a precise balance of opposing forces, a sort of yin-yang of optics.

Briefs

Patterned fiber makes tiny scope... Atom spouts photons on demand... Channel shapes split microdrops... Chip controls neural connection... Atomic microscope spots viruses... Charges make micro whirlpools.

Last Issue

fact

The potential energy that can be drawn from the sun per square meter is 1.368 kilowatts in the upper atmosphere. As it travels to Earth the energy fades by about 10 percent on clear days and nearly 100 percent on extremely cloudy days. A kilowatt hour is 3,412 Btu's, or 1.341 horsepower. The average year-round capacity per square meter on Earth's surface is 0.34 kilowatts. Power systems with capacities of 12 and 24 kilowatts are common in American homes.

quote

"Nature sparingly uses crystals. The building blocks of living structures are irregular proteins that were optimized over millions of years of evolution to perform tasks that rigid robots and crystalline silicon chips cannot."

- Ioan Gheorma, USC

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The Latest Technology Research News

Tiny pumps drive liquid circuits

By Kimberly Patch, Technology Research News

Many research teams are working to make labs-on-a-chip that manipulate tiny amounts of fluids. A second major research effort is geared toward making cheap and flexible organic, or plastic, electric components. And other researchers are looking for better ways to control, or tune, compact optical devices like fibers, waveguides and photonic crystals.

Researchers from the University of Illinois at Urbana-Champaign and Lucent Technologies' Bell Laboratories have combined microfluidics and organic electronics to make a tunable plastic transistor that could enable low-cost methods to drive, control and monitor labs-on-a-chip. The device can also use tiny amounts of fluid to adjust optical devices.

The idea is to use the microfluidic organic transistors to drive fluid motion, said John Rogers, a professor of materials science and engineering at the University of Illinois at Urbana-Champaign. Such motion can be harnessed to change circuit properties in order to drive pumps, detect fluid motion, and control microvalves, he said. "It is the marriage and direct integration of electronics with microfluidics," he said.

Electric transistors turn on when electricity flows from a source electrode through a central channel to a drain electrode, and off when the flow of electricity is blocked. Transistors usually use a gate electrode to generate an electric field that controls the flow of electricity through the central channel.

The researchers' microfluidic transistor contains channels filled with short plugs of a conducting liquid like mercury that act as source and drain electrodes. The transistor's electrical properties depend on geometries like the amount the electrodes overlap with one another and with the semiconductor.

And the position of the mercury in the channels adjusts the electrical response of the transistor, said Rogers. "As the plugs move through these channels, the geometries of these electrodes change, thereby altering the electrical properties of the transistor," he said.

This type of transistor provides a flexible way to drive a device and to sense its operation and amplify the output, said Rogers. This opens the way to building active power supplies and control circuitry for microfluidic pumps directly into the chip structure of a device in a low-cost and convenient way, he said.

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Key to the concept is the use of an elastomeric, or rubbery, material to form the channels, and surface chemistries that allow the material to instantly bond to an organic semiconductor once they come in contact, said Rogers. "Because they're soft and rubbery it is possible to achieve leakage-free seals... against a range of organic semiconductors without application of external pressure... heating [or] adhesives," he said.

The process doesn't affect the organic semiconductor, said Rogers. This is important because "nearly all organic semiconductors are very fragile from a chemical and mechanical standpoint -- it's easy to degrade them by doing any kind of processing on top of them," he said.

The elastomeric material is inexpensive, cheap and quick to process, and structures can be built over large areas, said Rogers. These characteristics make the material practical for new types of active, low-cost plastic microfluidic devices in addition to the tunable transistors, he said.

The next step is demonstrating microfluidic pumps that are capable of reconfiguring tunable microfluidic photonic systems, said Rogers.

The researchers are working on ways to use tunable microfluidic transistors or transistor arrays to build self-starting microfluidic pumps that can move liquids around in microfluidic systems, said Rogers. They are also looking to use the method to make active components like valves and fluid motion sensors, he said.

The researchers' test device shows that it may be possible to make tunable organic transistors, said Chang-Jin Kim, a professor of mechanical aerospace engineering at the University of California at Los Angeles. The device is "an important step" toward the goal of demonstrating such transistors. The approach is novel because it uses mercury as a part of a transistor, said Kim.

Tunable microfluidic transistors could be used practically in three to six years, according to Rogers.

Rogers's research colleagues were George Maltezos, Robert Nortrup and Jana Zaumseil of Lucent Technologies' Bell Laboratories, and Seokwoo Jeon of the University of Illinois at Urbana-Champaign. The work appeared in the September 8, 2003 issue of *Applied Physics Letters*. The research was funded by Lucent Technologies and the University of Illinois.

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