TECH UPDATE*

Newly designed carbon tubes could replace silicon in microchips

Researchers of IBM T.J. Watson Research Center in Yorktown Heights, N.Y. have created the first functional logic circuit within a single molecule, an achievement that could one day help replace silicon in microchips. This is a significant step toward smaller, faster and less power-consuming computers, according to the researchers. The new circuit works on a miniature scale, using a hollow carbon tube approximately 1.4 nanometers in diameter, or approximately 100,000 times thinner than a human hair. The researchers changed the nanotube's electrical characteristics so that some sections would allow the flow of electrons (called n-type, or negative sections), while other sections would allow the flow of electric current using positive entities on the nanotube called positive holes (also known as p type, or positive sections). The sections were turned into transistors that encode the "NOT" logic function along the length of the nanotube. The characteristics of the resulting circuit—its ability to propagate voltage, allows for more transistors to be placed along the tube to make more complex circuits. Both p and n-type sections are needed to build a logic circuit. While working with their previously assembled p-type transistors, the IBM team discovered a very simple way of producing n-type transistors: simply heating a p-type transistor in a vacuum. In future, the researchers plan to create more complex circuits and to further improve the performance of individual transistors.

Mini-lasers, silicon on sapphire technology lead to speedier chips

Using light beams in place of metal wires, engineers at the Johns Hopkins University, USA, have devised a cost-effective method to speed up the way microchips "talk" to each other. The method, created by a team in the Department of Electrical and Computer Engineering, takes advantage of unusual characteristics associated with "silicon on sapphire" technology, a new way to manufacture microchips. The microchips inside most modern computers are assembled on thin slices of silicon, a material that is a semiconductor. The Johns Hopkins engineers use microchips in which silicon is layered onto thin slices of synthetic sapphire, a material that is an insulator and also allows light to pass through it.

In this microsystem a signal that originates in a wire is transformed into light and beamed through the transparent sapphire substrate via a laser that is only slightly larger than a human hair. Microlenses and other optical components, manufactured at the same time as the electronic circuits on the microchip, collect the light beam and guide it to another place on the microchip or, using an optical fiber, move it to another chip. At its destination, the light enters a high-speed optical receiver circuit that transforms the stream of photons into a stream of electrons that continue their journey through electrical wiring connected to other computer components. By using optical signals, or simply an unhindered laser beam, the Johns Hopkins researchers believe a signal could move 100 times faster than it does along a metal wire. Also, the optoelectric interface circuits require much less power because the sapphire substrate is an insulating material, not a semiconductor. This property of the substrate reduces the power dissipation that commonly occurs in modern microprocessors when signals travel through wires that have capacitances, which are parasitic components that not only degrade the signals but also increase the power consumption of the system. The new design is expected to significantly speed up the movement of data between electronic components

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across a single chip and from one chip to another due to reduction of parasitic capacitances.

Power plant on a chip?

Scientists at Lehigh University, USA are developing a tiny generating plant, housed on a silicon chip, that they believe can produce enough hydrogen to run power-consuming portable devices. Though the amount of hydrogen produced was small, it was enough to demonstrate that the Lehigh project is feasible.

The chip is of the same size as that of an ordinary electronic chip, approximately three centimeters by three centimeters. This chip-based micro-chemical plant would be fuelled by small cartridges of methanol, or other hydrocarbons, that are fed to the "reformer" by micro-capillaries or miniature fuel lines. The reformer would be heated by electricity and the reaction would produce hydrogen which would be transmitted to the fuel cell via another network of micro-capillaries. A fuel cell creates power through the electrochemical reaction of hydrogen and oxygen. While one chip produces enough power, by wrapping scores or hundreds of the tiny micro-plants together — called "numbering up"— enough power could be produced to operate all kinds of electronic devices. A recent experiment in Germany demonstrated that a hydrogen micro-fuel cell powered a laptop computer for up to ten hours whereas the operating time of an ordinary rechargeable laptop battery is generally about two hours.

It is also found that by using a chip power plant one would not need to stop to recharge a battery. Just insert a new fuel source of methanol, diesel or gasoline to the chip plant and the power continues. Currently, one of the hurdles in creating a working plant is getting the reagents into the micro-capillaries, since there are no standard fittings for the chip plant and there are no standardized pipes. Other than chip-based power plant, there could be unlimited uses for devices developed from microchips. One use could be the implantation of a processing chip inside the body to conduct all sorts of medical functions. A tiny chip-analyzer could take in miniscule amount of blood, and analyze it for such things as sugar or insulin levels. Blood tests could be done instantly without the need of sending the results to a laboratory.

Beyond the everlasting lightbulb

Gallium nitride, hailed as the most important new electronic material since silicon, is used to produce very bright light emitting diodes and lasers, and very high power transistors that can operate at high temperature. Light emitting diodes based on gallium nitride can be used to make light bulbs that last 100 times longer than traditional bulbs and consume only 10 per cent of their energy. If light bulbs are replaced by these LEDs, huge energy savings will result with big reductions in CO_2 emissions from power stations.Gallium nitride can also be used to make blue lasers that will write at least four times more information on CDs and optical disks than the red lasers we use at present. This means that it will be possible to write all of Madonna's melodies - or all of Schubert's symphonies - on a single CD.Other potential applications for this technology include powerful transistors which can be used in the base stations for mobile phones to give much greater ranges of transmission, and highly accurate lasers which could be used in surgery and dentistry.

First robot-assisted coronary artery bypass surgery

A 71-year-old retired businessman from New Jersey is the first patient in the U.S. to receive robotically-assisted coronary artery bypass surgery without a chest incision of any kind. It was performed at New York-Presbyterian Hospital on January 15, 2002. Until this point, coronary artery bypass surgery required open-chest surgery, which involves an eight to ten-inch incision made in the chest. Robotically assisted surgery requires only three pencil-sized holes made between the ribs. Through these holes, two robotic-arms and an endoscope (a tiny camera) gain access to the heart, making surgery possible without opening the chest.

Flexible video screen

Presently available bulky CRT & LCD (narrow viewed angle) screens are soon going to be replaced by a new generation of very thin LED based screens. In these screens each pixel consists of three colored LED (Red, Green, Yellow). These screens are made up of ORGANIC LED (OLED) having a special organic material capable of emitting light on application of electric current. A group of scientists has been able to make screens made up of FLEXIBLE OLED (FOLED), flexible in the sense that one can roll it like a paper. They are now trying to build TRANSPARENT OLED (TOLED). With this developed, the screen when there is no message on it shall appear to be absolutely transparent like a glass. In near future, a car's front glass may be replaced by a video screen made up of TOLED.

Net Word

1. **cookie**— Data about you, generated by a website you've visited, and kept-in a file on your computer. It speeds up future access to that site.
2. **spam**— Unsolicited, junk e-mail, such as promotional messages and chain letters, sent to long lists of people.
3. **firewall**— Filter between a private network and the Internet, providing protection against unauthorized access.
4. **clickstream**— The route a person takes when navigating the Web. This is often tracked by advertisers and others who are interested in surfer behaviour.
5. **screenager**— A person who is young, online and seems to spend all of his/her time in front of a computer screen.
6. **worm**— Type of computer virus that replicates itself (other viruses must attach themselves to programs in order to spread).