Research News

NanoWorld: Nature Inspired Micro Circuits

Oct. 13, 2005, United Press International/Physorg — A team of chemical engineers, biologists, geneticists, and electronic engineers headed by Kenneth Sandhage at the Georgia Institute of Technology and colleagues has developed a new process for converting the finely detailed silica skeletons of diatoms into synthetic replicas constituted by materials like titanium dioxide, which could be used in electronic devices. Read more.

Engineers Build DNA 'Nanotowers' with Enzyme Tools

Oct. 13, 2005, Physorg — Duke engineers have added a new construction tool to their bio-nanofabrication toolbox. Using an enzyme called TdTase, engineers can vertically extend short DNA chains attached to nanometer-sized gold plates. This advance adds new capability to the field of bio-nanomanufacturing. Read more.

Nanotubes as Measuring Tips

Oct. 12, 2005, Physorg — Engineers at Purdue University have shown how researchers might better use tiny hollow fibers called "multi-walled carbon nanotubes" to more precisely measure structures and devices for electronics and other applications. Researchers attach the tubes to the ends of imaging instruments called atomic force microscopes. Because the tubes are long and slender, their shape is ideal for the emerging field of "nanometrology," which is precisely measuring structures on the scale of nanometers, or billionths of a meter. Read more.

Taking a Nanoscale Look Under the Surface

Oct. 12, 2005, Nanotechweb — Techniques such as atomic force microscopy provide high-resolution images of a material’s surface, but it's much trickier to look beneath the surface in fine detail. With this in mind, researchers at Northwestern University have come up with scanning near-field ultrasound
holography (SNFUH). The method can image buried nanostructures with a spatial resolution of 10–100 nm. Read more.

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**Nanotech Solar Breakthrough Will Help Spur Viability of Alternative Energy**

Oct. 11, 2005, Physorg — Researchers from New Mexico State University and Wake Forest University achieve 5.2 percent energy conversion with organic solar development. This means less expensive more durable solar panels available in four to five years. Read more.

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**Humidity Sensor: Hybrid Nanoelectronics Made from Living Bacteria and Gold Nanoparticles**

Oct. 7, 2005, Physorg — Living organisms as an integral part of electronic components? What may look like science fiction at first glance is actually a serious approach to the nanoelectronics of tomorrow. Living organisms could provide the required nanostructures. Researchers at the University of Nebraska have now shown that bacteria coated with gold nanoparticles can function as a humidity sensor. Read more.

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**The World’s Smallest Fountain Pen?**

Oct. 6, 2005, Physorg — The miniscule tip on an atomic-force microscope (AFM) helps researchers both "see" and manipulate the nanoscale environment. Now, engineers have created two novel technologies that enable such tips to write features as small as viruses and to withstand abuse with the resilience of diamond. Eventually, they believe, vast arrays of such nanofountain probes could prove useful for crafting such intricate systems as protein arrays or complex semiconductors. Read more.

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**Scientists Learn to Prevent Nano 'Merging'**

Oct. 6, 2005, Physorg — Researchers at the U.S. Department of Energy’s Brookhaven National Laboratory have identified how billionth-of-a-meter sized metal particles — gold-atom clusters within carbon-atom shells — can mesh together to form larger particles and have also found a way to control this process. The results may help scientists determine how these “nanoparticles,” which have unique physical, chemical, and electronic properties, could be incorporated into new technologies. Read more.

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**Scientists Create PNA Molecule With Potential to Build Nanodevices**

Oct. 4, 2005, Physorg — For the first time, a team of investigators at Carnegie Mellon University has shown that the binding of metal ions can mediate the formation of peptide nucleic acid (PNA) duplexes from single strands of PNA that are only partly complementary. This result opens new opportunities to create functional, three-dimensional nanosize structures such as molecular-scale electronic circuits, which could reduce by thousands of times the size of today’s common electronic devices. Read more.

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‘Defective’ Nanostructures Make Breaking Water to Extract Hydrogen Easier
Sep. 30, 2005, Physorg — Scientists at North Carolina State University have discovered a nanoscale method for extracting hydrogen from water that requires only half the energy of current hydrogen production methods. The researchers discovered that “defective” carbon nanotubes make it easier to “break” water molecules and extract hydrogen. The discovery could have big implications, namely, lower hydrogen production costs, for industries looking to hydrogen as an alternative fuel. Read more.

Nano World: Two-faced Janus Nanoparticles

Sep. 28, 2005, Physorg — Janus particles -- two-faced particles named after the Roman god of doorways -- could find use in everything from novel anti-cancer therapies and solar cells to paper-thin flexible video displays. A Janus particle is composed of two fused hemispheres, each made from a different substance than the other. This means Janus particles could, for instance, carry two different and complementary medicines. Read more.

"Keep Cool to Reduce Friction,” Suggests a New Study of Nanoscale Water Condensation

Sep. 26, 2005, Physorg — “Keep cool to reduce friction” might be the advice given to designers of nanoscale machinery by researchers who have just completed a study of factors influencing the formation of “water bridges” – capillary connections that can glue surfaces together, giving rise to friction forces. By studying the frictional forces acting on an atomic force microscope (AFM) tip drawn across a glass surface, researchers at the Georgia Institute of Technology have demonstrated for the first time that the formation of these capillaries is thermally activated. Their study suggests that it may be possible to reduce the adhesion between surfaces by reducing temperatures and putting nanoscale surfaces into motion before the water bridges have time to form. Read more.

Physicists Measure Tiny Force That Limits How Far Machines Can Shrink

Sep. 23, 2005, Physorg — University of Arizona physicists have directly measured how close speeding atoms can come to a surface before the atoms’ wavelengths change. Theirs is a first, fundamental measurement that confirms the idea that the wave of a fast-moving atom shortens and lengthens depending on its distance from a surface, an idea first proposed by pioneering quantum physicists in the late 1920s. The measurement tells nanotechnologists how small they can make extremely tiny devices before a microscopic force between atoms and surfaces, called van der Waals interaction, becomes a concern. The result is important both for nanotechnology, where the goal is to make devices as small as a few tens of billionths of a meter, and for atom optics, where the goal is to use the wave nature of atoms to make more precise sensors and study quantum mechanics. Read more.

World's Smallest Universal Material Testing System

Sep. 22, 2005, Eurekalert — The design, development and manufacturing of revolutionary products such as the automobile, airplane and computer owe a great deal of their success to the large-scale material testing systems (MTS) that have provided engineers and designers with a fundamental understanding of the mechanical behavior of various materials and structures. In the world of nanotechnology, however, where the mechanical characterization of materials and structures takes place on the scale of atoms and molecules, the existing material testing systems are useless. The development
of a universal nanoscale material testing system (n-MTS), which could fit in existing electron microscopes (instruments that can magnify images approximately one million times) and possess the resolution and accuracy needed to mechanically test nanoscale objects, has been a major challenge within the scientific community. Now researchers at Northwestern University have designed and built the first complete micromachine that makes possible the investigation of nanomechanics phenomena in real time. Read more.

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**Nanostructures Build Next-gen Lab Equipment**

Sep. 20, 2005, *Lab Technologist.Com* — A previously unknown zinc oxide nanostructure is set to provide a new building block for creating laboratory equipment that rely on electromechanical coupling. The material’s cost and flexibility makes it suitable for biomedical applications, which use silicon technology. The structure, resembling the helical configuration of DNA, could provide engineers with a new building block for creating nanometer-scale sensors, transducers, resonators and other devices that rely on electromechanical coupling. Scientists from the Georgia Institute of Technology are confident that this unique material could become the new material for nanotechnology following carbon nanotubes. Read more.

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**Study Suggests New Way of Making Super-hard Nanomaterials**

Sep. 19, 2005, *Physorg* — Research conducted by a team of scientists led by Lawrence Livermore National Laboratory suggests a new way of making super-hard materials under high-pressure conditions. The research offers a glimpse at harder materials that could one day be used in fusion energy production, spacecraft shielding and safer automobile frames, as well as other applications. Read more.

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**Rice Researchers Gain New Insight Into Nanoscale Optics**

Sep. 15, 2005, *Physorg* — New research from Rice University has demonstrated an important analogy between electronics and optics that will enable light waves to be coupled efficiently to nanoscale structures and devices. Both light and electrons share similar properties, at times behaving like waves, at other times like particles. Many interesting solid-state phenomena, such as the scattering of atoms off surfaces and the behavior of quantum devices, can be understood as wavelike electrons interacting with discrete, localized electrons. Now, Rice researchers have discovered and demonstrated a simple geometry where light behaves exactly as electrons do in these systems. Read more.

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**Like Fireflies and Pendulum Clocks, Nano-oscillators Synchronize Their Behavior**

Sep. 15, 2005, *Physorg* — Like the flashing of fireflies and ticking of pendulum clocks, the signals emitted by multiple nanoscale oscillators can naturally synchronize under certain conditions, greatly amplifying their output power and stabilizing their signal pattern, according to scientists at the Commerce Department's National Institute of Standards and Technology. Read more.

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**Researchers Create Tiny Magnetic Diamonds on the Nanoscale**
Sep. 12, 2005, *Physorg* — Diamonds have always been alluring, but now a team of scientists has made them truly magnetic -- on the nanoscale. Researchers associated with the Rensselaer Nanotechnology Center at Rensselaer Polytechnic Institute report a technique to make magnetic diamond particles only 4-5 nanometers across. The tiny diamond magnets could find use in fields ranging from medicine to information technology. Ferromagnetism has been historically reserved for metals, but scientists are becoming increasingly interested in the prospect of creating metal-free magnets, particularly from carbon-based materials. Diamond is a naturally occurring crystalline form of carbon. [Read more.]

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**Research Shows How Water May Enhance Nanocatalysis**

Sep. 12, 2005, *Physorg* — Researchers at the Georgia Institute of Technology have uncovered important evidence that explains how water, usually an inhibitor of catalytic reactions, can sometimes promote them. The findings could lead to fewer constraints on reaction conditions potentially leading to the development of lower cost techniques for certain industrially important catalytic reactions. [Read more.]

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**Rapid One-Pot Syntheses Developed For Quantum Dots**

Sep. 9, 2005, *Physorg* — Efficient and highly scalable new chemical synthesis methods developed at the University at Buffalo's Institute for Lasers, Photonics and Biophotonics have the potential to revolutionize the production of quantum dots for bioimaging and photovoltaic applications. Quantum dots are tiny semiconductor particles generally no larger than 10 nanometers that can be made to fluoresce in different colors depending on their size. Scientists are interested in quantum dots because they last much longer than conventional dyes used to tag molecules, which usually stop emitting light in seconds. Quantum dots also are of great interest for energy applications because they can produce electrons when they absorb light, making possible extremely efficient solar-energy devices. [Read more.]

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**From the Lab: Liquid Transistor**

Sep. 10, 2005, *MIT Technology and Review* — University of California, Berkeley, researchers have developed a nano-scale silicon device that acts like a transistor for fluids. By applying a voltage across the device, the researchers stopped and started the flow and controlled the concentration of ions and molecules moving through the device's 35-nanometer-high, one-micrometer-wide channels. [Read more.]

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**Nanowire Stability Depends on Surface Tension**

Sep. 7, 2005, *Nanotechweb* — Researchers at the University of Arizona have investigated why nanowires can become thin and break at temperatures above absolute zero. They believe that energy fluctuations in the wire create a collective motion, or soliton, among the material’s atoms. The solitons propagate from one end of the wire to the other, causing thinning. [Read more.]

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**Nanoparticles Create Anti-fog Coating**

Sep. 7, 2005, *Nanotechweb* — Fog on windows, spectacles and other glass surfaces could soon be a thing of the past if a nanotechnology coating developed in the US takes off. Michael Rubner and his
colleagues at Massachusetts Institute of Technology (MIT) have devised a silica nanoparticle coating that causes water droplets to flatten into a thin uniform sheet rather than form the usual annoying light-scattering beads. Read more.

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**Nanomaterial Hazard**

Sep. 6, 2005, *Physorg* — Preliminary research by a team of ASU scientists suggests the presence of nanomaterials in drinking water may be dangerous to humans. Two of the researchers – principal investigator Paul Westerhoff and civil and environmental engineering professor John Crittenden – caution against drawing conclusions from these preliminary results, but they say initial results indicate that certain nanomaterials in water may be toxic. Read more.

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**Silicon Nanotechnology to Combat Biowarfare Agents**

Sep. 6, 2005, *Physorg* — Researchers at the University of Rochester are developing a smart-system that would detect - and combat - the biowarfare agents. Research finds early detection and diagnosis is critical to ensure public safety and minimize the impact of agents such as anthrax. The biosensors will be able to function remotely inside buildings. The prototype development is a combination of nanoscience, nanotechnology and optics and fills an imminent national security need, researchers say. Read more.

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**Argonne Researchers Create New Diamond-nanotube Composite Material**

Sep. 6, 2005, *Argonne National Laboratory* — Researchers at the U.S. Department of Energy’s Argonne National Laboratory have combined the world’s hardest known material – diamond – with the world’s strongest structural form – carbon nanotubes. This new process for “growing” diamond and carbon nanotubes together opens the way for its use in a number of energy-related applications. Read more.

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**Researchers Find New Mechanism Governing Particle Growth in Nanocomposites**

Sep. 2, 2005, *Physorg* — Because the properties of nanoparticles depend so closely on their size, size distribution and morphology, techniques for controlling the growth of these tiny structures is of great interest to materials researchers today. A research team from the Georgia Institute of Technology and Drexel University has discovered a surprising new mechanism by which polymer materials used in nanocomposites control the growth of particles. Read more.

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**From the Lab: Nanotechnology**

Sep. 2, 2005, *MIT Technology Review* — In a step toward cheaper and more efficient solar cells, researchers from the University of California, Berkeley, have made solar cells out of billions of nanowires, each wire about 60 nanometers in diameter and 20 micrometers in length. The nanowires, made of zinc oxide and coated in a light-absorbing dye, conducted electrons from one end of the cell to the other about 100 times more efficiently than other nanoparticle-based solar cells currently under development. The solar cells' overall light-conversion efficiency, however, was a relatively poor 1.5
New 'Alien Nanofiber' Has Potential Anti-Counterfeiting Applications

Aug. 31, 2005, Physorg/North Carolina State University — Under a powerful microscope it looks like an alien - something out of Roswell, N.M., or "The X-Files." But a brand-new, tiny fiber dubbed the "alien nanofiber," co-invented by a North Carolina State University textiles professor and a chemical engineering professor from the University of Puerto Rico, Mayaguez, has the potential to become a big deterrent to counterfeiters. Novel nanoscale fibers they created can be placed inside a garment or paper document and serve as a "fingerprint" that proves the garment or document is genuine. Read more.

Gold Bowties May Shed Light on Molecules and Other Nano-sized Objects

Aug. 30, 2005, EurekAlert — One of the great challenges in the field of nanotechnology is optical imaging--specifically, how to design a microscope that produces high-resolution images of the nano-sized objects that researchers are trying to study. For example, a typical DNA molecule is only about three nanometers wide--so tiny that the contours of its surface are obscured by light waves, which are hundreds of nanometers long. Now, researchers from Stanford University have greatly improved the optical mismatch between nanoscale objects and light by creating the "bowtie nanoantenna," a device 400 times smaller than the width of a human hair that can compress ordinary light waves into an intense optical spot only 20 nanometers wide. These miniature spotlights may one day allow researchers to produce the first detailed images of proteins, DNA molecules and synthetic nano-objects, such carbon nanotube bundles. Read more.

UA Physicists Find Key To Long-Lived Metal Nanowires

Aug. 26, 2005, NanoTech — University of Arizona physicists have discovered what it takes to make metal 'nanowires' that last a long time. This is particularly important to the electronics industry, which hopes to use tiny wires in Lilputian electronic devices in the next 10 to 15 years. Read more.

Brookhaven's "Electro Pen" May Impact a Host of Developing Nanotechnologies

Aug. 25, 2005, Nanotechnology Now — At the U.S. Department of Energy's Brookhaven National Laboratory, scientists have developed a new chemical "writing" technique that can create lines of "ink" only a few tens of nanometers, or billionths of a meter, in width. Read more.

Nanoparticle Dispersion Technique Improves Polymers

Aug. 30, 2005, AZoneo — There is a lot of excitement about incorporating nanoparticles into polymers because of the ability to improve various properties with only a small percent of the particles. A research group at Virginia Tech has developed a method for improving the dispersion, or exfoliation, of individual nanoparticles into polymers. Read more.
Physicists Pose 'Chip Dip' Nano Process

Aug. 30, 2005, Small Times — Physicists at the University of Pennsylvania have developed a method to create functional electronic circuits by dipping semiconductor chips into liquid suspensions of carbon nanotubes rather than growing the nanotubes directly on the circuits. Nanotubes, tiny tubes composed of carbon atoms, can be either semiconducting or metallic, the latter being highly conductive to electricity. Semiconducting nanotubes make exceptional transistors, which is why so much attention has been devoted to finding a way to use them in electronics. Read more.

Columbia Researchers Bring Nanotech's Promise a Step Closer to Reality

Aug. 23, 2005, Physorg — Scientists at Columbia University's Nanoscience Center have solved a fundamental, and to date, highly elusive challenge in the fast-developing world of nanotech-molecular electronic devices by creating a so-called electricity-bridge to allow current to flow efficiently between molecules and nano-sized metals, a process necessary for molecular electronic device construction. Read more.

New Microprinting Technique Improves Nanoscale Fabrication

Aug. 19, 2005, PhysOrg — Scientists will announce next month a new technique called microdisplacement printing, which makes possible the highly precise placement of molecules during the fabrication of nanoscale components for electronic and sensing devices. Read more.

Researchers Produce Strong, Transparent Carbon Nanotube Sheets

Aug. 18, 2005, PhysOrg — University of Texas at Dallas (UTD) nanotechnologists and an Australian colleague have produced transparent carbon nanotube sheets that are stronger than the same-weight steel sheets and have demonstrated applicability for organic light-emitting displays, low-noise electronic sensors, artificial muscles, conducting appliqués and broad-band polarized light sources that can be switched in one ten-thousandths of a second. Read more.

Researchers Carve with Electricity at the Nanometer Scale

Aug. 18, 2005, National Science Foundation — By applying electric current through a thin film of oil molecules, engineers have developed a new method to precisely carve arrays of tiny holes only 10 nanometers wide into sheets of gold. The new system, called Electric Pen Lithography (EPL), uses a scanning-tunneling microscope, fitted with a tip sharpened to the size of a single atom, to deliver the charge through the dielectric oil to the target surface. Read more.

Researchers Develop New Source of Energy Using Nanotechnology

Aug. 16, 2005, PhysOrg — Countries across the world continue to search for new ways to create energy. As our current means for energy continue to deplete, thus making them more expensive to generate, governments are searching for new energy resources. Researchers at the University of Missouri-
Columbia have developed a more efficient source of energy involving nano-scale particles that take only microseconds to create and can be developed on a surface as small as a microchip. Read more.

**Tough New Probe Developed for Nanotechnologists**

Aug. 11, 2005, *PhysOrg* — Since the invention of the atomic force microscope (AFM) in 1986 by Nobel laureate Gerd Binnig, the tool has been employed to advance the science of materials in many ways, from nanopatterning (dip-pen nanolithography) to the imaging of surfaces and nano-objects such as carbon nanotubes, DNA, proteins and cells. In all these applications, the quality and integrity of the tip used to obtain the images or interrogate materials is paramount. A common problem in atomic force microscopy is the deterioration of the tip apex as surfaces are scanned. To overcome this problem, a team of scientists from Northwestern University and Argonne National Laboratory report the microfabrication of monolithic ultra-nano-crystalline diamond (UNCD) cantilevers with tips exhibiting properties similar to single-crystal diamond. Read more.

**Ice Transforms Chipmaking**

Aug. 10, 2005, *Technology Research News* — Harvard University scientists have taken ice sculpture to a new level -- that of molecules. The researchers showed that molecular-scale layers of ice could be made easily and cheaply and then etched with electron or ion beams. The method promises to make it easier for researchers to make nanoscale machines, and could someday make for an inexpensive, environmentally-friendly way to make computer chips. Read more.

**Penn Researchers Take a Big Step Forward in Making Smaller Circuits**

Aug. 1, 2005, *PhysOrg* — Physicists at the University of Pennsylvania have overcome a major hurdle in the race to create nanotube-based electronics. In an article in the August issue of the journal *Nature Materials*, the researchers describe their method of using nanotubes tiny tubes entirely composed of carbon atoms -- to create a functional electronic circuit. Their method creates circuits by dipping semiconductor chips into liquid suspensions of carbon nanotubes, rather than growing the nanotubes directly on the circuit. Read more.

**Lens Allows Optical Microscopy Down to 60 Nanometers**

Aug. 2005, *Technology Review* — A team from the University of California, Berkeley, has devised a silver "superlens" that could increase the resolution of light microscopy by about a factor of six. The lens doesn't diffract light like conventional glass lenses. Instead, it uses evanescent waves, which are produced when light hits a lens at such an angle that it bounces off instead of passing through. Evanescent waves emerge on the other side of the lens and add optical information to normal "propagating" light waves, but they decay very quickly over short distances. By capturing and amplifying these weak waves, the researchers obtained images with 60-nanometer resolution. Read more.

**Researchers Help Sort Out the Carbon Nanotube Problem**
Jul. 28, 2005, PhysOrg — National Institute of Standards and Technology (NIST) and university researchers report a significant step toward sorting out the nanotube “problem”—the challenge of overcoming processing obstacles so that the remarkable properties of the tiny cylindrical structures can be exploited in new polymer composite materials of exceptional strength. As described in the July 15 issue of Physical Review Letters, their analysis reveals that, during mixing, carbon nanotubes suspended in viscous fluids can be encouraged to sort themselves by length. Achieving uniform sizes of nanotubes is one of several keys to producing affordable, high-quality polymer nanocomposites. Read more.

Physicists Find Way to Create 3D Quasicrystals

Jul. 12, 2005, PhysOrg — New York University physicists have applied a ground-breaking nanotechnology method to create three-dimensional quasicrystals, highly ordered structures that, unlike conventional crystals, never repeat themselves. Metallic quasicrystals created from exotic alloys have shown promise for storing hydrogen more efficiently than crystalline hosts. Their non-repeating structure has the potential to dramatically strengthen industrial and commercial products. The NYU quasicrystals, by contrast, are made of glass and plastic and have potentially revolutionary optical properties. Read more.

The Presence of Oxygen on Carbon Nanotubes Enhances Interaction with Ammonia

Jul. 12, 2005, PhysOrg — Single-walled carbon nanotubes (SWNTs), which could play an important role in developing sensors against chemical threats, have enhanced interaction with ammonia because of the presence of oxygen groups on the nanotubes, researchers at Temple University have discovered. Read more.

Discovery of 'Doping' Mechanism in Semiconductor Nanocrystals Advances Potential of Nanotechnology

Jul. 8, 2005, NRL Press Release — Novel electronic devices based upon nanotechnology may soon be realized due to a new understanding of how impurities, or 'dopants,' can be intentionally incorporated into semiconductor nanocrystals. This understanding, announced today by researchers at the Naval Research Laboratory (NRL) and the University of Minnesota (UMN), should help enable a variety of new technologies ranging from high-efficiency solar-cells and lasers to futuristic 'spintronic' and ultra-sensitive biodetection devices. Read more.

Nanotubes in a New Light

Jul. 7, 2005, PhysOrg — Nanotubes are tiny cylindrical molecules just a few nanometers in diameter, but their potential for new technologies is vast. They are extraordinarily strong, conduct electricity well, and can even emit light, properties suitable for many applications, from flat-panel television displays to fuel cells to building materials. But nanotubes must be extensively studied before they can be used in industrial applications. In collaborative research, a team of scientists has pioneered a novel way of using x-rays at the NSLS to study arrays of nanotubes. In an ongoing series of research projects, they have determined the degree of order contained in certain nanotube systems - that is, to what extent they form organized patterns - and have investigated the structural and chemical properties of others. Read more.
New Design Developed for Silicon Nanowire Transistors

Jul. 6, 2005, PhysOrg — In an advance for nanoscale electronics, researchers at the National Institute of Standards and Technology (NIST) have demonstrated a new design for silicon nanowire transistors that both simplifies processing and allows the devices to be switched on and off more easily. The NIST design, described in a paper published June 29 by the journal Nanotechnology, uses a simplified type of contact between the nanowire channel and the positive and negative electrodes of the transistor. The design allows more electrical current to flow in and out of the silicon. Read more.

A Giant Step Toward Tiny Functional Nanowires

Jul. 1, 2005, PhysOrg — Carving a telephone pole is easy if you have the right tools, say a power saw and some large chisels. And with some much tinier tools you could even carve a design into a paper clip if you wanted to. But shrink your sights down to the nanoscale, to a nanowire that is 1,000 times smaller than the diameter of a paper clip, and you find there are no physical tools to do the job properly. So a team of Northwestern University scientists turned to chemistry and developed a new method that can routinely and cheaply produce nanowires with gaps as small as five nanometers wide -- a feat that is unattainable using conventional lithographic techniques. Read more.

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