



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Physicists engrave nanoscale magnets directly into layer of material](#)

[PhysOrg.com, 23NOV2015](#)

Researchers in Germany fabricated nanomagnets in a wafer-thin layer of iron-aluminum for the first time without the use of masks. With a highly focused ion beam, which they used like a magnetic stylus, they generated prototypes of complex magnetic geometries. The nanomagnets are embedded in an electrically conductive layer which facilitates the development of spintronic components. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Microelectronics, Featured article

[Self-healing sensor brings ‘electronic skin’ closer to reality](#)

[Science Daily, 17NOV2015](#)



The researchers are currently experimenting with carbon-based self-healing composites and self-healing transistors. Credit: © praisaeng / Fotolia

Researchers in Israel have developed materials that can be integrated into flexible devices to “heal” incidental scratches or damaging cuts that might compromise device functionality. The advancement, using a new kind of synthetic polymer has self-healing properties that mimic human skin, which means that e-skin “wounds” can quickly “heal” themselves in remarkably short time—less than a day.

[TECHNICAL ARTICLE](#)

Tags: Biotechnology, Featured article

ADVANCED MATERIALS

[International Graphene Centre launches in Beijing..](#)

[Nanowerk, 23NOV2015](#)

The China-UK collaborative effort to support the development of international graphene standards and testing centre was officially launched at Zhongguancun Fengtai Science Park, Beijing, China, in October 2015. As the demand for international standards for testing graphene increases, the Centre in Beijing will lay the foundation for the development of graphene industry and high-end applications in China.

Tags: Advanced materials, S&T Policy

[Hybrid carbon foams serve as good heat conductors](#)

[Nanotechweb, 20NOV2015](#)

An international team of researchers (USA - UT Austin, Italy, Republic of Korea) has developed a 3D continuous ultrathin graphite foam (UGF) and carbon nanotubes (CNT) hybrid nanomaterial in which nanotubes are directly grown on the UGF struts. When the UGF-CNT hybrid structures are combined with erythritol, the composite produced has a thermal conductivity as high as 4 Wm⁻¹K⁻¹. This value is 1.8 and 5.2 times higher than that of UGF/erythritol and pure erythritol respectively. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: Cyborg Athletes, Drone Drop Test, and Robot Makes Sandwiches](#)

[IEEE Spectrum, 20NOV2015](#)

In this talk a researcher from the UK describes what he sees as the main obstacles to achieving human-level artificial intelligence given the current state of machine learning, and suggests a number of ways these obstacles might be overcome.

Tags: Autonomous systems & robotics

S&T NEWS ARTICLES

BIG DATA

Optimized software-controlled solid-state drive for big data processing[PhysOrg.com, 19NOV2015](#)

Researchers in Japan developed a solid-state drive that enables read/write commands for each flash memory chip directly from software. They developed a “read-ahead” feature that enables parallel data retrievals from multiple flash memory chips without the instructions interfering with each other. By loading data into DRAM before using the data from the in-memory database, data usage and data loading are processed simultaneously, enabling high-speed big data processing, with no access lags, even with limited DRAM capacity.

Tags: Big data, Information technology, S&T Japan

Climate macroscope: New software for finding tipping points and critical network structures[Science Daily, 17NOV2015](#)

Researchers in Germany have developed a new tool to help grapple with enormous data sets and reveal big picture trends, such as climatic tipping points and their effects on species. The researchers created a software package based on the Python programming language that unifies complex network theory and nonlinear time series analysis—two important data analysis concepts. The software could be used to identify critical network structures, such as bottlenecks and backbones, for transport processes, as well as revealing tipping points in climatological or physiological time series.

Tags: Big data, S&T Germany

Managing the data deluge for national security analysts[Science Daily, 17NOV2015](#)

Researchers at the Sandia National Laboratory looked at raw data and ways to pre-process and analyze it to make it searchable and more meaningful. The project’s fundamental research in cognitive science will inform the design of software and tools to help those viewing the data and make information of interest or trends easier to uncover. They developed software that can represent remote sensor images, couple them with additional information and present them in a searchable form.

Tags: Big data, Government S&T

BIOTECHNOLOGY

Light-driven nanosubmarines built from 244 atoms[Nanowerk, 17NOV2015](#)

Built by a team of researchers in the US (Rice University, North Carolina State University), each of the single-molecule, 244-atom submersibles has a motor powered

by ultraviolet light. With each full revolution, the motor’s tail-like propeller moves the sub forward 18 nanometers. With the motors running at more than a million RPM, the sub’s top speed amounts to less than 1 inch per second which is an “enhancement in diffusion” of 26 percent for nanosubmersibles. Future nanosubs will be able to carry cargoes for medical and other purposes. [TECHNICAL ARTICLE](#)

Tags: Biotechnology

BREAKTHROUGH TECHNOLOGY

Electronic plants created[Science Daily, 20NOV2015](#)

Researchers in Sweden used the vascular system of living roses to build key components of electronic circuits. They demonstrated wires, digital logic, and even display elements—fabricated inside the plants—that could develop new applications for organic electronics and new tools in plant science. [TECHNICAL ARTICLE](#)

Tags: Breakthrough technology, S&T Sweden

COMMUNICATIONS TECHNOLOGY

Researchers confirm ‘realistic’ answer to quantum network puzzle[PhysOrg.com, 19NOV2015](#)

An international team of researchers (UK, Canada, USA - MIT, Denmark) compared the state of the art in continuous variable systems (optical modes) with the standard discrete variable systems (qubits). Continuous variable systems offer the best and cheapest technology for reaching high rates over metropolitan distances and they can work at room temperature. On the other hand, the cryogenic devices needed to improve the bit rate on a system using standard qubit-based QKD and would require a built-in facility that operated at temperatures close to zero kelvin. [TECHNICAL ARTICLE](#)

Tags: Communications technology, Quantum science

‘Power Over Wi-Fi’ named one of the year’s game-changing technologies[PhysOrg.com, 18NOV2015](#)

Researchers at the University of Washington found that the peak energy contained in untapped, ambient Wi-Fi signals often came close to meeting the operating requirements for some low-power devices. But because the signals are sent intermittently, energy “leaked” out of the system during silent periods. They fixed that problem by optimizing a router to send out superfluous “power packets” on Wi-Fi channels not currently in use without affecting the quality and speed of data transmission. They developed sensors that can be integrated in devices to harvest the power. [TECHNICAL ARTICLE](#)

Tags: Communications technology, Emerging technology

“For a successful technology, reality must take precedence over public relations, for Nature cannot be fooled.” RICHARD FEYNMAN

ENERGY

Perpetual youth for batteries?

Science Daily, 17NOV2015

Researchers in Germany determined two key mechanisms for the loss of capacity in lithium ion batteries during operation: The active lithium in the cell is slowly used up in various side reactions and is thus no longer available.

The process is very temperature dependent: At 25 °C the effect is relatively weak but becomes quite strong at 60 °C.

TECHNICAL ARTICLE

Tags: Energy, Battery, S&T Germany

Valley current control shows way to ultra-low-power devices

Nanowerk, 16NOV2015

Researchers in Japan created an electrically controllable valley current device that converts conventional electrical current to valley current, passes it through a long (3.5 micron) channel, then converts the valley current back into charge current that can be detected by a measurable voltage. The research group used a graphene bilayer sandwiched between two insulator layers, with the whole device sandwiched between two conducting layers or ‘gates’, allowing for the control of valley. The research may pave the way to ultra-low-power “valleytronics” devices.

TECHNICAL ARTICLE

Tags: Energy, S&T Japan

FORECASTING

Predicting solar flares

PhysOrg.com, 16NOV2015

The new technique, developed by an international team of researchers (USA - California State University Northridge, Belgium, UK, India), allows changes in the Sun’s magnetic fields, which drive the initiation of solar flares, to be monitored up to ten times faster than previous methods. It demonstrates a novel way of probing the Sun’s outermost magnetic fields, providing scientists worldwide with a new approach to examine, and ultimately understand, the precursors responsible for destructive space weather.

TECHNICAL ARTICLE

Tags: Forecasting

INFORMATION TECHNOLOGY

This app lets you target autonomous video drones with facial recognition

KurzweilAI, 19NOV2015

A company in the US has combined facial-recognition and drone-control mobile software in an iOS/Android app

called “Selfie Dronie” that enables low-cost Parrot Bebop and Bebop 2 drones to take hands-free videos and follow a subject autonomously. It can immediately learn to recognize an object using an ordinary camera. As the object moves, the deep learning algorithms learn more about the object in real time and in different environments.

Tags: Information Technology, Pattern recognition

X-ray microscope reveals ‘solitons,’ a special type of magnetic wave

Science Daily, 16NOV2015

An international team of researchers (USA - Stanford University, SLAC National Accelerator Laboratory, University of New York, Emory, industry partner, Spain, Sweden) used a powerful, custom-built X-ray microscope to directly observe the magnetic version of a soliton. Scientists are exploring whether such magnetic waves can be used to carry and store information in a new, more efficient form of computer memory that requires less energy and generates less heat.

TECHNICAL ARTICLE 1, 2

Tags: Information Technology, Sensors

MATERIALS SCIENCE

Indium selenide makes high-gain phototransistor

Nanotechweb, 19NOV2015

An international team of researchers (the Netherlands, Spain) have developed photodetecting devices based on indium selenide in which they can control the mechanism that produces the photocurrent by varying the back gate voltage. The detector could be well suited for applications in which very weak light sources need to be detected—for example, in night vision or astronomy instruments.

TECHNICAL ARTICLE

Tags: Materials science, Sensors

New vision for multifunctional materials

Science Daily, 19NOV2015

Taking a cue from nature, a team of researchers in the US (MIT, Harvard University, University of South Carolina) has deciphered how the biomineral making up the body armor of a chiton mollusk has evolved to create functional eyes embedded in the animal’s protective shell. The findings could help determine so far still elusive rules for generating human-made multifunctional materials. Multifunctional materials could enable us to build houses that make use of their environments, monitor wear-and-tear and look for signs of damage in materials or even to better deliver some drugs and produce bioengineered organs.

TECHNICAL ARTICLE

Tags: Materials science, Biomimetics

continued...

Graphene's stabilizing influence on supercapacitors

Nanowerk, 18NOV2015

An international team of researchers (Singapore, China) has fabricated asymmetric supercapacitors which incorporate metal nitride electrodes with stacked sheets of graphene. The team used atomic layer deposition to grow two different materials on vertically aligned graphene nanosheets: titanium nitride for their supercapacitor's cathode and iron nitride for the anode. The cathode and anode were then heated and then separated in the asymmetric supercapacitor by a solid-state electrolyte, which prevented the oxidization of the metal nitrides. They showed they could cycle the device 20,000 times and it exhibited both high capacitance and high power density. [TECHNICAL ARTICLE](#)

Tags: Materials science

FEATURED RESOURCE

Defense Update

Highlights worldwide defense programs; asymmetric, hybrid warfare and net centric operations. Provides a comprehensive list of professional events and exhibitions. [RSS](#)

A new symmetry underlies the search for new materials

PhysOrg.com, 17NOV2015

Researchers at Penn State report a new set of boxes called distortion symmetry groups that describes what happens when physical systems are perturbed by stresses, electric and magnetic fields or other forces, and change from one state to another. They show that there is a huge family of problems that this will apply to, such as phase transitions. The research has the potential to speed up the search for new advanced materials that range from tougher steels to new types of electronic, magnetic, and thermal materials.

Tags: Materials science, Advanced materials

Researchers test the limits of toughness in nanocomposites

Nanowerk, 17NOV2015

A team of researchers in the US (Stanford University, industry partner) has tested the upper boundaries of mechanical toughness in a class of lightweight nanocomposites toughened by individual molecules, and offered a new model for how they get their toughness. The potential applications for nanocomposites cut across many industries, from computer circuitry to transportation to athletics. They could even revolutionize space-flight with their ability to withstand tension and extreme

temperatures. [TECHNICAL ARTICLE](#)

Tags: Materials science

Stacking instead of mixing improves the energy efficiency of topological insulators

Nanowerk, 17NOV2015

The overheating of computer chips is a major obstacle to the development of faster and more efficient computers and mobile phones. In order to obtain a topological insulator, an international team of researchers (Germany, Poland) stacked both semiconductors on top of each other, atomic layer by atomic layer, placing this in turn on a silicon backing layer with the help of molecular beam epitaxy. Thus they found a way to control the desired conducting properties of topological insulators more precisely and reliably.

[TECHNICAL ARTICLE](#)

Tags: Materials science, Advanced materials

MICROELECTRONICS

New discovery provides new opportunities for chips

Science Daily, 18NOV2015

Researchers in the Netherlands have developed a special 3D mask that can define the structure on two sides of the wafer simultaneously. This ensures that both sides of the chip are neatly aligned, thereby guaranteeing the vertical alignment of the final three-dimensional nanostructure. The method opens the way for the mass production of chips in which various functionalities are positioned close together. The discovery also makes it possible to produce chips with additional functions for mobile devices, computers and other applications. [TECHNICAL ARTICLE](#)

Tags: Microelectronics

Flexoelectricity is more than Moore

Nanowerk, 17NOV2015

An international team of researchers (Spain, the Netherlands, USA - Cornell University) managed to produce the world's first integrated flexoelectric microelectromechanical system on silicon. They have found that, at the nanoscale, the desirable attributes of flexoelectricity are maintained. The universality of flexoelectricity implies that all high-k dielectric materials used currently in transistor technology should also be flexoelectric, thus providing an elegant route to integrating "intelligent" electromechanical functionalities within already existing transistor technology.

[TECHNICAL ARTICLE](#)

Tags: Microelectronics, Information technology

QUANTUM SCIENCE

Quantum entanglement achieved at room temperature in semiconductor wafers

PhysOrg.com, 20NOV2015

A team of researchers in the US (University of Chicago, UC Santa Barbara, University of Iowa, industry partner) used

continued...

infrared laser light to order the magnetic states of thousands of electrons and nuclei and then used electromagnetic pulses to entangle them. Using this procedure they entangled pairs of electrons and nuclei in Silicon carbide. It might even be possible to go from entangled states on the same SiC chip to entangled states across distant SiC chips. Long-distance entangled states have been proposed for synchronizing global positioning satellites and secure communications. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology

[Quantum fingerprint is impossible to replicate](#)

[Nanotechweb](#), 20NOV2015

Researchers in the UK have developed a technique to authenticate the identity of electronic devices using resonant tunneling diodes. The idea takes a problem in quantum electronics—the extreme sensitivity of the energy levels of a quantum well to its height and breadth—and turns it into an opportunity for creating a unique “quantum fingerprint” that is impossible to forge. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T UK

SCIENCE WITHOUT BORDERS

[Advancing the Design and Modeling of Complex Systems](#)

[DARPA News](#), 20NOV2015

DARPA has announced the Complex Adaptive System Composition and Design Environment (CASCADE) program. The goal of CASCADE is to advance and exploit novel mathematical techniques able to provide a deeper understanding of system component interactions and a unified view of system behaviors. [BAA](#)

Tags: Science without borders, DARPA, Government S&T, Simulation and modeling

[Particle accelerator on a microchip](#)

[Nanowerk](#), 19NOV2015

Until now, the necessary facilities have been very large and costly. The Gordon and Betty Moore Foundation has awarded 13.5 million US dollars to an international team of researchers (Germany, USA - Stanford University) to promote the development of a working prototype of an ‘accelerator-on-a-chip’ within five years. Particle accelerators are an indispensable tool in countless areas of research—from fundamental research in physics to examining the structure of biomolecules in order to develop new drugs.

Tags: Science without borders, R&D Funding

[R&D Magazine 2015 R&D 100 Winners](#)

[R&D Magazine](#), 18NOV2015

The 2015 R&D 100 Award Winners are listed in alphabetical order by the name of the primary developer company.

Tags: Science without borders

SENSORS

[Manipulating transistors at terahertz frequencies](#)

[Science Daily](#), 23NOV2015

Researchers in Germany have demonstrated that 2D electron gases in transistors can be controlled not only via DC and radio-frequency voltages. The thickness determines the frequency which makes the gas oscillate optimally. Deploying external voltage, the researchers were able to fine-tune the electron gas to the resonators, i.e. adjust the gas so that the alternating electric pressure of the resonators excites it optimally to oscillate in the terahertz range. This method could be of interest for sensors in chemical and environmental applications as the molecule oscillations typically happen in the terahertz range. [TECHNICAL ARTICLE](#)

Tags: Sensors, S&T Germany, Terahertz technology

[Lockheed Martin introduces next-generation radar technology—Digital Array Row Transceiver \(DART\)](#)

[PhysOrg.com](#), 19NOV2015

Based on the use of Gallium Nitride technology, Digital Array Row Transceiver (DART) results in greater performance within current Lockheed Martin radar products and lowers life-cycle costs due to an increase in energy efficiency. GaN is a low-risk solution whether part of a systems upgrade or in a newly built system. DART provides greater performance thanks to improved reliability and increased efficiency.

Tags: Sensors, Imaging technology, Military technology ■

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