



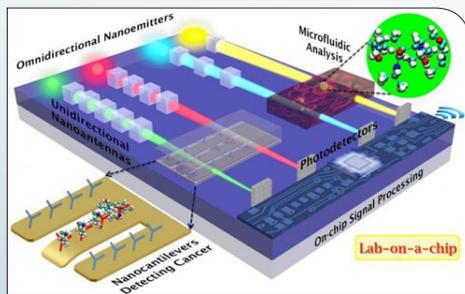
S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Optical nanoantennas set the stage for a NEMS lab-on-a-chip revolution](#)

[Nanowerk, 24FEB2015](#)

Schematic representation of unidirectional cubic nanoantennas inducing directionality to omnidirectional nanoemitters to precisely focus light with adjustable beam width and intensity. Image: D. Sikdar and M. Premaratne/Monash University

Researchers in Australia describe analysis and simulation of 200-nanometer dielectric nanocubes placed in the path of visible and near-infrared light sources. The nanocubes are arranged in a

chain, and the space between them can be adjusted to fine-tune the light beam as needed for various applications. As the separation between cubes increases, the angular width of the beam narrows and directionality improves. [TECHNICAL ARTICLE](#)

Tags: [Sensors](#), [S&T Australia](#), [Featured Article](#)

[Physicists use nanotechnology to capture perfect colors with one ultra-thin lens](#)

[Nanowerk, 19FEB2015](#)

Researchers at Harvard University have overcome an inherent drawback of a wafer-thin lens: light at different wavelengths responds to the surface very differently. Instead of treating all wavelengths equally, the researchers have devised a flat lens with antennas that compensate for the wavelength differences and produce a consistent effect--for example, deflecting three beams of different colors by the same angle, or focusing those colors on a single spot. This means that complicated effects like color correction can be achieved in one extremely thin miniaturized device.

[TECHNICAL ARTICLE](#)

Tags: [Photonics](#), [Featured Article](#)

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[Fibers made by transforming materials](#)

[Nanowerk, 20FEB2015](#)

An international team of researchers (USA, Singapore) has created fibers through a conventional method that can have a composition that's completely different from that of the starting materials. They made fibers from aluminum metal and silica glass. The aluminum metal and silica glass react chemically as they are heated and drawn, producing a fiber with a core of pure, crystalline silicon and a coating of silica. The new approach could enable low-cost silicon devices in fibers that could be made into fabrics. [TECHNICAL ARTICLE](#)

Tags: [Advanced manufacturing](#)

ADVANCED MATERIALS

["Hopping" electrodeposition makes gold nanodot plating](#)

[Nanotechweb, 20FEB2015](#)

An international team of researchers (Moldova, Germany) reports on a new and simple way to cover the surfaces of porous semiconductors with a monolayer of gold nanodots using a pulsed electroplating technique. The method might be used to make plasmonic photonic crystals, optoelectronic on-chip interconnects and chemical and biological sensors. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#)

[Graphene's potential for energy conversion and storage](#)

[Nanowerk, 19FEB2015](#)

In a review article, researchers in the UK note the substantial progress made in material preparation at the laboratory level. They also highlight the challenge of producing the materials on an industrial scale in a cost-effective manner. The challenge ahead is to demonstrate a disruptive technology in which two-dimensional materials not only replace traditional electrodes, but more importantly enable whole new device concepts.

[TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [S&T UK](#)

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New technique for making graphene competitor, molybdenum disulfide

Science Daily, 19FEB2015

Researchers at the University of Pennsylvania have made an advance in manufacturing molybdenum disulfide by growing flakes of the material around “seeds” of molybdenum oxide. They can control where the flakes form by “seeding” the substrate with sulfur gas. Under the right conditions, those seeds react with sulfur and flakes of molybdenum disulfide begin to grow. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

Shape-shifting nanorod ensembles release heat differently

Science Daily, 19FEB2015

The new findings by researchers at DOE’s Argonne National Laboratory depict three distinct stages of evolution in groups of gold nanorods from the initial rod-shape to the intermediate-shape to a sphere-shaped nanoparticle. The research suggests new rules for the behavior of nanorod ensembles providing insights into how to increase heat-transfer efficiency in a nanoscale system. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T, Materials science

New paper-like material could boost electric vehicle batteries

Science Daily, 18FEB2015

The problem with silicon is that it suffers from significant volume expansion, which can quickly degrade the battery. Researchers at UC Riverside produced nanofibers using electrospinning, whereby 20,000 to 40,000 volts are applied between a rotating drum and a nozzle, which emits a solution composed mainly of tetraethyl orthosilicate. The nanofibers are then exposed to magnesium vapor to produce the sponge-like silicon fiber structure. The new process allows the battery to be cycled hundreds of times without significant degradation.

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

DARPA Seeks to Remove Communication Barrier Between Humans and Computers

DARPA News, 20FEB2015

Human-machine communication falls short of the human-human standard. And so computers that might otherwise contribute more significantly to solving problems in a range of areas, including national security, remain in relatively simplistic roles such as crunching large datasets and providing driving directions. To further the goal of developing systems that communicate more like people do, the CwC program will set tasks in which humans and machines must communicate to do a job.

Tags: Autonomous systems & robotics, DARPA

Video Friday: Robotic Garden, Drone With Parachute, and Chocolate Robot Competition

IEEE Spectrum, 20FEB2015

In this video we see how Leonardo is capable of (1) learning new skills via social guidance and (2) reusing parts of those skills in new social tasks.

Tags: Autonomous systems & robotics

COMMUNICATIONS TECHNOLOGY

New NIST tools to help boost wireless channel frequencies and capacity

Science Daily, 19FEB2015

The new calibrated signal source, developed by researchers at NIST, demonstrated at 44 GHz and 94 GHz enables measurements of modulated signals to be traced to fundamental physical quantities. The mobile channel sounder, demonstrated at 83 GHz so far, provides calibrated received signal strength and additional data for analysis of signal scattering and reflections, to help researchers develop network protocols that account for distortions.

Tags: Communications Technology, Government S&T

Optical Antennae Amplify LEDs for Fast Interconnects

IEEE Spectrum, 18FEB2015

A team of researchers in the US (UC Berkeley, Bell labs, Alcatel Lucent) has shown that by equipping LEDs with tiny antennae, they will be able to match and even surpass transmission speeds of semiconductor lasers, which would be especially useful over short distances. To be used in interconnect or short-distance communication we will have to modulate light by electrical currents. They are currently introducing electrical biasing circuits into the device. [TECHNICAL ARTICLE](#)

Tags: Communications Technology

Coupling Microwaves to Optoelectronics With Sound

IEEE Spectrum, 17FEB2015

Integration of piezoelectric transducers with photonic chips is difficult. Their acoustic frequencies, limited to the megahertz range, make them unsuitable for high-speed optical communications. Researchers at the University of Minnesota overcame the frequency limitations of the transducer by reducing the size of the acoustic modulator and by integrating a nanophotonic circuit with the piezoelectric transducer on a single chip. [TECHNICAL ARTICLE](#)

Tags: Communications Technology

Loss-tolerant position-based quantum cryptography

arXiv, 06FEB2015

A team of researchers in the US (Oak Ridge National Laboratory, University of Tennessee) reports on the

continued...

“Science can amuse and fascinate us all, but it is engineering that changes the world.”

ISAAC ASIMOV

performance of various position-based quantum cryptography (PBQC) protocols over a lossy channel under the assumption that no entanglement is pre-shared between adversaries. By introducing the decoy state idea, they show that an extended BB84-type PBQC protocol implemented with a weak coherent source and realistic single photon detectors can tolerate an overall loss of 13 dB if the intrinsic quantum bit error rate is 1%. [TECHNICAL ARTICLE](#)

Tags: Communications Technology, Quantum science

ENERGY

[Nanoboxes provide breakthrough in rechargeable batteries](#)

[Nanowerk, 24FEB2015](#)

An international team of researchers (Singapore, Canada) has successfully achieved simultaneous control of the phase purity and nanostructure of $\text{Li}_2\text{MnSiO}_4$. The silicate-based nanoboxes could more than double the energy capacity of lithium-ion batteries as compared to conventional phosphate-based cathodes. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery

[Novel electrode boosts green hydrogen research](#)

[PhysOrg.com, 20FEB2015](#)

Polymer electrolyte membrane water electrolyzers (PEMWEs) convert electricity and water into hydrogen and oxygen using two electrodes separated by a solid polymer electrolyte and catalysts. To understand the degradation of catalysts, researchers in the UK have adapted their innovative fuel cell reference electrode for use in PEMWEs, allowing in-situ measurement of the electrochemical processes at the anode and the cathode. [TECHNICAL ARTICLE](#)

Tags: Energy, S&T UK

[Simply silicon](#)

[Nature Materials, 20FEB2015](#)

Researchers in China report the preparation of polycrystalline nanosized silicon from the reduction of SiCl_4 in the presence of metallic Mg and AlCl_3 at 200 °C inside a stainless steel autoclave. The resultant nanoparticles are shown to have a high reversible capacity of 3,083 mAh g⁻¹ at 1.2 A g⁻¹ after 50 cycles when used as anode materials and good long-term cycles. [TECHNICAL ARTICLE](#)

Tags: Energy, Advanced materials, Battery, S&T China

[Old Battery Type Gets an Energy Boost](#)

[MIT Technology Review, 19FEB2015](#)

Researchers at BASF recently doubled the amount of energy nickel-metal hydride batteries can store, making them comparable to lithium-ion batteries. And they have a plan to improve them far more, potentially increasing energy storage by an additional eight times.

Tags: Energy, Battery

INFORMATION TECHNOLOGY

[Electronic skin tattoos with advanced near-field communication capabilities](#)

[Nanowerk, 20FEB2015](#)

An international team of researchers (USA, South Korea, China, Singapore, Australia) has demonstrated materials, mechanics designs and integration strategies for near field communication (NFC) enabled electronics with ultrathin construction and ultralow modulus. These attributes allow seamless, conformal contact with the skin and simultaneous capabilities for wireless interfaces to any standard, even under extreme deformations and after/during normal daily activities. [TECHNICAL ARTICLE](#)

Tags: Information Technology, Flexible electronics

MATERIALS SCIENCE

[Extremely repellent surfaces: How tiny pillars affect condensation of vapor onto a surface](#)

[Science Daily, 19FEB2015](#)

Researchers in Singapore have developed a computational technique to analyze how water vapor condenses on a surface patterned with an array of tiny pillars. Calculations carried out using this technique reveal that water droplets preferentially form either on top of the pillars or in the gaps between them, depending on factors such as the height and spacing of the pillars. The discovery provides a quantitative basis for designing surfaces optimized to either inhibit or enhance condensation in engineered systems. [TECHNICAL ARTICLE](#)

Tags: Materials science

[Vortices Queue Up in a Nanowire](#)

[American Physical Society Spotlight, 18FEB2015](#)

Researchers at Johns Hopkins University have measured a repulsive effect between the tiny quanta of magnetic flux (vortices) that become trapped in superconductors in an external field. The observation of the effect, known as Weber blockade, could inspire devices that use vortices, instead of charge, to carry information. [TECHNICAL ARTICLE](#)

Tags: Materials science

continued...

MICROELECTRONICS

Radio chip for the "Internet of things"

MIT News, 22FEB2015

Realizing the vision of the "Internet of things" requires transmitters that are powerful enough to broadcast to devices dozens of yards away but energy-efficient enough to last for months or even to harvest energy from heat or mechanical vibrations. At an IEEE conference, researchers from MIT will present a new transmitter design that reduces off-state leakage 100-fold. At the same time, it provides adequate power for Bluetooth transmission, or for the even longer-range 802.15.4 wireless-communication protocol.

Tags: *Microelectronics*

FEATURED RESOURCE

Spectrum of Physics

Spectrum of physics provides exhaustive, comprehensive, carefully selected and structured lists on over 346 pages and 5000 links to physics.

Beyond silicon: New semiconductor moves spintronics toward reality

PhysOrg.com, 19FEB2015

A team of researchers in the US (University of Michigan, Ann Arbor, Louisiana State University) used a mixture of iron, bismuth and selenium to create a complex crystal that offers much greater flexibility. Their low-symmetry crystal has holes of varying size placed at varying distances in multiple, overlapping layers. The new compound allows atoms to be arranged in a huge number of different combinations so that conductivity and magnetism can be manipulated independently. That level of control is going to open a whole new set of possibilities in spintronics. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

Rapidly reconfigurable waveform generator on a CMOS chip could be used for high-speed wireless communication

PhysOrg.com, 19FEB2015

An international team of researchers (USA, China) has designed and fabricated a new waveform generator on a silicon chip with reconfiguration speeds of just 4 nanoseconds. It uses light instead of electricity to create RF waves, and offers high pulse bandwidth, low phase noise, and the capability of intra-pulse modulation.

[TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

New approach to distributing computations could make multicore chips much faster

PhysOrg.com, 18FEB2015

Researchers at MIT describe a system that cleverly distributes data around multicore chips' memory banks, improving execution times by 18 percent on average while actually increasing energy efficiency. In simulations involving a 64-core chip, the system increased computational speeds by 46 percent while reducing power consumption by 36 percent. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

Semiconductor works better when hitched to graphene

Science Daily, 18FEB2015

An international team of researchers (Sweden, Canada, USA) discovered that a polymer film about 50 nanometers thick conducted charge about 50 times better when deposited on graphene. By better controlling the thickness and crystalline structure of the semiconducting film, it may be possible to design even more efficient graphene-based organic electronic devices. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Advanced materials*

PHOTONICS

Frequency combs in molecular fingerprint region

Science Daily, 23FEB2015

An international team of researchers (Belgium, Germany, New Zealand, France) used CMOS-compatible silicon nanophotonic waveguides on a silicon-on-insulator chip. They were able to record phase-coherent octave-spanning (1500-3300 nm) comb spectra. Even after several months, no modifications of the characteristics of the supercontinuum spectrum have been observed. Silicon technology has the potential to provide a room-temperature-operating platform for supercontinuum generation extending deeper in the mid-infrared, up to 8500 nm. [TECHNICAL ARTICLE](#)

Tags: *Photonics, Terahertz technology*

QUANTUM SCIENCE

Quantum many-body systems on the way back to equilibrium

Science Daily, 23FEB2015

An international team of researchers (Spain, Germany) discusses the various quantum systems that have been realised, how they are described theoretically, and give an outlook on promising developments. Of particular interest is the temporal evolution when global parameters, such as temperature or an external field, are changed. The scientists thereby investigate whether, how, and on what time scales systems go to a new equilibrium state. [TECHNICAL ARTICLE](#)

Tags: *Quantum science*

continued...

The dark exciton as a qubit**Nature Materials, 20FEB2015**

An international team of researchers (Israel, Poland) demonstrates that the quantum dot-confined dark exciton forms a long-lived integer spin solid-state qubit that can be deterministically on-demand initiated in a pure state by one optical pulse. They show that this qubit can be fully controlled using short optical pulses, which are several orders of magnitude shorter than the life and coherence times of the qubit. **TECHNICAL ARTICLE**

*Tags: Quantum science***SCIENCE WITHOUT BORDERS****Higgs mode in superconducting materials: Tabletop technique for examining physics' most celebrated missing link****Science Daily, 19FEB2015**

An international team of researchers (Israel, Germany) used disordered and ultra-thin superconducting films of Niobium Nitrite and Indium Oxide near the superconductor-insulator critical point. This created the conditions to excite a Higgs mode at relatively low energies. The Higgs mechanism in superconductors is significant because it reveals how a single type of physical process behaves under drastically different energy conditions. **TECHNICAL ARTICLE**

*Tags: Science without borders, Particle physics***SENSORS****Nanowire Brushes Usher in New Generation of Smoke Detectors****IEEE Spectrum, 19FEB2015**

Researchers in the UK have dramatically increased the effective surface area of zinc oxide by fashioning the material into what amounts to nanowire "brushes," making the smoke detectors they're used in 10,000 times more sensitive to UV light than a traditional zinc-oxide detector. The technology could find application in future flexible electronic devices. **TECHNICAL ARTICLE**

*Tags: Sensors, S&T UK***Researchers build atomically thin gas and chemical sensors****EurekAlert, 18FEB2015**

The sensors built by researchers at UC Riverside using molybdenum disulfide have two-dimensional channels, which are great for sensor applications because of the high surface-to-volume ratio and widely tunable concentration of electrons. It can selectively detect ethanol, acetonitrile, toluene, chloroform and methanol vapors. **TECHNICAL ARTICLE 1, 2**

*Tags: Sensors ■***ABOUT THIS PUBLICATION**

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