



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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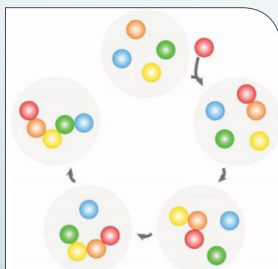
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FEATURE ARTICLES

[DNA sent on sequential, and consequential, building mission](#)

[Science Daily, 16JUN2017](#)



A team of scientists has developed a method to create structures whose building blocks are a millionth of a meter in size by encoding DNA with assembly instructions. Credit: Image courtesy of Yin Zhang

Researchers at the University of New York have developed a method to create structures encoding DNA with assembly instructions. They used droplets of DNA functionalized emulsions which are initially inert because the grafted DNA strands are pre-hybridized in pairs. Active strands on initiator droplets then displace one of the paired strands and thus release its complement, which in

turn activates the next droplet in the sequence. Their strategy provides time and logic control during the self-assembly process, and offers a new perspective on the synthesis of materials. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Advanced manufacturing, Featured Article

[Electrolytes made from liquefied gas enable batteries to run at ultra-low temperature](#)

[Science Daily, 15JUN2017](#)

Researchers at UC San Diego have developed a lithium battery electrolyte using liquefied fluoromethane gas and an electrochemical capacitor electrolyte using liquefied difluoromethane gas. The electrolytes enable the lithium batteries to run at temperatures as low as -60 degrees Celsius and the capacitors as cold as -80 degrees Celsius. The electrolytes mitigate the problem of thermal runaway and dendrites thus making the batteries safer. The technology could be used to power craft in the extreme cold, such as high atmosphere WiFi drones and weather balloons, satellites, interplanetary rovers and other aerospace applications. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery, Featured Article

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[New A.I. Chip Could Implement Predictive Maintenance in Smart Factories](#)

[R&D Magazine, 20JUN2017](#)

Predictive maintenance forecasts machine failures monitoring the function and health of machines. The new chip developed by researchers in Singapore is expected to perform significantly faster than the conventional method for predictive maintenance, as well as reduce power consumption, paving the way for greater asset productivity and lower overall maintenance costs.

Tags: Advanced manufacturing

ADVANCED MATERIALS

[Nickel for thought: Compound shows potential for high-temperature superconductivity](#)

[Eurekalert, 16JUN2017](#)

One approach to solving the problem of understanding how the high temperature-superconductivity material cuprate works is to study nickel-based oxides (nickelates). An international team of researchers (USA - Argonne National Laboratory, Spain) has successfully synthesized single crystals of a metallic trilayer nickelate compound. They verified that the electronic structure of the nickelate resembles that of cuprate. They are hopeful that they can find the right doping to induce superconductivity in the nickelate material. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[A simple platform to achieve polymorphic graphene quantum dots](#)

[Nanowerk, 15JUN2017](#)

Researchers at UC San Diego have demonstrated a simple platform for designing structured nanomaterials through self-assembly of graphene quantum dots. The approach reveals that graphene derivatives at the nanoscale assemble into various architectures of nanocrystals in a binary solution system. The shapes of the nanocrystals continue to evolve obtaining a high index faceted superlattice. The process provides a manufacturing pathway

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for designing structured graphitic carbon-based materials and producing hybrids composed of 2D nanostructures to regulate photonic and electronic behaviors. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

[New chemical method could revolutionize graphene](#)

[Science Daily](#), 14JUN2017

An international team of researchers (USA - University of Illinois, University of Toledo, India) used a chemical process to attach plasmonic silver nanoparticles to graphene without changing the properties and arrangement of the carbon atoms in graphene. It increased the material's ability to boost the efficiency of graphene-based solar cells 11-fold. Metal atoms, such as chromium or molybdenum, have delocalized bonds which keep the carbon atoms' arrangement undistorted and planar, so that graphene retains its unique properties of electrical conduction. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

BIG DATA

[9 Experts Answer Your Top Data Science & Machine Learning Questions](#)

[IBM Big Data and Analytics Hub](#) , 16JUN2017

In an interview, a group of prominent data technologists answer a wide variety of question on topics ranging from the fast-evolving area of unified governance, preparing for General Data Protection Regulations (GDPR) to transformative hybrid data management technologies and data science and machine learning.

Tags: Big data, Cyber security

BIOTECHNOLOGY

[Viruses in microfabricated channels produce superior supercapacitors](#)

[Nanotechweb](#), 15JUN2017

A team of researchers in the US (University of Maryland, Princeton University) has devised a microfabrication method that uses capillary channels in a photoresist to position nanorods of the tobacco mosaic virus. The team used the quick and simple new approach to create a supercapacitor with nanostructured electrodes. The method can be applied to construct many other microdevices requiring high surface areas. It can potentially contribute to a new microfabrication process for a wide range of micro- and nano-devices which need nanostructures to increase their surface area or change their surface properties.

[TECHNICAL ARTICLE](#)

Tags: Biotechnology, Materials science

COMMUNICATIONS TECHNOLOGY

[Physicists use quantum memory to demonstrate quantum secure direct communication](#)

[Physorg.com](#), 12JUN2017

Researchers in China have demonstrated a quantum secure direct communication (QSDC) protocol combined with quantum memory. It covered most of the essential steps of the protocol, including entanglement generation, channel security, distribution, storage and encoding of entangled photons. Due to the difficulty of decoding entangled photons in the optimal way, they used an alternative decoding method that is easier to implement. In the future, the researchers expect to demonstrate QSDC across distances of 100 km or more in free space. [TECHNICAL ARTICLE](#)

Tags: Communications technology, S&T China

CYBER SECURITY

[Potent malware targets electricity systems](#)

[Physorg.com](#), 12JUN2017

According to two cyber security firms, a malware called Industroyer works using the communication protocols designed decades ago and built into energy, transportation, water and gas systems around the world. It can take direct control of electricity substation switches and circuit breakers, giving hackers the ability to shut down power distribution and damage equipment. It is not unique to any vendor or configuration, instead leverages knowledge of grid operations and network communications to cause impact. It can be applied to work at several electricity substations at the same time. With a small amount of tailoring it could be adapted to render it potent against the North American power grid.

Tags: Cyber security

ENERGY

[Piezoelectric nanogenerators for self-powered flexible sensors](#)

[Nanowerk](#), 16JUN2017

Researchers in China have demonstrated a high-performance flexible piezoelectric nanogenerator based on a piezoelectrically enhanced nanocomposite micropillar array of BaTiO₃ nanoparticles embedded into a highly crystalline polymer for efficient energy harvesting and highly sensitive self-powered sensing. The piezoelectric voltage was enhanced to 7.3 times that of the pristine flat polymer film under the same vertical compressive force. Because of high sensitivity, good stability and high power-generating property, the nanogenerator will have a wide potential application in smart clothes, medical sciences and next-generation electronics. [TECHNICAL ARTICLE](#)

Tags: Energy, Materials science

“The most incomprehensible thing about our universe is that it can be comprehended.”

ALBERT EINSTEIN

Investigating battery failure

[Physorg.com](#), 12JUN2017

Thermal runaway (a sequence of exothermic reactions taking place within a cell) leads to overheating and, potentially, an explosion in Li-ion batteries. To study this type of battery failure, an international team of researchers (UK, EU, UAS - NASA, National Renewable Energy Laboratory) developed an internal short circuit (ISC) device which can initiate a short circuit at a specific location and time within a cell, triggering a thermal runaway event. With the device, they can see the location of failure and how it spreads. The technology helps assess the effectiveness of safety devices.

Tags: Energy, Battery

FOREIGN S&T

Israel's All Seeing SkEye - Persistent Surveillance Countering Terror

[Defense Update](#), 12JUN2017

The system known as SkEye performs Wide Area Persistent Surveillance (WAPS) video surveillance by airborne manned and unmanned platforms. It enables security or military forces to constantly and closely monitor an area of interest up to 80 square kilometers. It provides real-time, high-resolution monitoring of the entire area, providing up to ten simultaneous areas of interest in real time. It also provides operators and analysts 'backtracking' capability tracing events back in time to detect the origins of related movements and events. The system uses a single payload integrating multiple cameras that together provides an image of one billion pixels in size.

Tags: Foreign S&T, Military technology

INFORMATION TECHNOLOGY

Researchers develop a reliable forward error correction method for digital data

[Physorg.com](#), 15JUN2017

Researchers in Russia generalized the construction of polar codes, noise-immune coding developed by researchers in Turkey, for channel coding. They excluded some code words which could be easily entangled by the receiver, and introduced additional restrictions on the symbols to simplify the error correction task of the decoder. Polar codes have not yet found an application in real devices, but now various generalizations of polar codes are considered by the leading international standardization bodies to be included as a part of 5G wireless standard. [TECHNICAL ARTICLE](#)

Tags: Information technology, S&T Russia

What will the future internet look like?

[Science Daily](#), 09JUN2017

It is expected that by 2020 there will be over 50 billion devices connected to the Internet with powerful sensing and computing capabilities which will enable IoT and smart environments. However, there is no clear picture yet about what the future Internet will look like. At the recent IMDEA Networks Workshop in Spain, industry players, practitioners and academic researchers met to share experiences, discuss technological trends, present recent advances and confront the societal, economic, technological and security challenges to be addressed to make the future Internet a reality.

Tags: Information technology

MATERIALS SCIENCE

Sound waves direct particles to self-assemble, self-heal

[sd](#), 19JUN2017

An international team of researchers (USA - UC Berkeley, Saudi Arabia) used a 2-meter-long acrylic tube that contained a 5-millimeter-deep pool of a glycerin-water solution to demonstrate how floating particles assemble and synchronize in response to acoustic waves. The particles, made from straws, floating on top of a flat piece of plastic were subject to sound waves. Within 10 minutes, the collective pattern of the particles emerged, where the distance between the particles was surprisingly non-uniform. The researchers found that the self-assembled particles exhibited a phononic bandgap. The work could help address fundamental questions about energy dissipation and non-equilibrium thermodynamics.

[TECHNICAL ARTICLE](#)

Tags: Materials science

Making wires of polymers chains

[Science Daily](#), 16JUN2017

An international team of researchers (China, Singapore) applied density functional theory to a two-step approach for synthesizing linear polymer chains on a silicon surface. They exhibit a semiconducting character and can be made conductive either by p-doping or by applying an external electric field. Both surface-grafted polymers and substrates retain their electrical properties and the polythiophene chains are the sole conductive channels in the structures. Their findings put forth a new way to fabricate conductive polymeric molecular wires on traditional semiconducting substrates and could find potential application in nanoelectronic devices. [TECHNICAL ARTICLE 1, 2](#)

continued...

Tags: Materials science

Silver atom nanoclusters could become efficient biosensors

Physorg.com, 13JUN2017

Extremely small nanoclusters consisting of only a few noble metal atoms bound to a DNA fragment are of great interest because of their optical properties. An international team of researchers (Sweden, Denmark) studied nanoclusters consisting of 20 silver atoms. They measured the exact energy levels and identified that the ultrafast energy flow is linked to the structural changes that occur when light excites the nanoclusters. They showed how the relaxation of the excited nanocluster through the energy levels is linked to the motions of atoms in the nanocluster. The findings may have useful application in the development of biosensors, imaging and an in-depth understanding of energy transfer mechanisms involving movements of both the electrons and nuclei, which are essential for efficient light-capture by natural photosynthetic systems as well as solar cells.

[OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Materials science

FEATURED RESOURCE

Chinese Academy of Sciences

CAS has 117 institutes, more than 100 national key laboratories and national engineering research centers, and about 1,000 field stations throughout the country. Links to many English language journals and contents and English abstracts of Chinese articles provided.

MICROELECTRONICS

Laying the foundations for hybrid silicon lasers

Science Daily, 16JUN2017

Researchers in Singapore have developed an innovative method for producing a hybrid III-V semiconductor and silicon-on-insulator optical microcavity. The new process greatly reduces the complexity of the current fabrication process and results in a more compact device. The work presents a new heterocore configuration and integrated fabrication process that combines low-temperature SiO₂ interlayer bonding with dual hard-mask, single lithography patterning. It greatly reduces the challenges of fabricating them, and could serve as an alternative hybrid microcavity for use by the research community.

[TECHNICAL ARTICLE](#)

Tags: Microelectronics

Amazing spintronics

Nanowerk, 13JUN2017

A team of researchers in the US (Johns Hopkins University, University of Arizona) used thin films of antiferromagnetic insulators, such as nickel and cobalt oxide, sandwiched between ferrimagnetic insulator yttrium iron garnet (YIG) and normal metal films to demonstrate that small spin currents can be amplified ten-fold by inserting thin films of antiferromagnetic insulator materials into the layered structures, effectively producing a spin-transistor. They found that spin fluctuation of the antiferromagnetic insulating layer enhances the spin current and the amplification is linearly proportional to spin mixing conductance of the normal metal and the YIG. The research is a step towards realizing spintronics. [TECHNICAL ARTICLE](#)

Tags: Microelectronics

QUANTUM SCIENCE

A skyrmion square dance

Nanowerk, 16JUN2017

An international team of researchers (Japan, Australia) formed robust triangular lattice in manganese silicide that was stable over a wide range of temperatures and magnetic fields. They report that skyrmions undergo a triangular-to-square lattice transition with a decreasing magnetic field at low temperatures. The study suggests that various skyrmion lattices can emerge at low temperatures where the skyrmions exhibit distinct topological nature and high sensitivity to the local magnetic anisotropy arising from the underlying chemical lattice. The findings have applications in future magnetic memory devices. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Quantum science, Materials science

Big scientific breakthrough at sub-atomic level holds promise for secure comms

Physorg.com, 16JUN2017

Researchers in China have produced entangled photons in a laser on a satellite orbiting 300 miles above the earth. They were then transmitted to two different ground-based stations 750 miles (1,200 kilometers) apart, without breaking the link between the photons. The research holds potential for revolutionizing telecommunications, perhaps someday developing a hack-proof internet and the possibility of a future global quantum communication network. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology, S&T China

Toward optical quantum computing**MIT News, 16JUN2017**

An international team of researchers (USA - MIT, Denmark) has developed a device enabling photon-photon interaction at room temperature, using a silicon crystal with distinctive patterns etched into it. If a single photon enters their device, it will pass through unimpeded. But if two photons—in the right quantum states—try to enter the device, they'll be reflected. The quantum state of one of the photons can thus be thought of as controlling the quantum state of the other. The research will not yield a working quantum computer in the immediate future, but would greatly help a range of research in quantum information science and communications. **TECHNICAL ARTICLE**

*Tags: Quantum science***A Hybrid of Quantum Computing and Machine Learning Is Spawning New Ventures****IEEE Spectrum, 13JUN2017**

The hybrid field of Machine learning and AI concentrates on either using nascent quantum computers to speed up machine learning algorithms or, using conventional machine learning systems, to increase the power, durability, or effectiveness of quantum computer systems. The goal in the field is to do both—use smaller quantum-computer-based machine learning systems to better improve, understand, or interpret large data sets of quantum information or the results of large-scale quantum computer calculations. Quantum machine learning, even in its earliest incarnations, still holds promise.

*Tags: Quantum science***S&T POLICY****China cracks down on fake peer reviews****Nature News, 20JUN2017**

The Chinese government is going on the offensive against scientists who dupe journals by creating fraudulent reviews of submitted papers. A coalition of agencies announced that the government would suspend the grants of researchers involved in such fraud. Online companies that orchestrate fake peer review are among the main targets of the crackdown. Funding agencies in China promised to increase policing of the scientific community to prevent similar deceptions.

*Tags: S&T policy, Science without borders***EU unveils plans to regulate drones by 2019****Physorg.com, 16JUN2017**

The blueprint from the European Commission covers allowing drones to operate in high density under the supervision of fleet operators. Current common European rules only cover drones weighing above 150 kilograms

(330 pounds). According to IATA, 65 countries currently have rules for the use of small drones. The International Civil Aviation Organization (ICAO) is trying to establish a global framework for the future use of drones.

*Tags: S&T policy***SCIENCE WITHOUT BORDERS****Inspecting Algorithms for Bias****MIT Technology Review, 12JUN2017**

Many institutions are using automated decision-making (ADM) systems to make decisions. ADM systems make choices based on the underlying assumptions that are not clear even to the systems' designers. It is not necessarily possible to determine which algorithms are biased and which ones are not. Raising the incidence of true positives or lowering the false positives are both ways to improve positive predictive value (PPV). Any algorithm will have biases but we can still use such systems to guide decisions that are wiser and fairer than the ones humans tend to make on their own.

*Tags: Science without borders***SENSORS****Face recognition system 'K-Eye'****Science Daily, 15JUN2017**

To make AI technology suitable for mobile devices, researchers in Singapore have developed a chip for running a face recognition system (K-eye) with low power requirements but at high speeds. It can recognize and share information about users at any time. When recognizing that an authorized user is looking at its screen, the smartphone automatically turns on without a passcode, fingerprint, or iris authentication. In tests, the device was 97% accurate but consumed only 1/5000 power of the GPU.

*Tags: Sensors***Zig-zagging device focuses high-energy radiation emissions****Science Daily, 12JUN2017**

Undulator devices force a penetrating charged particle to radiate, by using crystal deformations to initiate a zig-zagging trajectory. An international team of researchers (Denmark, Germany) has confirmed the existence of the crystalline undulator radiation in a crystal that is approximately 10 times thicker than the traditional undulator. They performed theoretical simulations which proved consistent with the observable radiation detected in their experimental setup. The device could potentially be used as a source of radiation for cancer treatment or nuclear waste processing. **TECHNICAL ARTICLE**

Tags: Sensors, Nuclear energy ■

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