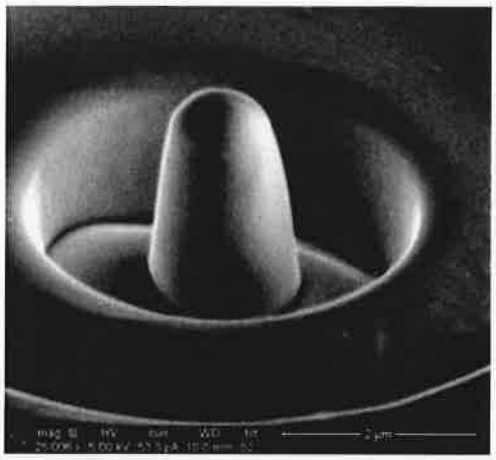
Civil Engineering

1. Technique Offers Advance in Testing Micro-Scale Compressive Strength of Cement

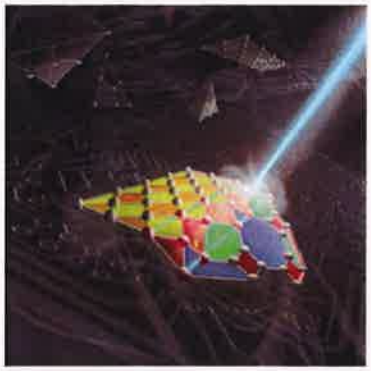


This image shows a representative cement micropillar sample imaged by scanning electron microscope. Samples like this one are key to the use of a 'micropillar compression' technique to characterize the micro-scale strength of cement, allowing for the development of cement with desirable strength properties for civil engineering applications.

Researchers from North Carolina State University have, for the first time, used a "micropillar compression" technique to characterize the micro-scale strength of cement, allowing for the development of cement with desirable strength properties for civil engineering applications. "The information collected using this technique can be used to better understand the behaviour of concrete when it fails, as well as providing key data for 'constitutive' models that are used for designing and determining the safety of large-scale civil engineering structures," says Rahnuma Shahrin, a lead researcher. "The research outcomes will lead to significant impacts in the study of failure of materials containing cement," Shahrin says. "The production, transportation and use of concrete accounts for between 5 and 9 percent of total carbon dioxide emissions worldwide. The knowledge from this study can be applied toward development of stronger, more sustainable materials for civil infrastructure, reducing consumption of natural resources and production of CO_2." Cement is used to make concrete, one of the most widely used construction materials in the world. The compressive strength of cement is a primary factor in determining how much load concrete can bear -- a critical consideration for civil engineering projects. Engineers have long known that cement derives its strength from an ingredient called calcium silicate hydrate (C-S-H) -- the primary product formed when cement powder is mixed with water. Researchers, however, have not been able to measure the compressive strength of the C-S-H in a cement sample -- the sample sizes needed for isolating and testing the C-S-H components are too small to fabricate by conventional sample preparation methods. To address this challenge, the researchers turned to a technique used in materials science called micropillar compression. Normally used on crystalline materials, micropillar compression uses very small samples to determine the compressive strength of a material. Because cement is a heterogeneous material, made up of multiple components, Shahrin used a scanning electron microscopy/X-ray technique to find the areas in cement samples that had the highest ratio of C-S-H relative to other constituent materials. Once the C-S-H sites were identified, they were milled into cylinders 2 micrometers wide and 4 micrometers in height. These samples could then be subjected to micropillar compression. "There are lots of ways to make cement, and it can be made with different constituents in different ratios," Shahrin says. "We've shown that the micropillar technique can be used to give us precise measures of C-S-H compressive strength in these different type of mixtures" . This information can be used to help us understand how various processes, and the constituents added during cement production, can affect the cement's strength. It's basically a tool that can be used to develop better, stronger cement."

Source https://www.sciencedaily.com/releases/2017/10/171025105033.htm

2. Researchers Develop Data Bus for Quantum Computer



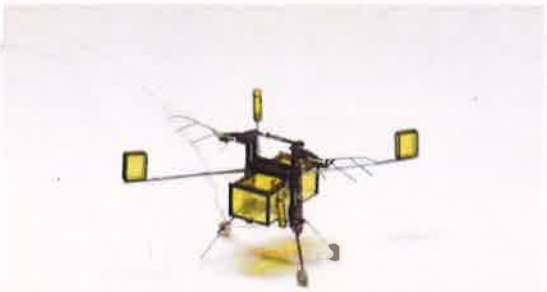
Scientists have developed a protocol that can be used to connect quantum systems that are encoded differently.

Future quantum computers will be able to solve problems where conventional computers fail today. We are still far away from any large-scale implementation, however, because quantum systems are very sensitive to environmental noise. Although systems can be protected from noise in principle, researchers have been able to build only small prototypes of quantum computers experimentally. One way to reduce the error rate is by encoding quantum information not in one single quantum particle but in several quantum objects. These logical quantum bits or qubits are more robust against noise. In the last few years, theoretical physicists have developed a whole range of error correction codes and optimized them for specific tasks. Physicists from the Institute of Theoretical Physics of the University of Innsbruck and the Institute of Quantum Optics and Quantum Information in Vienna, have found a technique to transfer quantum information between systems that are encoded differently. Similar to classical computers, future quantum computers might be built with different components. Scientists have already built small-scale quantum processors and memories experimentally, and they have used different protocols to encode logical qubits: For example, for quantum processors they use so-called colour codes and for quantum memories surface codes. "For the two systems to interact with each other quantum mechanically, we have to connect them," says a researcher. "We have developed a protocol that allows us to merge quantum systems that are encoded differently." The scientists suggest to locally modify specific elements of the encoded quantum bits. This process is also called lattice surgery, which is used to couple systems such as quantum processors and memories. Once the systems are temporarily "sewed" together, quantum information can be teleported from the processor to the memory and vice versa. "Similar to a data bus in a conventional computer, scientists can use this technique to connect the components of a quantum computer," explains a researcher. This new scheme is another step towards building a universal quantum computer and research for experimental realization is under way.

Source https://www.sciencedaily.com/releases/2017/11/171106100525.htm

Mechanical Engineering

3. New Robobee Flies, Dives, Swims and Explodes Out the Of Water

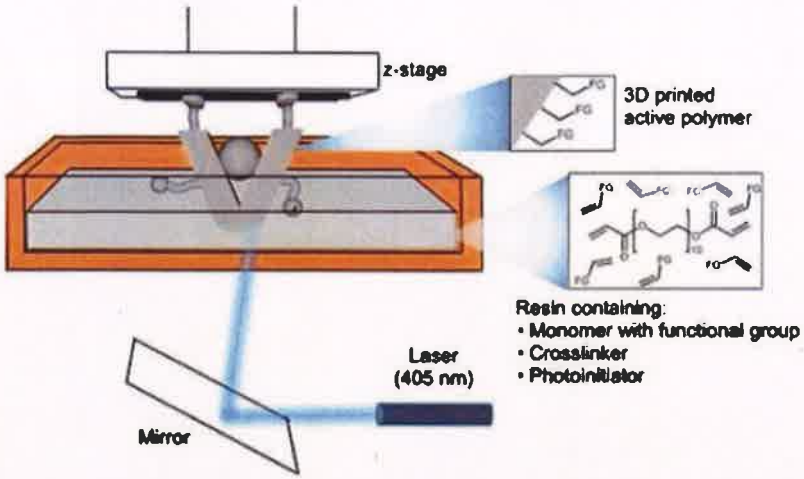


New, hybrid RoboBee can fly, dive into water, swim, propel itself back out of water, and safely land. The RoboBee is retrofitted with four buoyant and a central gas collection chamber. Once the RoboBee swims to the surface, an electrolytic plate in the chamber converts water into oxyhydrogen, a combustible gas fuel.

We've seen RoboBees that can fly, stick to walls, and dive into water. Now, get ready for a hybrid RoboBee that can fly, dive into water, swim, propel itself back out of water, and safely land. New floating devices allow this multipurpose air-water microrobot to stabilize on the water's surface before an internal combustion system ignites to propel it back into the air. This latest-generation RoboBee, which is 1,000 times lighter than any previous aerial-to-aquatic robot, could be used for numerous applications, from search-and-rescue operations to environmental monitoring and biological studies. The research was led by a team of scientists from the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) and the Wyss Institute for Biologically-Inspired Engineering at Harvard. "This is the first microrobot capable of repeatedly moving in and through complex environments," said Yufeng Chen, a researcher in the Microrobotics Lab at SEAS. "We designed new mechanisms that allow the vehicle to directly transition from water to air, something that is beyond what nature can achieve in the insect world." Designing a millimeter-sized robot that moves in and out of water has numerous challenges. First, water is 1,000 times denser than air, so the wing flapping speed must will vary widely between the two mediums. If the flapping frequency is too low, the RoboBee can't fly. If it's too high, the wing will snap off in water. By combining theoretical modeling and experimental data, the researchers found the goldilocks combination of wing size and flapping rate, scaling the design to allow the bee to operate repeatedly in both air and water. Using this multimodal locomotive strategy, the robot to flaps its wings at 220 to 300 hertz in air and nine to 13 hertz in water. Another major challenge the team had to address: at the millimeter scale, the water's surface might as well be a brick wall. Surface tension is more than 10 times the weight of the RoboBee and three times its maximum lift. Previous research demonstrated how impact and sharp edges can break surface tension on a RoboBee's entry into water but the question remained: How does it get back out again? To solve that problem, the researchers retrofitted the RoboBee with four buoyant outriggers -- essentially robotic floaties -- and a central gas collection chamber. Once the RoboBee swims to the surface, an electrolytic plate in the chamber converts water into oxyhydrogen, a combustible gas fuel. "Because the RoboBee has a limited payload capacity, it cannot carry its own fuel, so we had to come up with a creative solution to exploit resources from the environment," said a researcher in the Microrobotics Lab. "Surface tension is something that we have to overcome to get out of the water, but is also a tool that we can utilize during the gas collection process." The gas increases the robot's buoyancy, pushing the wings out of the water and the floaties stabilize the RoboBee on the water's surface. From there, a tiny, novel sparker inside the chamber ignites the gas, propelling the RoboBee out of the water. The robot is designed to passively stabilize in air, so that it always lands on its feet. "By modifying the vehicle design, we are now able to lift more than three times the payload of the previous RoboBee," said Chen. "This additional payload capacity allowed us to carry the additional devices including the gas chamber, the electrolytic plates, sparker, and buoyant outriggers, bringing the total weight of the hybrid robot to 175 miligrams, about 90mg heavier than previous designs. We hope that our work investigating tradeoffs like weight and surface tension can inspire future multi-functional microrobots -- ones that can move on complex terrains and perform a variety of tasks." Because of the lack of onboard sensors and limitations in the current motion-tracking system, the RoboBee cannot yet fly immediately upon propulsion out of water but the team hopes to change that in future research. "The RoboBee represents a platform where forces are different than what we -- at human scale -- are used to experiencing," said Robert Wood, Charles River Professor of Engineering and Applied Sciences at Harvard, Core Faculty Member of the Wyss Institute. "While flying the robot feels as if it is treading water; while swimming it feels like it is surrounded by molasses. The force from surface tension feels like an impenetrable wall. These small robots give us the opportunity to explore these non-intuitive phenomena in a very rich way."

Source https://www.sciencedaily.com/releases/2017/10/171025140514.htm

4. One-Step 3-D Printing of Catalysts



Catalysts can be built in one step by directly shining a laser through a bath of customized resins that polymerize and harden layer-by- layer.

The U.S. Department of Energy's Ames Laboratory has developed a 3D printing process that creates a chemically active catalytic object in a single step, opening the door to more efficient ways to produce catalysts for complex chemical reactions in a wide scope of industries. While 3D printing has found applications in many areas, its use as a way to control chemical reactions, or catalysis, is relatively new. Current production of 3D catalysts typically involves various methods of depositing the chemically active agents onto pre-printed structures. The Ames Laboratory method combines the structure with the chemistry in only one step using inexpensive commercial 3D printers. The structures are designed in a computer and built directly by shining a laser through a bath of customized resins that polymerize and harden layer-by-layer. The final product that emerges has catalytic properties already intrinsic to the object. "The monomers, or building blocks that we start with, are designed to be bifunctional. They react with light to harden into the three-dimensional structure, and still retain active sites for chemical reactions to occur," said Sebastián Manzano, researcher in the Department of Chemistry at Iowa State. The catalysts built with this method demonstrated success in several reactions common to organic chemistry. They are also adaptable with further post-processing, making possible multi-step reactions. "We can control the shape of the structure itself, what we call the macroscale features; and the design of the catalyst, the nanoscale features, at the same time," said Igor Slowing, a scientist in heterogeneous catalysis at the U.S. Department of Energy's Ames Laboratory. "This opens up many possibilities to rapidly produce structures custom designed to perform a variety of chemical conversions."

Source https://www.sciencedaily.com/releases/2017/11/171101130317.htm

5. Highly Flexible Organic Flash Memory for Foldable and Disposable Electronics

A KAIST team reported ultra-flexible organic flash memory that is bendable down to a radius of 300 μm. The memory exhibits a significantly-long projected retention rate with a programming voltage on par with the present industrial standards. A joint research team led by Professor Seunghyup Yoo of the School of Electrical Engineering and Professor Sung Gap Im of the Department of Chemical and Biomolecular Engineering said that their memory technology can be applied to non-conventional substrates, such as plastics and papers, to demonstrate its feasibility over a wide range of applications. Flash memory is a non-volatile, transistor-based data-storage device that has become essential in most electronic systems in daily life. With straightforward operation mechanisms and easy integration into NAND or NOR array architecture, flash memory has been established as the most successful and dominant non-volatile memory technology by far. Despite promising demonstrations in the early stages of organic electronics, the overall progress in this field has been far slower than that of thin-film transistors (TFTs) or other devices based on flexible materials. It has been challenging, in particular, to develop flash memory that simultaneously exhibits a significant level of flexibility and performance. This is mainly due to the scarcity of flexible dielectric layers, which are responsible for the tunneling and blocking of charges. The solution processing used for the preparation of most of the polymeric dielectric layers also makes it difficult to use them in flash memory due to the complexity involved in the formation of the bilayer dielectric structure, which is the key to flash memory operations. The research team tried to overcome these hurdles and realize highly flexible flash memory by employing thin polymeric insulators grown with initiated chemical vapor deposition (iCVD), a vapor-phase growth technique for polymers that was previously shown to be promising for the fabrication of flexible TFTs. It was further shown that these iCVD-based polymeric insulators, when coupled with rational device design and material choice, can make a significant contribution to flash memory as well. Memory using conventional polymer insulating films has often required a voltage as high as 100 V (volt) in order to attain long memory retention. If the device is made to operate at a low voltage, the short retention period of less than a month was problematic. The KAIST team produced flash memory with programming voltages around 10 V and a projected data retention time of over 10 years, while maintaining its memory performance even at a mechanical strain of 2.8%. This is a significant improvement over the existing inorganic insulation layer-based flash memory that allowed only a 1% strain. The team demonstrated the virtually foldable memory devices by fabricating the proposed flash memory on a 6-micrometer-thick ultrathin plastic film. In addition, it succeeded in producing them on printing paper, opening a way for disposable smart electronic products such as electronic paper and electronic business card.Professor Yoo said, " This study well illustrates that even highly flexible flash memory can be made to have a practically viable level of performance, so that it contributes to full-fledged wearable electronic devices and smart electronic paper."

Source https://www.sciencedaily.com/releases/2017/11/171107092852.htm

Electronics and Communication Engineering

6. The Next Generation of Power Electronics? Gallium Nitride Doped with Beryllium

Sample chamber of the positron accelerator.

The trick is to be able to use beryllium atoms in gallium nitride. Gallium nitride is a compound widely used in semiconductors in consumer electronics from LED lights to game consoles. To be useful in devices that need to process considerably more energy than in your everyday home entertainment, though, gallium nitride needs to be manipulated in new ways on the atomic level. "There is growing demand for semiconducting gallium nitride in the power electronics industry. To make electronic devices that can process the amounts of power required in, say, electric cars, we need structures based on large-area semi-insulating semiconductors with properties that allow minimising power loss and can dissipate heat efficiently. To achieve this, adding beryllium into gallium nitride -- or 'doping' it -- shows great promise," explains Professor Filip Tuomisto from Aalto University. Experiments with beryllium doping were conducted in the late 1990s in the hope that beryllium would prove more efficient as a doping agent than the prevailing magnesium used in LED lights. The work proved unsuccessful, however, and research on beryllium was largely discarded. Working with scientists in Texas and Warsaw, researchers at Aalto University have now managed to show -- thanks to advances in computer modelling and experimental techniques -- that beryllium can actually perform useful functions in gallium nitride. The research shows that depending on whether the material is heated or cooled, beryllium atoms will switch positions, changing their nature of either donating or accepting electrons. "Our results provide valuable knowledge for experimental scientists about the fundamentals of how beryllium changes its behaviour during the manufacturing process. During it -- while being subjected to high temperatures -- the doped compound functions very differently than the end result," describes Tuomisto. If the beryllium-doped gallium nitride structures and their electronic properties can be fully controlled, power electronics could move to a whole new realm of energy efficiency. "The magnitude of the change in energy efficiency could as be similar as when we moved to LED lights from traditional incandescent light bulbs. It could be possible to cut down the global power consumption by up to ten per cent by cutting the energy losses in power distribution systems," says Tuomisto.

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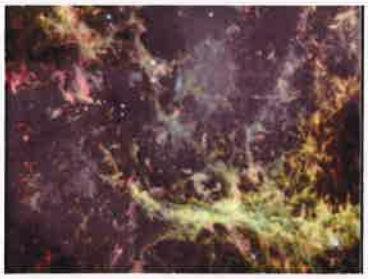
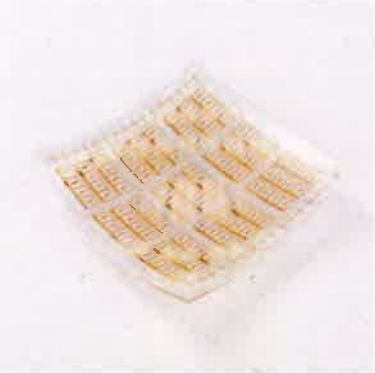
7. ISRO's Space Telescope AstroSat measures X-ray Polarization of the Crab pulsar in the Taurus Constellation



India's multi-wavelength space telescope AstroSat had measured the X-ray polarisation of the Crab pulsar (star) in the Taurus constellation, said space agency ISRO. "AstroSat accomplished the difficult task of measuring X-ray polarisation of Crab pulsar in the Taurus constellation during 18-months of its study for the first time," said the Indian Space Research Organisaion (ISRO) recently. ISRO launched its first dedicated space observatory AstroSat on a Polar Satellite Launch Vehicle (rocket) on September 28, 2015, from its spaceport at Sriharikota in Andhra Pradesh. "The telescope measured the variations of polarisation as the magnetized object (pulsar) spins 30 times per second," said the statement. A pulsar is a rotating neutron star or white dwarf, which emits electromagnetic radiation. Neutron stars and black holes are examples of such objects. Taurus is the second astrological sign in the present zodiac. It spans the 30-60th degree of the zodiac. The landmark measurement by the satellite's CZT (Cadmium-Zinc-Telluride) imaging instrument challenges theories of high energy X-ray emission from pulsars. "Indian scientists using data from the CZT Imager have performed the most sensitive measurement of X-ray polarisation of the Crab pulsar, the rotating neutron star which is the main energy source of the nebula," the research pointed out. The 1,513 kg space observatory built at a cost of Rs 180 crore has five scientific instruments to study celestial objects in the universe for the first time at optical, ultraviolet and x-ray wavebands simultaneously. The instruments are a soft x-ray telescope, an ultraviolet imaging telescope, an imager and a scanning sky monitor. "The universe is home to many such exotic objects with conditions quite different from the Earth. It is essential to study them to ensure our predictions describe what goes on in and around them. They are less than a few tens of km but have masses more than that of the Sun and are known as compact objects," noted the statement. X-ray polarisation measurement is so difficult that so far the measurement obtained worldwide is for the pulsar in the Crab Nebula - the ghostly remains of a massive stellar explosion known as supernova, observed in 1054 AD. With mass condensed in a small volume, the pulsars possess strong gravitational and magnetic fields, both trillion times that on the Earth. They are also sources of intense X-ray radiation, electromagnetic waves similar to light but have ten to hundred thousand times higher energy, which carries vital clues to understand them as well as the physical processes responsible for the radiation. Astronomers have studied properties of this radiation to make a picture of compact objects and their surroundings. "The idea of using CZT Imager for X-ray polarisation measurement has been around for a while, but this is the first time the idea was tested on ground before launch and then employed in space. This makes our measurements credible," said ISRO's Ahmedabad-Physical Research Laboratory (PRL) Professor Santosh Vadawale.Another feature of the measurements is the study of polarisation properties at different rotation phases of the pulsar, which has not been done so far, reiterated Vadawale, lead author of the paper and part of the CZT Imager team. According to Mumbai-based Tata Institute of Fundamental Research (TIFR) Professor and Imager's principal investigator A.R. Rao, the team had to observe the Crab pulsar many times and combine data of months given its small rotation period. "To get the micro-second accuracy for combining the data, the AstroSat team sought help from one of the world's best radio telescopes - the Indian Giant Meter-wave Radio Telescope (GMRT), at Khodad near Pune. Professor Bhal Chandra Joshi and a team from NCRA, Pune, monitored the radio pulsations from Crab with GMRT and Ooty radio telescope, corrected anomalies and provided accurate ephemeris to the imager. The CZT-Imager was built by a consortium of Indian academic and research institutes, including ISRO's Vikram Sarabhai Space Centre at Thiruvananthapuram and the Satellite Application Centre in Bengaluru, the Inter-University Centre for Astronomy and Astrophysics (IUCAA) at Pune and the Space Application Centre at Ahmedabad. PRL provided the polarisation detection algorithm and ground calibration.

Source http://www.firstpost.com/tech/news-analysis/isros-space-telescope-astrosat-measures-x-ray-polarisation-of-the-crab-pulsar-in-the-taurus-constellation-4196615.html

8. Graphene Enables High-Speed Electronics on Flexible Materials

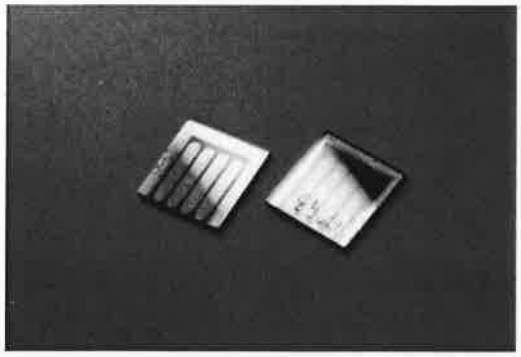


With the help of the two-dimensional material graphene, the first flexible terahertz detector has been developed by researchers at Chalmers. The opportunities are great within health and Internet of Things, and for new types of sensors.

Terahertz radiation has a wide range of uses and can occur in everything from radio astronomy to medicine. The term refers to the electromagnetic waves whose frequencies range from 100 gigahertz to 10 terahertz. Demand for higher bandwidth in wireless communications and depiction for security applications has led to intensified research on systems and components intended for terahertz frequencies. One challenge has long been to enable low weight and cheap applications. However, advances in polymer technology have promoted the development of flexible electronics and enabled the production of high frequency units on flexible substrates. Now, Chalmers researchers have developed the first mechanically flexible and graphene-based terahertz detector in its kind. Thus, paving the way for flexible terahertz electronics.The detector has unique features. At room temperature, it detects signals in the frequency range 330 to 500 gigahertz. It is translucent and flexible, and opens to a variety of applications. The technique can be used for imaging in the terahertz area (THz camera), but also for identifying different substances (sensor). It may also be of potential benefit in health care, where terahertz waves can be used to detect cancer. Other areas where the detector could be used are imaging sensors for vehicles or for wireless communications. The unique electronic features of graphene, combined with its flexible nature, make it a promising material to integrate into plastic and fabric, something that will be important building blocks in a future interconnected world. Graphene electronics enables new applications for, among other things, everyday objects, which are commonly referred to as the Internet of Things. The detector shows the concrete possibilities of graphene, a material that conduct electric current extremely well. It is a feature that makes graphene an attractive building block in fast electronics. The Chalmers researchers' work is therefore an important step forward for graphene in the terahertz area, and a breakthrough for high performance and cheap flexible terahertz technology.

Source https://www.sciencedaily.com/releases/2017/10/171031101818.htm

9. Highly Stable Perovskite Solar Cells Developed



A recent study, affiliated with UNIST, has presented highly stable perovskite solar cells (PSCs), using edged-selectively fluorine (F) functionalized graphene nano-platelets (EFGnPs). The advance is important as the cells are made out of fluorine, a low-cost alternative to gold. This study has been jointly led by Professor Jin Young Kim in the School of Energy and Chemical Engineering at UNIST in collaboration with Dong Suk Kim of Korea Institute of Energy Research (KIER). Perovskite solar cells (PSCs) have attracted more attention in the past few years, as the next-generation solar cells with the potential to surpass silicon cells' efficiency. Nevertheless, stability and cost issues in PSCs seem to block further advancements toward commercialization. The perovskite materials are easily decomposed in moisture conditions. They cannot survive even for one day without proper encapsulation and this results in low stability. To solve these issues and make progress toward the commercialization of PSCs, Professor Kim and his team introduced a highly stable p-i-n structure for PSCs using fluorine functionalized EFGnPs to fully cover the perovskite active layer and protect against the ingress of water for high-stability PSCs. "Fluorocarbons, such as polytetrafluoroethylene (Teflon) are well-known for their superhydrophobic properties and comprise carbon fluorine (C-F) bonding," says a researcher at UNIST. "By substituting carbon for fluorine, we have created a two-dimensional material with high hydrophobicity, like Teflon. Then, applied it to PSCs. " "This study overcame weakness of perovskite solar cells that have high efficiencies but low stability," says Professor Jin Young Kim. "This breakthrough holds substantial promise as the base technology for the application of the next-generation solar cells, as well as various IoT devices and displays," says Professor Jin Young Kim. The newly-developed perovskite solar cell device was fabricated using solution processes, a process that involves the coating perovskite materials on a flexible film. Using this process allows the future application of solar cells to wearable devices. The next-generation solar cells are advantageous in that they have a simple manufacturing process and a low manufacturing cost, compared the existing silicon-based inorganic electronic devices.

Source https://www.sciencedaily.com/releases/2017/10/171025103127.htm

10. Wireless Handheld Spectrometer Transmits Data to Smartphone

A new pencil-like wireless spectrometer can be used with a smartphone to collect 3-D spectral images of the body and other objects. This design could make the device useful for point-of-care diagnostics.

Spectral images, which contain more colour information than is obtainable with a typical camera, reveal characteristics of tissue and other biological samples that can't be seen by the naked eye. A new smartphone-compatible device that is held like a pencil could make it practical to acquire spectral images of everyday objects and may eventually be used for point-of-care medical diagnosis in remote locations. Potential applications of the new device include detecting oxygen saturation in a person's blood, determining the freshness of meat in the grocery store and identifying fruit that is the perfect ripeness. The spectrometer could also make it easier to acquire spectral data in the field for scientific studies. The researchers describe how to make the new pencil-like spectrometer and demonstrate its ability to acquire spectral images of bananas, pork and a person's hand. The new device can detect wavelengths from 400 to 676 nanometers at 186 spots simultaneously. "The easiest way to use a spectrometer is to wave it over the part of the body or object being examined," said first author Fuhong Cai, Hainan University, China. "However, many home-made portable spectrometers use a smartphone camera to acquire data and a phone cradle that contains other necessary optics. The cradle can be hard to align correctly and makes it awkward to wave the smartphone over the body. "Rather than using a smartphone camera to acquire images, the new spectrometer uses a commercially available complementary metal-oxide-semiconductor (CMOS) camera that wirelessly transmits images to a smartphone. This approach allowed the researchers to assemble a cylindrical spectral imaging device weighing just 140 grams (about 5 ounces) that is about the length of smartphone and just over 3 centimeters in diameter. The new pencil-like spectrometer uses all commercially-available components that can be purchased for less than $300 (US). The light source is an array of white LEDs, which connects to an off-the-shelf optical lens tube with the CMOS detector and other optical components necessary for spectral imaging. One can use the pencil-like spectrometer simply by moving it across the target area by hand. This manual push-broom scanning process builds up a series of spectral images that are sent to a smartphone or computer where software stitches the spectral images together into a 3D spectral image data cube. The researchers tested the spectrometer by using it to detect banana ripeness and levels of myoglobin -- the iron-containing protein that gives meat its colour -- in a piece of pork. They also used it to scan a person's hand, obtaining a 16-second video containing 200 spectral images. From the 3D spectral images, the researchers could distinguish five fingers and the palm and saw differences in hemoglobin distribution in various parts of the hand. The researchers are also interested in using their compact imaging spectrometer for environmental monitoring. "We're developing distributed spectral cameras that could be used for a wide range of ocean surveys, such as detecting dissolved organic matter in water or pigments that indicate early signs of harmful algal blooms," said Cai. "Since the imaging spectrometer can connect to any type of camera, we are also examining the idea of attaching it to the camera of an autonomous vehicle to create a remote ocean sensing system." Although using commercially-available components to make the prototype means that anyone can assemble the device, it also places some limits on resolution and sensitivity. For example, the prototype can only resolve wavelengths that differ by at least 17 nanometers. "We expect significant spectral resolution improvements in the future by using an improved camera with a long focal length lens," said Dan Wang, Beijing University of Chemical Technology, China. "These improvements would expand the applications for the device." The researchers also plan to develop software to make the spectral imager even more useful. "We want to develop ways to use machine learning algorithms to analyze the massive amounts of data that could be collected with the portable spectra imager," said Sailing He, Zhejiang University, China.

Source https://www.sciencedaily.com/releases/2017/11/171108124009.htm

Engineering Innovation in India

DRDO India Testing Trawl System to Locate Mines in Battlefield

Defence Research and Development Organisation (DRDO) has undertaken trials of the indigenously developed Trawl System that could locate mines in the battlefield for Indian Army. Trawl System is employed for breaching of land mines and creating a vehicle safe lane, through a minefield for the advancing columns of mechanized forces in combat zone. The equipment consists of Trawl roller, track width mine plough and electro-magnetic device (EMD). The anti-mine system has components that could detect all type of mines usually encountered by the tanks, the Defence Research Development Organisation (DRDO) said recently. The Trawl system underwent blast trials recently which demonstrated the survivability of the equipment, when subjected to successive series of blast directly underneath it. The fieldable prototype of the Trawl system is in final stage and would be shortly ready for conduct of user evaluation trials by the Army.

Source
http://www.defenseworld.net/news/20633/DRDO_India_Testing_Trawl_System_To_Locate_Mines_In_Battlefield#.WfFn5miCzIU