



NEWS ALERT

Forum for Indian Science Diplomacy

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CONTENTS

GLOBAL

[Use of Multimaterial 3D printing to accelerate manufacturing processes](#)

[Platinum Nickel Catalyst enhances Storing energy capacity of hydrogen](#)

[Virus resistant Mosquitoes to reduce Dengue cases](#)

INDIA

[India-Japan to signed agreement on Expeditious Grant of Patents](#)

[BRICS Young Innovators Prize for Affordable Milk Chilling Technology](#)

[India-US universities to launch dual engineering doctoral degree program](#)

[India's Approach to International Climate Change Discourse](#)

[PSLV-C47 launches Cartosat-3 and 13 Commercial nanosatellites](#)

[Low Power, Nanomagnets based Chips for Devices](#)

IN BRIEF

[Researchers develop thin heat shield for superfast aircraft](#)

[Porous polymer for heating and illumination purposes](#)

[‘nanotubes’ developed to protect ceramic coatings from heat radiation](#)

RESOURCES AND EVENTS

[Eighth session of the ITPGRFA Governing Body Meeting](#)

[Third Conference to the Minamata Convention on Mercury](#)

[Global Bio-India 2019](#)

GLOBAL

[Use of Multimaterial 3D printing to accelerate manufacturing processes](#)

Harvard University scientists have developed a new technique called multimaterial multinozzle 3D (MM3D), which uses high-speed pressure valves to achieve rapid, continuous, and seamless switching between up to eight different printing materials, enabling the creation of complex shapes in a fraction of the time. These 3D printheads are manufactured using 3D printing, enabling their rapid customization and facilitating adoption by others in the fabrication community; each nozzle is capable of switching materials at up to 50 times per second. The key to MM3D printing's high speed performance is a series of Y-shaped junctions inside the print head where multiple ink channels come together at a single output nozzle. The shape of the nozzle, printing pressure, and ink viscosity are all

precisely calculated and tuned so that when pressure is applied to one of the "arms" of the junction, the ink that flows down through that arm does not cause the static ink in the other arm to flow backwards. This technique prevents the inks from mixing and preserves the quality of the printed object. One can also readily integrate materials with disparate properties to create origami-like architectures or soft robots that contain both stiff and flexible elements. MM3D printing can also be used to create more complex objects, including actuating robots. This method enables the rapid design and fabrication of voxelated matter (composites with 3D pixels), using a broad palette of functional, structural, and biological inks, and disparate materials can now be seamlessly integrated into 3D-printed objects on-demand. There are possibilities of exploring the use of sacrificial inks to create even more complex shapes.

Platinum Nickel Catalyst enhances Storing energy capacity of hydrogen

Researchers at Eindhoven University of Technology (TU/e), along with their counterparts from China, Singapore and Japan, have now developed a new catalyst with hollow nanocages of an alloy of nickel and platinum and made significant changes to the morphology. The activity of the new catalyst is 20 times higher than that of the current platinum catalysts. Researchers tested the catalyst for 50,000 cycles in a fuel cell, and saw a negligible decrease in activity. This catalyst can be of significant, both in the form of fuel cell and the reverse reaction in an electrolyzer. For example, fuel cells are used in hydrogen-powered cars while some hospitals already have emergency generators with hydrogen-powered fuel cells. An electrolyzer can be used, on wind farms at sea or next to every single wind turbine. Transporting hydrogen is much cheaper than transporting electricity and feasibility to install an electrolyzer in every neighborhood is high. This refrigerator-sized device stores all the energy from the solar panels on the roofs as hydrogen. It can be envisaged that the underground gas pipelines will transport hydrogen and the domestic central heating boiler will be replaced by a fuel cell, leading to conversion of stored hydrogen into electricity. The researchers are working on further development of the new catalyst based electrolyzer and have set up a start-up of the energy institute of TU Eindhoven. The aim is to scale up the current commercial electrolyzers to a refrigerator-size electrolyzer of about 10 megawatts.

Virus resistant Mosquitoes to reduce Dengue cases

Release of *Aedes aegypti* mosquitoes modified to be resistant to dengue virus, can result in lesser cases of Dengue fever. It has been found that after their release, there has been a decline in cases of Dengue fever in Indonesia, Vietnam and Brazil; in the areas they were released. Scientists used mosquitoes carrying *Wolbachia* bacteria, which block the replication of mosquito-borne pathogens like dengue, chikungunya and Zika viruses, which cause diseases. . The *Wolbachia* infection spreads through mosquito population in those areas. In Indonesia, the releases of *Wolbachia*-infected mosquitoes near Yogyakarta City, Indonesia, in 2016 resulted in a 76% fall in dengue fever cases over a period of 30 months, compared with dengue fever cases in areas where these mosquitoes were not released. Similar results have been obtained in Vietnam and Brazil where it has been shown that this strategy works. However, the sponsor of this research World Malaria Program (WMP) is working on a larger study across Yogyakarta City with better controls, for conclusive evidence for the hypothesis that release of such mosquitoes results in significant reduction in dengue cases.

INDIA

India Japan sign agreement.

German Chancellor Merkel and Prime Minister Modi emphasized on driving the digital transformation through innovation and frontier technologies, and, advocated sustainable economic growth and cooperation on tackling climate change. It was agreed that the two countries will work together on AI technologies while affirming the commitment to Digital Partnership. In the collaboration on the next generation technologies, importance will be

given to developing IoT and AI solutions for societal benefits. Both sides stressed the importance of responsible and human centric development in and use of artificial intelligence, and applauded the Global Partnership on AI (GPAI). Both leaders expressed their appreciation for research partnership within the Indo-German Science and Technology Centre, IGSTC, which will complete a decade in 2020. Collaborating in the start up ecosystems and strengthening the current co-operation in this sector was another highlight of this visit.

BRICS Young Innovators Prize for Affordable Milk Chilling Technology

Mr. Ravi Prakash, a scholar from ICAR-National Dairy Research Institute (NDRI), Bangalore received the BRICS Young Innovator Prize for inventing a nano-particle based affordable unit for chilling milk while harvesting for small and marginal dairy farmers. The young scientist received the first prize worth \$25,000 at the 4th BRICS- Young Scientist Forum (YSF) - 2019 held on 6-8 November, 2019 in Rio de Janeiro, Brazil. The researcher devised indigenous cold chain devices, on the basis of nano-particle enhanced phase change material (PCM) which can store cooling energy, which is suitable for small and marginal raw food producers. The system cools fresh raw milk instantly. The estimated cost of a milking cum cooling pail is around 20-25 USD (1500-2000 INR), which is affordable for small to medium dairy farmers. Moreover, the equipment involved is robust and durable. The cooling performance of the module is superior as compared to the existing milk cooling systems. Therefore, this technology is envisaged to have very high socio-economic utility by helping millions of small scale milk producers and dairy farmers in developing countries like India and other BRICS countries in maintaining quality of milk and milk products, and contributing to the overall economy of the country.

India-US universities to launch dual engineering doctoral degree program

New York University's Tandon School of Engineering, and the Indian Institute of Technology, Kanpur, will begin offering dual doctoral degrees in computer and electrical engineering. Leaders of the two institutions signed a five-year agreement that will expand an international collaboration, formally began in 2016, with their partnership for research and education in cyber security. The agreement will allow students in computer or electrical engineering to enroll at either of the institutions and subsequently finish the last two years of their doctoral program at the other, leading to graduating with degrees from both. Applicants will need to pass qualifying exams at both schools, and advisors at both must approve and supervise their dissertation work, but only one dissertation defense will be required for the students accepted into the program. All course credits will transfer. For doctoral students from either continent, the collaboration will offer cultural and academic diversity they would normally find only by leaving their home country for about twice the length of time. Students will also encounter complementary academic strengths at the collaborating schools.

India's Approach to International Climate Change Discourse

The Union Cabinet approved the negotiating stand of India at the 25th Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) scheduled to be held in Madrid, Spain (under the Presidency of Chile) from 2-13 December 2019. India's leadership on climate change has been well recognised across the globe. The Indian Prime has recently announced India's plan on scaling up of renewable energy target to 450 GW and called for responsible action by all on the principles of equity and CBDR-RC. India has been leading the world in its pursuit of enhanced solar energy capacity through International Solar Alliance (ISA). In addition, two new initiatives have been launched by India : (a) Coalition for Disaster Resilient Infrastructure, which will serve as a platform to generate and exchange knowledge on different aspects of climate and disaster resilient infrastructure and (b) 'Leadership Group for Industry Transition' launched jointly by India and Sweden, which will provide a platform for government and the private sector in different countries to work together on accelerating low carbon growth and cooperation in the area of technology innovation. India has emphasized that Developed

countries should take lead in undertaking ambitious actions and fulfils their climate finance commitments of mobilizing USD 100 billion per annum by 2020 and progressively and substantially scale up their financial support to inform Parties for future action through NDCs. India will further stress upon need for fulfilling pre-2020 commitments by developed countries and that pre-2020 implementation gaps should not present an additional burden to developing countries in the post-2020 period..

PSLV-C47 launches Cartosat-3 and 13 Commercial nanosatellites

India's Polar Satellite Launch Vehicle, in its forty ninth flight (PSLV-C47), successfully launched Cartosat-3 along with 13 Nanosatellites of USA from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota. Cartosat-3 was effectively injected into a sun synchronous orbit of 509 km. Subsequently, the 13 nanosatellites were injected into their intended orbits. The mission life of the Cartosat-3 is 5 years. Cartosat-3 will address the increased user's demands for large scale urban planning, rural resource and infrastructure development, coastal land use and land cover, etc. PSLV-C47 was the 21st flight of PSLV in 'XL' configuration (with 6 solid strap-on motors). This was the 74th launch vehicle mission from SDSC SHAR, Sriharikota and the 9th satellite of Cartosat series.

Low Power, Nanomagnets based Chips for Devices

Researchers at IIT Hyderabad have developed low-power chips with nanomagnets for use in portable devices. The devices with these chips will need little power, and, can store and process data even when power is off. It is expected that these chips can be used as alternatives to traditional computing devices. They can meet the increasing demand for process and storing of data from different initiatives in digitization. Portable devices need constant computing for functioning. These chips can be used in such devices.

IN BRIEF

Researchers develop thin heat shield for superfast aircraft

Aerospace industry increasingly relies on carbon fiber reinforced polymer composites to build the structures of satellites, rockets and jet aircraft. But the life of those materials is limited by how they handle heat. A team of researchers from Florida State University is developing a design for a heat shield that better protects those extremely fast machines. The team used carbon nanotubes, to build the heat shields. Sheets of those nanotubes are also known as "buckypaper," a material with incredible abilities to conduct heat and electricity. By soaking the buckypaper in a resin made of a compound called phenol, the researchers were able to create a lightweight, flexible material that is also durable enough to potentially protect the body of a rocket or jet from the intense heat it faces while flying. This design lets engineers build a very thin shield, like a sort of skin that protects the aircraft and helps support its structure. Researchers conducted a test in which a flame was applied to the samples. They found the samples with sheets of buckypaper were better than control samples at dispersing heat and keeping it from reaching the base layer. They also stayed strong and flexible compared to control samples made without protective layers of nanotubes. That flexibility is a helpful quality. The nanotubes are less vulnerable to cracking at high temperatures compared to ceramics, a typical heat shield material. They are helpful to reduce the weight on an aircraft and have promising attributes for numerous applications in aerospace.

Porous polymer for heating and illumination purposes

Researchers at Columbia University have created new coating materials that could help cool buildings in the summer, and then change their optical and thermal properties in the winter to keep the same buildings warm. The polymer-based materials could allow daylight to illuminate building interiors. The energy use of a building can be reduced by coating its exterior with a smart material that reflects sunlight and emits heat in the summer – but can then be switched in the winter to absorb sunlight and be a poor emitter of heat. The researchers have created such materials using porous polymer coatings (PPCs). These are

synthetic materials that can absorb and desorb a wide range of compounds. Their unique properties – including interconnected pore structures, large surface areas, and small pore sizes – make them suitable for many industrial applications. In particular, the variable optical and structural properties of PPCs have found wide uses in coatings for optical and thermal management. The optical properties of PPCs can be tuned by controlling the amount of moisture present in the pores of the material. The newly developed PPCs use this effect to switch between opaque and translucent states for solar radiation.

'nanotubes' developed to protect ceramic coatings from heat radiation

Most gas turbines powering aircraft engines rely on ceramic coatings that ensure structural stability at high temperatures. But these coatings don't control heat radiation, limiting the performance of the engine. Researchers at Purdue University have engineered ceramic "nanotubes" that behave as thermal antennas, offering control over the spectrum and direction of high-temperature heat radiation. This could increase the lifetime of the coating and improve performance of the engine. The team built nanotubes out of an emerging ceramic material called boron nitride, known for its high thermal stability. These boron nitride nanotubes control radiation through oscillations of light and matter, called polaritons, inside the ceramic material. High temperatures excite the polaritons, which the nanotubes - as antennas - then couple efficiently to outgoing heat radiation. The antennas could bring the ability to accelerate the radiation, perform enhanced cooling of a system or send information in very specific directions or wavelengths.

RESOURCES AND EVENTS

Eighth session of the ITPGRFA Governing Body Meeting

The eighth session of the Governing Body (GB 8) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA or Treaty) met in Rome (11-19 November) to address a range of policy, implementation, cooperation, and administrative matters of relevance to the Treaty and its Multilateral System (MLS) of access and benefit-sharing (ABS). The main item under discussion concerned a package of measures to enhance the functioning of the MLS, which has been under negotiation for six years and would have resulted in revising the coverage of the MLS and the Standard Material Transfer Agreement (SMTA) used for exchanges of genetic resources in the MLS. Rates for benefit-sharing payments, and PGRFA-related information, also referred to as genetic sequence data or digital sequence information (DSI), remained as the main outstanding issue. However, a consensus could not be reached to bring out measures, nor on continuing inter-sessional work on this issue. This failure to enhance the MLS raises serious questions over the future of the Treaty. The meeting adopted a series of other decisions including on farmers' rights, conservation and sustainable use of plant genetic resources for food and agriculture (PGRFA), and the Funding Strategy. India's offer to host the next session of the Governing Body was welcomed.

Third Conference to the Minamata Convention on Mercury

The 3rd Conference of Parties (COP3) to the Minamata Convention met from 25-29 November 2019, in Geneva, Switzerland. The Minamata Convention on Mercury came into force in August 2017 with 128 signatories; 115 of those countries have since become parties to the agreement. Minamata is the world's youngest environmental treaty and it is among the most promising. Science has informed international policymaking on mercury since negotiations around the treaty began in 2005. Mercury is a pollutant that has long been known to cause neurological problems. Recent studies have shown effects on behavior, development, renal and immune function, and reproduction. Science has also clearly determined that the main exposure route for humans is through eating fish. The Convention phases out existing mines and bans new ones. It also contains measures to control trade, releases, and air emissions, and regulates the informal sector of artisanal and small-scale gold mining. COP3 is expected to adopt decisions to ensure that the Convention is on track to meet its objectives and the goal of safeguarding human health and

protecting the environment from emissions of mercury, a highly toxic heavy metal. Some of the technical issues include -(a)mercury-added products and manufacturing processes in which mercury or mercury compounds are used;(b)releases of mercury;(c) mercury waste, in particular consideration of relevant thresholds;(d) emissions of mercury resulting from the open burning of waste; and (e) guidance on the management of contaminated sites.

[Global Bio-India 2019](#)

The three day Global Bio-India Summit 2019 concluded in New Delhi on 23 November. The Department of Biotechnology plans to turn the Summit into an annual event with support from all stakeholders. A report on the bright future of biologics and biosimilars was released during the Summit. Also, a report on private investment in biotechnology was brought out, which highlighted the need to stimulate private investment in biotech research. The Summit was organized by the Department of Biotechnology (DBT), Ministry of Science & Technology, and Government of India along with its Public Sector Undertaking, the Biotechnology Industry Research Assistance Council (BIRAC). The associated partners for this event were Confederation of Indian Industry (CII), Association of Biotechnology Led Enterprises (ABLE) and Invest India. The Summit provided an opportunity to showcase the potential of India's biotech sector to the international community, identify and create opportunities as well as deliberate on key challenges in the areas of Bio-pharma, Bio-Agri, Bio-Industrial, Bio-Energy and Bio-Services and allied sectors.

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