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समाचार पत्रों से चयित अंश Newspapers Clippings

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Technologies, Defence Technologies, Defence Policies,
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The Tribune

Fri, 27 May 2022

DRDO Chief lays stress on Collaborative Research

The 13th International High Energy Materials Conference and Exhibits, being organised by the High Energy Materials Society of India, in association with Terminal Ballistics Research Laboratory (TBRL), UT, began here today. Inaugurating the conference, Dr G Satheesh Reddy, Secretary, Department of Defence Research and Development and Chairman, Defence Research and Development Organisation (DRDO), stressed that collaborative research was the way ahead for the country to become self-reliant and a scientific powerhouse. Stating that the country needs to be self-reliant not only in raw materials, but also in composite technology, he said the DRDO Centres of Excellence in High Energy Material Shock and Detonics were planned to be set up at IITs to harness the potential of the academia. Industry, MSMEs and startups were involved in development efforts through DRDO's Technology Development Fund, he added.

While urging the scientific community to explore new frontiers of technology to meet the emerging requirements of the armed forces and other strategic sectors, Dr Reddy also called upon the need to develop green propellants and explosives to counter harmful chemical emissions. Dr PK Mehta, Director General Armaments, DRDO, and Dr BHVS Narayana Murthy, Director General Missiles and Strategic Systems, DRDO, spoke about the emerging technologies and challenges in these fields, while Dr A Rajarajan, Director, Satish Dhavan Space Centre, gave an overview of India's space programme and future prospects.

Prateek Kishore, Director, TBRL, said the new generation of energetics required stable and powerful, but insensitive compounds whose processing and output should be safe, maintain environmental factors and be amenable to disposal after its operating life. Over 100 Indian academic delegates and 600 scientific community from the DRDO, Department of Atomic Energy, Indian Space Research Organisation, Council for Scientific and Industrial Research and the armed forces are participating in the three-day event. Delegates from 10 countries, including Russia, Germany, Czech Republic and Israel have registered for participation in the conference, which is aimed at providing a platform to discuss, share research work and exchange of scientific knowledge in defence technology related to high energy materials.

<https://www.tribuneindia.com/news/chandigarh/drdo-chief-lays-stress-on-collaborative-research-398529>

DRDO On Twitter





पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Thu, 26 May 2022 4:45 PM

सर्वेक्षण पोत (बृहद्) परियोजना के दूसरे पोत 'निर्देशक' (याई 3026) को लॉन्च किया गया

भारतीय नौसेना के लिए एलएंडटी पोत निर्माण के सहयोग से जीआरएसई द्वारा निर्माणाधीन चार सर्वेक्षण पोत (बृहद्) (एसवीएल) परियोजना में से दूसरे जहाज निर्देशक को 26 मई, 2022 को चेन्नई के कट्टूपल्ली में लॉन्च किया गया। इसने 10:38 बजे आयोजित उद्घाटन समारोह में पूर्वी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग इन चीफ वाइस एडमिरल बिस्वजीत दासगुप्ता की गरिमामयी उपस्थिति में बंगाल की खाड़ी में अपना पहला जल संपर्क स्थापित किया।

नौसेना की समुद्री परंपरा का अनुपालन करते हुए श्रीमती सरबानी दासगुप्ता ने अथर्ववेद का आहवाहन जाप कर पोत को लॉन्च किया। इस पोत ने अपना नाम पूर्ववर्ती निर्देशक से लिया है, जो कि एक भारतीय नौसेना सर्वेक्षण पोत था और दिसंबर, 2014 में 32 साल की शानदार सेवा के बाद इसे हटा दिया गया। एसवीएल के चार पोतों में से तीन का आंशिक निर्माण कट्टूपल्ली स्थित एलएंडटी में जीआरएसई और एलएंडटी पोत निर्माण के बीच सहयोगात्मक दृष्टिकोण के तहत किया जा रहा है। सार्वजनिक-निजी भागीदारी का यह मॉडल भारत में युद्धपोत निर्माण के लिए भविष्य में सफल सहयोग का अगुआ होगा।

इससे पहले 30 अक्टूबर, 2018 को रक्षा मंत्रालय और कोलकाता स्थित गार्डन रीच शिपबिल्डर्स एंड इंजीनियर्स (जीआरएसई) के बीच चार एसवीएल पोतों के निर्माण के अनुबंध पर हस्ताक्षर किए गए थे। प्रथम श्रेणी के जहाज 'संध्याक' को 5 दिसंबर, 2021 को कोलकाता के जीआरएसई में लॉन्च किया गया था। एसवीएल पोत, समुद्र संबंधी जानकारी एकत्र करने के लिए मौजूदा संध्याक श्रेणी के सर्वेक्षण जहाजों को नई पीढ़ी के हाइड्रोग्राफिक उपकरणों से बदल देंगे। इस सर्वेक्षण पोत (बृहद्) की लगभग 3400 टन और 226 कर्मियों की क्षमता है। इस पोत को 14 समुद्री मील की क्रूज गति और 18 समुद्री मील (नॉट) की

अधिकतम गति पर परिचालित करने के लिए डिजाइन किया गया है। उथले पानी के सर्वेक्षण कार्यों के दौरान आवश्यक कम गति पर बेहतर कुशलता के लिए बो और स्टर्न थ्रस्टर्स को लगाया गया है। इन पोतों के पतवार स्टील अथॉरिटी ऑफ इंडिया लिमिटेड द्वारा स्वदेशी रूप से विकसित डीएमआर 249-ए इस्पात से बनाया गया है।

चार सर्वेक्षण मोटर नौकाओं और एक एकीकृत हेलीकॉप्टर को ले जाने की क्षमता के साथ पोतों की प्राथमिक भूमिका पत्तनों व नौवहन चैनलों के पूर्ण पैमाने पर तटीय और गहरे जल के हाइड्रोग्राफिक सर्वेक्षण करने की होगी। रक्षा के साथ-साथ नागरिक अनुप्रयोगों के लिए समुद्र विज्ञान और भूभौतिकीय डेटा एकत्र करने के लिए भी पोतों को तैनात किया जाएगा। वहीं, आपात स्थिति के दौरान पोतों को अस्पताल के रूप में उपयोग करने के अलावा इनकी द्वितीयक भूमिका सीमित रक्षा प्रदान करने में सक्षम होना है। कोविड-19 महामारी के कारण चुनौतियों के बावजूद जीआरएसई ने पर्याप्त प्रगति की है और जनवरी 2023 तक एसवीएल के पहले पोत संध्याक को सौंपने का लक्ष्य रखा है। दूसरे पोत यानी निर्देशक की डिलीवरी अप्रैल 2023 तक होने की संभावना है। दूसरे सर्वेक्षण पोत की लॉन्चिंग 'मेक इन इंडिया' और 'आत्मनिर्भर भारत' की सोच के तहत स्वदेशी पोत निर्माण के हमारे संकल्प की पुष्टि करता है। सर्वेक्षण पोत (बृहद्) में लागत के आधार पर 80 फीसदी से अधिक स्वदेशी सामग्री होगी। इसके अलावा यह भी सुनिश्चित करेगा कि बड़े पैमाने पर रक्षा उत्पादन भारतीय विनिर्माण इकाइयों द्वारा निष्पादित किया जाता है, जिससे देश के भीतर रोजगार और क्षमता का निर्माण होता है।

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1828565>

Business Standard

Thu, 26 May 2022

Indian Navy successfully tests surface to Air Missile System from Warship

The Indian Navy successfully tested its ship-based surface to air missile system by taking down a low flying target. The video of the test was also shared by the Indian Navy on Twitter. "All in a days work! Watch YourNavy's guided-missile anti-submarine stealth frigate do what it does best - successfully engage a low flying target with its SAM system, reaffirming the mantra of her crew, HIT FIRST! HIT HARD! Congrats to the team for a text book bullseye!" the Indian Navy tweeted. The test was carried out from a stealth frigate deployed on the western seaboard by the force.

https://www.business-standard.com/article/current-affairs/indian-navy-successfully-tests-surface-to-air-missile-system-from-warship-122052600320_1.html



Thu, 26 May 2022

Defence Minister Arrives in Karnataka on two-day visit to meet Navy officials

Defence Minister Rajnath Singh on Thursday interacted with Indian Navy personnel and their families at Karnataka Naval Area here. "Our defence personnel serve the nation diligently and keep our country safe and secure. Their family members also serve the country by giving them support and strength," he said. Singh arrived on a two-day visit to the naval base here in Uttara Kannada district to interact with personnel of the Indian Navy.

<https://www.news18.com/news/india/defence-minister-arrives-in-karnataka-on-two-day-visit-to-meet-navy-officials-5255317.html>

Business Standard

Fri, 27 May 2022

PM Modi to Inaugurate 'Bharat Drone Mahotsav 2022' today

Prime Minister Narendra Modi will today inaugurate India's biggest Drone Festival -- 'Bharat Drone Mahotsav 2022' on Friday at Pragati Maidan in New Delhi. The Prime Minister will also interact with 'Kisan drone pilots', witness open-air drone demonstrations and interact with startups in the drone exhibition centre. Bharat Drone Mahotsav 2022 is a two-day event and is being held on May 27 and May 28. Fierce battles raged in eastern Ukraine on Wednesday, with Russian troops on the verge of encircling a key industrial city, as President Volodymyr Zelensky issued a bitter rebuke of the West for not doing enough to help Kyiv win the war.

The leadership of Prime Minister Narendra Modi and the contribution of armed forces have changed the perception of the world about India, Defence Minister Rajnath Singh said on Thursday. "The perception about India is changing in the world. Earlier India was not taken seriously at the international fora. Today the world listens to us. It's your contribution and the leadership of our Prime Minister Narendra Modi which makes the world hear us," Singh said during his address to the Naval officers, personnel and their families at the Karwar Naval base. India's top oil and gas producer ONGC on Thursday said it will invest Rs 31,000 crore over the next three years in exploring the Indian sedimentary basin for fuel reserves which could augment the nation's production in its attempt to be self-reliant in the energy sector.

https://www.business-standard.com/article/current-affairs/live-news-updates-bharat-drone-mahotsav-2022-inauguration-pm-modi-russia-ukraine-war-naval-base-ongc-fuel-reserves-exploration-27-may-2022-122052700101_1.html

Thu, 26 May 2022

Aerospace – The next big bet for India

By Niranjana Kalyandurg

The last two years have been highly challenging for the aerospace and aviation sectors globally. Ripple effects have been felt by the Indian aerospace industry as well. All private and commercial flights were stalled for the longest time possible, and business leaders faced the dual challenges of navigating through COVID-19 and maintaining the sector's resilience in the face of this crisis. If 2021 was the year of recovery, 2022 is going to be a turning point. Globally, cash flows and investments have started to increase in space tech companies – an industry long viewed as too risky for serious investment. This has also translated into increased investments in aerospace. In India, policy interventions with government schemes such as UDAN, which focuses on strengthening regional connectivity and aviation infrastructure, and national programs like *Atmanirbhar Bharat* have opened up a plethora of opportunities for the private sector to develop core expertise, accelerate research and development (R&D) and invest in manufacturing in the country.

The pandemic has also accelerated adoption of new technologies at a pace not witnessed before. This has further led to demand in areas like data science, cloud computing, cyber security, artificial intelligence (AI), machine learning (ML), and big data analytics. Companies are now investing in expanding their portfolio and digitalizing processes.

The big tech play

Innovation is the bedrock of every industry. As we move into a future dotted with revolutionary new realities such as aerial ride-sharing and autonomous vehicles, rapid adoption of advanced technologies will bring in radical efficiencies and operational benefits that were previously unimaginable. These technologies are here to stay and will redefine the future of transportation. At the level of design philosophy, businesses are slowly moving away from hardware product design – the 'nuts and bolts' manufacturing – and becoming more focused on software applications that solve problems. The promise of affordable mobility across commercial, civil and defense applications in aerospace is thus deeply embedded in software.

Within the domain of product design, AI algorithms evaluate and streamline design and manufacturing systems in a shorter timeframe. Apart from making systems energy-efficient, AI-powered generative design, when combined with 3D printing, brings aesthetic, practical designs to life. Additionally, cloud-based applications facilitated by AI make maintenance simpler and easier. Urban air mobility (UAM) and advanced air mobility (AAM) will be the next big disrupter of the aero industry and there is huge potential in India to be a leader in designing and developing these. The next generation of innovation will be super compact, fly-by-wire control systems and super-small, sense-and-avoid radar systems. The best thing is that not only does this technology enable autonomy and urban air mobility; it also has applications in other industries.

Building India's R&D capabilities

According to the industry body NASSCOM, India is a hotbed for R&D and digital talent. India's engineering R&D services sector is expected to reach a valuation of \$63 Bn by 2025, up from \$31 Bn in 2019. India's attractiveness as the destination of choice for aero R&D includes the ability to develop strategic business impact, strong focus on continuous innovation, large digital talent pool, and differentiated service delivery. India has one of the largest R&D talent pools in the world to address the scalability needs of global enterprises. To develop and nurture the right talent for the aero industry and to emerge as a new global leader in this space, reskilling and upskilling should be the nation's number one priority for both private and public sectors. Industry-academia collaboration, including joint R&D initiatives, curriculum design, and internships will be key to developing a future-ready workforce.

Achieving sustainability goals

The global aviation industry has also been an early adopter of cleaner fuels. Significant progress has been made in developing sustainable aviation fuel (SAF) as a drop-in substitute to fossil fuel-based aviation fuels. Progress has also been made on developing SAF as a 100% replacement to existing jet fuel. To achieve carbon neutrality in aerospace, companies are focusing on sustainable propulsion alternatives along with incremental technology improvements and operational efficiencies. SAF made from renewable resources such as biomass currently offers 70-80% reduction in carbon emissions. Environmental, social, and governance (ESG) priorities are now also becoming imperatives in corporate governance. Finally, with multiple signatories to climate conventions (such as the recently-concluded COP26) starting to promote "test and learn" mechanisms and driving sustainability through industry certifications, we should soon expect large players in multiple industries to collaborate with a single-minded focus on achieving sustainability goals for organizations, sectors and entire economies.

Flying into the future

Rising incomes, a growing mid-segment, competition among low-cost carriers, investment in airport infrastructure and conducive government policies have led to a healthy growth of the aviation sector in India. The country is expected to become the world's third-largest aviation market by 2024. The big leap forward can be expected when companies move above incremental gains towards an era of exploration, with the next generation of product and service innovation. With innovation at the forefront, organizations can focus on maintaining a high degree of competency in managing technology, while handling their workforce and improving their global footprints. The transition from bricks to chips and in bringing Internet and computing technology together have led to tremendous cost and process optimization for the aerospace industry. As these technologies mature and become smarter, it is not just the ecosystem that grows – our entire concept of mobility does.

<https://www.financialexpress.com/defence/aerospace-the-next-big-bet-for-india/2538764/lite/>

Fri, 27 May 2022

Bharat Forge can supply 100 Artillery Guns every year

The process of the final approval followed by a formal ordering process for the indigenous Advanced Towed Artillery Gun System (ATAGS) is expected to gather steam in the coming months, according to Bharat Forge, one of the two gun manufacturers for the Indian Army. The Pune-based auto parts maker is ready to supply 100 ATAGS in the first year before doubling its capacity at later stages, said a senior executive of Bharat Forge to analysts. Tata Advanced Systems (TASL) is the other manufacturing entity in this venture. ATAGS are a part of the list of weapons which are banned from imports. This was done to boost local manufacturing of such critical defence goods.

Amit Kalyani, Deputy Managing Director, Bharat Forge said, “We expect that this whole ordering process to pick up steam and hopefully get completed in this financial year. On capacity, I think in our first year, we will have a capacity of about 100 guns. And after that, we will have an increase in our capacity to 200 a year.” Towards the end of April, the Defence Research Development Organisation (DRDO) completed the firing trials of the ATAGS at Pokhran, Rajasthan. Last year the guns completed their high-altitude trials.

The towed artillery gun (155mm x 52 Calibre) has a firing range of more than 48 km, making it one of the best in the world. Each of these guns, will become the mainstay of the Indian Army, is expected to cost Rs.15-22 crore. While the initial order will be for 150 guns, the ensuing orders of nearly 1,600, represents a business opportunity of around Rs. 24,000 crore – Rs. 35,000 crore. “The investment made by us so far has been about Rs. 250 crore. But this is only the investment for the gun making; the machining, forging, heat treatment, steel making, all that was already in place. So, we’re leveraging the group capabilities,” Kalyani added.

<http://www.indiandefensenews.in/2022/05/bharat-forge-can-supply-100-artillery.html?m=1>



The Indian EXPRESS

Fri, 27 May 2022

Defence Minister Rajnath Singh to dive deep underwater in a Submarine today

After taking a sortie on Navy surveillance and anti-submarine aircraft P8I last week, Defence Minister Rajnath Singh is scheduled to dive deep underwater in a submarine on Friday. Singh, who is at Karwar in Karnataka on a visit, will take a sortie in the indigenously made Navy’s Kalvari class submarine. The sortie will last a few hours and Singh will witness all aspects of underwater operations. With the underwater sortie, Singh will have witnessed all three dimensions of the Navy’s operational capabilities — on surface, aerial and underwater. For surface operations, he had in September 2019 gone on board the Navy’s only aircraft carrier, INS

Vikramaditya, in September 2019. For aerial operations, it was the P8I sortie last week, which will now be followed by the submarine sortie for underwater operations.

Minister of State for Information and Broadcasting L Murugan keeps a low profile. Usually at I&B events, the senior I&B Minister, Anurag Thakur, takes the limelight. But as Prime Minister Narendra Modi attended events in Tamil Nadu on Thursday, Murugan's home state, the spotlight was on him. Amid cheers from the crowd, the Prime Minister said Murugan, "son of this great soil", had just returned from France, where he attended the Cannes Film Festival. He said Murugan walked the red carpet there in traditional Tamil attire, making "Tamils all over the world very proud". Murugan stood with hands folded as the Prime Minister spoke about him.

<https://indianexpress.com/article/delhi-confidential/delhi-confidential-submarine-sortie-rajnath-singh-karnataka-murugan-7938512/>



Thu, 26 May 2022

Russian Defence Ministry shows footage of Iskander Missile launch

Russia's defence ministry on Thursday showed footage of an Iskander-K missile launch against an unnamed "military target" in Ukraine, the RIA Novosti news agency reported. The Iskander is a short-range ballistic missile system that Russian forces have deployed against Ukrainian cities, ammo depots and other military targets since it sent tens of thousands of troops into Ukraine on Feb. 24 in what the Kremlin calls a "special military operation."

<https://www.moneycontrol.com/news/business/earnings/piramal-enterprises-q4-net-profit-at-rs-150-53-crore-8587981.html>



Thu, 26 May 2022

NATO Deputy Secretary General opens “Defence Disrupted” Innovation and Technology Conference

Deputy Secretary General Mircea Geoană opened the “Defence Disrupted 2022” conference on Thursday (26 May 2022), stressing the importance of maintaining NATO's technological edge, and remaining at the forefront of defence innovation. In a video address to participants gathered in London, he reflected on how innovation and technology have always been central to NATO's mission of preventing war. The Deputy Secretary General cautioned that today, the West's

technological edge “is being challenged by nations that do not share our values, like Russia and China”. He pointed to Russia’s investment in hypersonic missiles, cyber weapons, and disinformation capabilities, and China’s work to become the world leader in artificial intelligence by the end of this decade. However, he noted that free and open societies have a unique advantage: the fact that “our most creative and innovative minds are able to express themselves freely, to challenge, to think in radical new directions, without the threat of reprisals”.

Underlining NATO’s vital role as a platform for cooperation on technology and innovation, Mr Geoană noted that interoperability is essential to credible collective defence. "Two ships may sail side-by-side, but if their systems cannot communicate, if they cannot operate as part of a larger whole, they may as well be in different oceans," he said. He welcomed that NATO’s new Defence Innovation Accelerator for the North Atlantic (DIANA) will “identify and develop the next generation of new technologies”, working with dozens of sites across Europe and North America. DIANA, together with a new multinational NATO Innovation Fund for start-ups developing “cutting-edge dual-use technologies”, should be fully operational in 2023.

The Deputy Secretary General concluded by saying that “it is vital that the open, democratic nations of the world work together to ensure our values remain at the heart of our technological future.” He added: “it is up to all of us to play our part in maintaining our security, and building a better, safer world for future generations”.

https://www.nato.int/cps/en/natohq/news_195824.htm

Science & Technology News



Thu, 26 May 2022

Self-Sensing Artificial Muscle-Based on Liquid Crystal Elastomer and Low-Melting Point Alloys

Materials scientists and bioengineers at the intersection of regenerative medicine and bioinspired materials seek to develop shape-programmable artificial muscles with self-sensing capabilities for applications in medicine. In a new report now published in *Science Advances*, Haoran Liu and a team of researchers in systems and communications engineering at the Frontier Institute of Science and Technology, Jiaotong University, China, were inspired by the coupled behavior of muscles, bones, and nerve systems of mammals and other living organisms to create a multifunctional artificial muscle in the lab. The construct contained polydopamine-coated liquid crystal elastomer (LCE) and low-melting point alloys (LMPA) in a concentric tube or rod. While the team adopted the outer liquid crystal-elastomer to mimic reversible contraction and recovery, they implemented the inner low-melting point alloy for deformation locking and to detect

resistance mechanics, much like bone and nerve functions, respectively. The artificial muscle demonstrated a range of performances, including regulated bending and deformation to support heavy objects, and is a direct and effective approach to the design of biomimetic soft devices.

Soft robotics inspired by the skeleton–muscle–nerve system

Scientists aim to implement biocompatibility between soft robotic elements and human beings for assisted movement and high load-bearing capacity; however, such efforts are challenging. Most traditional robots are still in use in industrial, agricultural and aerospace settings for high-precision sensor-based, load-bearing applications. Several functional soft robots contrastingly depend on materials to improve the security of human-machine interactions. Soft robots are therefore complementary to hard robots and have tremendous potential for applications. Biomimetic constructs have also provided alternative inspiration to emulate the skeleton-muscle-nerve system to facilitate agile movement and quick reaction or thinking, with a unique body shape to fit tasks and perform diverse physiological functions. In this work, Liu et al were inspired by the fascinating idea of biomimicry to develop multifunctional artificial muscles for smart applications.

Biomimicry in the lab

During the experiments, the team imparted shape-programmable, deformation-locking and self-sensing features via liquid crystal elastomers (LCE), and low melting point alloys (LMPA) in the shape of a concentric tube or rod. While the outer elastomer provided reversible contraction and recovery, the inner alloy delivered shape loading for the functions of muscles and bones. To achieve rapid photothermal conversion under light irradiation, the team coated a thin film of polydopamine on the surface of the elastomer, and triggered contraction and bending deformation. The process allowed convenient functionality in complex and unknown environments to create shape-configurable artificial muscles with high load-bearing capacity and low power consumption for smart functionality.

The working principle

The team showed the proposed multifunctional muscle coupled with soft elastomer and hard alloy materials. Liu et al prepared the liquid crystal elastomers (LCE), using Michael addition reactions with amines and thiols, and created a loosely cross-linked hollow elastomer tube via gelation in a glass tube or rod. The researchers introduced the photothermal effect by developing a polydopamine layer on the material surface to maintain excellent photostability and strong absorption characteristics in the near infrared range. The team showed how the multifunctional artificial muscles could be developed by embedding pre-fabricated low melting point alloys (LMPA) into the polymer-coated LCE tube. They then irradiated the side of the artificial muscle with a laser and caused instant transformation of light into heat in the region. Comparative analysis of deformation showed instant bending about six seconds after laser irradiation, highlighting the influence of LMPA on the excellent properties of muscle deformation.

Characterizing the multifunctional artificial muscles as a reconfigurable antenna

Liu et al performed finite element analysis using the ABAQUS software and simulated the heat source. They studied the temperature and stress distributions of the artificial muscle under diverse powers of irradiation. While large irradiating powers induced large stress in the elastomer, this further triggered a large bending angle in the artificial muscle's alloy area. The

team analyzed the bending angle of the multifunctional artificial muscle, governed by the laser power, spot area and irradiating time using experimental tests and simulations. They showed how to regulate flexible deformation in the bending angle, direction and position to increase the possibility of forming a shape-programmable artificial muscle.

The team characterized the rapid shape transformation and deformation locking performance of the artificial muscle via a range of experiments including cyclic tests to demonstrate its deformation capacity. They further characterized the sensing functions to monitor the dynamic behavior of artificial muscles in real-time based on changes in electrical resistance. Liu et al made further use of the multi-material properties and demonstrated applications of the proposed multifunctional artificial materials, as a reconfigurable antenna. In this instance, they measured the bending angle by applying the laser on the artificial muscle surface, to function as a remotely controlled reconfigurable antenna.

Outlook

In this way, Haoran Liu and colleagues developed a shape-programmable, deformation-locking and self-sensing artificial muscle based on the behavioral characteristics of living bones, muscles, and nerves using soft elastomer materials coupled with high-stiffness alloy materials. The rigid low melting point alloy (LMPA) mimicked the endoskeletons of living organisms, to provide structural strength, while pure soft materials made of the liquid crystal elastomer (LCE), offered powerful actuating stress and secure physical compatibility to mimic the natural muscle. The study provided a first instance to form an artificial muscle with aforementioned features, where the constructs showed rapid shape transformation and deformation properties to yield proof-of-concept robot arms with applications across haptic displays and medicine.

<https://techxplore.com/news/2022-05-self-sensing-artificial-muscle-based-liquid-crystal.html>



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Developing a One-Stop Shop for Diamond-Based Quantum Sensing Materials

The brilliant blue of the Hope Diamond is caused by small impurities in its crystal structure. Similar diamond impurities are also giving hope to scientists looking to create materials that can be used for quantum computing and quantum sensing. In new research from the U.S. Department of Energy's (DOE) Argonne National Laboratory, researchers have created extremely thin membranes of pure diamond. In a few locations in the crystal structure of the membrane, however, the team substituted carbon atoms with other atoms, notably nitrogen. These defects connect to neighboring atomic vacancies—regions where an atom is missing—creating unusual quantum systems known as "color centers." Such color centers are sites for storing and processing quantum information.

Equipped with a way to cheaply and easily create diamond membranes that have robust color centers, scientists at Argonne hope to build a kind of assembly line for generating large numbers of these membranes for quantum experiments around the world. The ability to grow the

membranes could be the ticket to enhancing collaboration between different laboratories devoted to quantum information science, said University of Chicago graduate student Xinghan Guo, lead author of the study. "Essentially, we hope this will eventually give us the ability to become a one-stop shop for quantum sensing materials," Guo said.

"The defects in the diamond are interesting to us because they can be exploited for quantum application," said Nazar Delean, scientist in Argonne's Materials Science division and the Pritzker School of Molecular Engineering at the University of Chicago and a collaborator with Q-NEXT. "Making these membranes allows us to integrate these defects with other systems and enables new experimental configurations." Diamond is mechanically hard, chemically stable and generally expensive—in other words, it is kind of a scientific nightmare, notoriously difficult to fabricate and integrate. At the same time, diamond's particular structure makes it a great host for color centers that can store quantum information for a long time, Guo said.

"Conventional diamond as a substrate is super hard to work with," he said. "Our membranes are thinner and more accessible for a wide range of experiments." The new diamond material fashioned by the researchers offers greater crystal and surface quality, enabling greater control over the coherence of the color centers. "You can peel the membrane off and put it on a wide range of substrates, even put it on a silicon wafer. It's a cheap, flexible and easy way of working with color centers without having to work directly with conventional diamond," Guo said. "Because we're able to control and maintain the quantum properties in individual defects within these very thin materials, it makes this platform promising as basis for a quantum technologies," Delean said.

<https://phys.org/news/2022-05-one-stop-diamond-based-quantum-materials.html>

