

मई  
May  
2024

खंड/Vol. : 49 अंक/Issue : 97

28/05/2024

# समाचार पत्रों से चयित अंश Newspapers Clippings

डीआरडीओ समुदाय को डीआरडीओ प्रौद्योगिकियों, रक्षा प्रौद्योगिकियों, रक्षा नीतियों, अंतर्राष्ट्रीय संबंधों और विज्ञान एवं प्रौद्योगिकी की नूतन जानकारी से अवगत कराने हेतु दैनिक सेवा

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology



रक्षा विज्ञान पुस्तकालय

Defence Science Library

रक्षा वैज्ञानिक सूचना एवं प्रलेखन केंद्र

Defence Scientific Information & Documentation Centre

मेटकॉफ हाउस, दिल्ली - 110 054

Metcalfe House, Delhi - 110 054

# CONTENTS

S. No.	TITLE	Page No.
	<b>DRDO News</b>	<b>1</b>
	<b>DRDO Technology News</b>	
1	Appointment Committee of Cabinet approves one-year extension in service of Secretary, Department of Defence R&D and Chairman DRDO Dr Samir V Kamat up to May 31, 2025	<i>Press Information Bureau</i> 1
	<b>Defence News</b>	<b>2-12</b>
	<b>Defence Strategic: National/International</b>	
2	Indian Army partners with IOCL for hydrogen fuel cell bus trials	<i>Press Information Bureau</i> 2
3	Defence Ministry tightens weapons monitoring	<i>The Economic Times</i> 3
4	India-France joint military exercise ‘Shakti’ concludes in Meghalaya	<i>The Statesman</i> 4
5	Indian Army Now Equipped with First Batch of Upgraded T-90 Mark-III Tanks from Bulgaria	<i>The Republic</i> 4
6	Espionage: Pakistani hackers target ‘Make in India’ defence programs	<i>India Today</i> 6
7	Akash, Pinaka, BrahMos, Tejas – India Banks On ‘Big Weapons’ To Emerge As World’s Top 10 Defense Exporters	<i>The Eurasian Times</i> 8
8	South Korea completes development of long-range SAM system	<i>Janes</i> 11
9	Iran further increases its stockpile of uranium enriched to near weapons-grade levels	<i>The Economic Times</i> 11
	<b>Science &amp; Technology News</b>	<b>12-15</b>
10	Scientists find way to boost supercapacitors’ energy storage. It could change how we charge devices	<i>The Print</i> 12
11	Agnikul Cosmos attempted to launch Agnibaan rocket twice, launch called off	<i>News Nine</i> 14

**DRDO News**

**DRDO Technology News**



**Press Information Bureau  
Government of India**

*Mon, 27 May 2024*

**Ministry of Defence**

**Appointment Committee of Cabinet approves one-year extension in service of Secretary, Department of Defence R&D and Chairman DRDO Dr Samir V Kamat up to May 31, 2025**

The Appointment Committee of Cabinet, on May 27, 2024, approved the extension in service of Secretary, Department of Defence R&D and Chairman DRDO Dr Samir V Kamat for a period of one year, beyond his normal age of superannuation (May 31, 2024), i.e. up to May 31, 2025. He was appointed to this post on August 25, 2022. Dr Kamat is an alumni of IIT Kharagpur and The Ohio State University, USA and joined DRDO in 1989. Prior to the appointment of Secretary DDR&D and Chairman DRDO, Dr Kamat served as Director General (Naval Systems and Materials)

Dr Kamat is a Fellow of the Indian National Academy of Engineering (INAE) and Institution of Engineers India (IEI). He is a recipient of Distinguished Alumni Award from IIT Kharagpur, Metallurgist of the Year Award from Ministry of Steel and Scientist of the Year Award from DRDO. He has published more than 180 papers in international peer-reviewed journals.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2021885>



*Mon, 27 May 2024*

### **Indian Army partners with IOCL for hydrogen fuel cell bus trials**

Displaying a firm resolve towards finding green and sustainable transport solutions, the Indian Army has collaborated with Indian Oil Corporation Limited (IOCL) for demonstration trials of Hydrogen Fuel Cell Bus technology, a PIB press release stated.

A Memorandum of Understanding (MoU) was signed between the Indian Army and the IOCL in presence of General Manoj Pande, Chief of the Army Staff (COAS) and Shrikant Madhav Vaidya, Chairman of Indian Oil. During the event, one Hydrogen Fuel Cell Bus was received by the Indian Army. This marks the commencement of mutually beneficial partnership between Indian Army and IOCL.

The MoU emphasised the commitment to fostering innovation and advancing sustainable transport solutions for the future. Hydrogen Fuel Cell technology offers a clean and efficient alternative by converting Hydrogen gas into electricity through an electro-chemical process. The process leaves water vapour as the only by product, thus ensuring zero emission.

The Hydrogen Fuel Cell Bus has a seating capacity of 37 passengers. It promises an impressive mileage of 250-300 km on a full 30 kg onboard tank of Hydrogen fuel.

Notably, on 21 March 2023, the Indian Army became the first government entity to ink an MoU with National Thermal Power Corporation Renewable Energy Limited for installation of Green Hydrogen based Microgrid Power Plants along the Northern Borders. A pilot project is being setup at Chushul, where a 200 Kilo Watt Green Hydrogen based Microgram will provide 24×7 clean electricity to troops deployed in inhospitable terrain and extreme climatic conditions.

<https://theprint.in/defence/indian-army-partners-with-iocl-for-hydrogen-fuel-cell-bus-trials/2104029/>

## Defence Ministry tightens weapons monitoring

The defence ministry is tightening the monitoring of defence equipment being manufactured in India and has asked the industry to strictly follow end-user certification rules when it comes to exports, after some reports of equipment going into the "wrong hands" have come up.

The Indian defence sector has seen a sharp increase in production of arms and weapons for both internal use and export orders in the past few years. Weapons manufacturing is on the rise throughout the world, given the Ukraine-Russia crisis, and multiple reports have emerged of weapons landing up on either side of the conflict without proper authorization by the country of origin.

The ministry is now looking to set up an internal portal that will monitor consumption patterns of imports being done by defence sector companies, particularly when it comes to explosives and primers.

"We are looking at an internal portal so that when things are imported, we can also monitor them because these should not go into the wrong hands. There are instances we have come across where reports are there that it has gone into the wrong bands," a senior defence ministry official told industry representatives. He did not specify details or the reported lapses.

Annual defence production by value zoomed to ₹ 1,08,684 crore in financial year 2022-23, with private companies' share valued at ₹21,083 crore and the rest coming from public sector entities. Exports have also risen to ₹ 21,003 crore in financial year 2023-24, with private sector companies contributing the significant majority.

The official also cautioned the industry to be careful when it comes to export of weapons and to ensure that the country which is purchasing lethal arms certifies that it will not send them to a third party.

"Particularly due to the present geo-political scenario, you(industry) need to come up with the entire chain of end-users and the government of that particular country must mention that they will not send it to any other country" he said.

While arms exports are being encouraged by the government, strict rules and regulations still apply when it comes to exports to particular nations. For example at present Indian companies are not granted permissions to export weapons to Ukraine. While most companies refrain from directly dealing with Russia due to the fear of western sanctions. Other countries where exports are restricted include Turkey; besides China and Pakistan.

<https://economictimes.indiatimes.com/news/defence/defence-ministry-tightens-weapons-monitoring/articleshow/110475318.cms?from=mdr>

## India-France joint military exercise 'Shakti' concludes in Meghalaya

The 12-day long India and France joint military exercise came to an end at the Foreign Training Node in Umroi Meghalaya on Sunday.

The 7th edition of the Joint Military Exercise 'Shakti' between India and France started on May 13 and concluded on May 26, 2024.

The joint exercise was conducted to enhance the joint tactical operations between the armed forces of the two countries.

Exercise 'Shakti' is a biennial event that alternates between India and France, with the previous edition held in France in November 2021.

The Indian contingent consisted of 90 personnel from the RAJPUT Regiment, along with observers from the Indian Navy and Indian Air Force, who participated alongside 90 personnel from the 13th Foreign Legion Half-Brigade (13th DBLE) of France.

Guests at the opening ceremony included the French Ambassador to India, Thierry Mathou, and Major General Prasanna Sudhakar Joshi, General Officer Commanding 51 Sub Area.

The joint exercise focused on enhancing joint military capabilities in sub-conventional scenarios under Chapter VII of the United Nations Mandate, a release said.

Training emphasised operations in semi-urban and mountainous terrain, with a focus on physical fitness, tactical drill refinement, and the sharing of best practices.

Exercise 'Shakti' as a collaboration not only strengthened defense cooperation but also reinforces the bilateral relations between the two friendly nations.

[https://www.thestatesman.com/india/india-france-joint-military-exercise-shakti-concludes-in-meghalaya-1503304280.html#google\\_vignette](https://www.thestatesman.com/india/india-france-joint-military-exercise-shakti-concludes-in-meghalaya-1503304280.html#google_vignette)

**R. REPUBLICWORLD.COM**

Mon, 27 May 2024

## Indian Army Now Equipped with First Batch of Upgraded T-90 Mark-III Tanks from Bulgaria

In a significant development for India's defence capabilities, the Indian Army has taken delivery of the first batch of upgraded T-90 Mark-III tanks, locally known as the Bhisma Mark-III. Manufactured by the Heavy Vehicles Factory, this upgrade represents a crucial step in modernizing

India's armoured fleet. With plans to upgrade 300 T-90 tanks, New Delhi aims to bolster the combat potential of its armoured forces.

A key focus of the T-90 Bhishma Mark-III modernization has been the integration of indigenous systems, aligning with India's "Make in India" initiative. This initiative emphasizes local manufacturing and technological development, compelling both Russian and Western manufacturers to enhance their capabilities on Indian soil. The incorporation of advanced technologies aims to elevate the tank's performance and effectiveness on the battlefield.

### **Tailored for Indian Operations with Enhanced Firepower**

The Bhishma Mark-III represents an advanced variant of the T90, customized to meet the specific operational requirements and environmental challenges encountered by the Indian Army, according to a report by the Bulgarian Military. With upgrades across various systems, including firepower, armour protection, and mobility, the tank is poised to excel in diverse combat scenarios, from deserts to mountainous terrains.

The T-90 Mark-III boasts significant enhancements in firepower, facilitated by advanced fire control systems and digital ballistic computers. The integration of a Correction Input Device (CID) and the Main Battle Tank (MBT) commander's infrared sight enhances precision and accuracy during engagements. Furthermore, digital communication capabilities have been implemented to improve coordination among crew members and units on the battlefield, enhancing overall situational awareness.

### **Improved Armor Protection and Mobility**

Distinguishing itself from its predecessor, the Bhishma Mark-III features enhanced armour protection, including composite armour and Explosive Reactive Armor (ERA), offering superior defence against modern anti-tank threats. Moreover, an upgraded engine provides improved mobility and combat range, enabling the tank to manoeuvre effectively across varied terrains.

While retaining the 125mm smoothbore gun of the original T90, the Bhishma Mark-III incorporates improved ammunition types and an automatic loading system, resulting in faster reloading and increased firepower. Additionally, the tank is equipped with advanced anti-tank guided missiles (ATGMs) for extended-range combat operations, further augmenting its lethality on the battlefield.

Despite initial plans for Russia's involvement in the modernization process, geopolitical tensions and domestic priorities have led to adjustments in India's approach. Reports of Russian use of Indian T-90s in Ukraine underscored the need for careful diplomatic navigation. While preserving relations with Russia remains a priority, India seeks to leverage its technological capabilities and forge strategic partnerships to advance its defence interests.

<https://www.republicworld.com/defence/indian-armed-forces/indian-army-now-equipped-with-first-batch-of-upgraded-t-90-mark-iii-tanks-from-bulgaria/?amp=1>

## **Espionage: Pakistani hackers target ‘Make in India’ defence programs**

A seemingly innocuous email landed in the inbox of an Indian defence official. At first, his wary eyes dismissed it. But the sender – supposedly a renowned think-tank - held a certain weight. He clicked the mail and the attached PDF document circulated by one Shakeel Bhatti. By the time he realised it was a trap, sensitive data had already been stolen.

A seemingly innocuous email landed in the inbox of an Indian defence official. At first, his wary eyes dismissed it. But the sender – supposedly a renowned think-tank - held a certain weight. He clicked the mail and the attached PDF document circulated by one Shakeel Bhatti. By the time he realised it was a trap, sensitive data had already been stolen.

Transparent Tribe, known as Advanced Persistent Threat (APT) 36 among cybersecurity professionals, has been targeting employees in defence establishment, especially in companies that come under the Defence Ministry’s Department of Defence Production.

A cyberattack campaign designed to target personnel of the Indian Air Force (IAF), earlier reported by India Today, was also run by this group.

In its report, Canadian cybersecurity firm BlackBerry said it traced the roots of the online espionage campaign to Pakistani cities and identified Shakeel Bhatti as a group member.

### **Defence Makers On Target**

Indian defence forces and state-run defence contractors were the focus of the Transparent Tribe between September 2023 and April 2024, the BlackBerry Research & Intelligence Team said in its report.

Phishing emails containing malware were sent directly to “one of the largest aerospace and defense companies in Asia”, “an Indian state-owned aerospace and defence electronics company” and to “Asia’s second-largest manufacturer of earth moving equipment, which plays a key role in the country’s Integrated Guided Missile Development Project by supplying ground support vehicles”, the report said without explicitly naming the targets.

The companies most likely are Hindustan Aeronautics Limited (HAL), Bharat Electronics Limited (BEL), and Bharat Earth Movers Limited (BEML) – all headquartered in Bengaluru.

The attackers “carbon-copied” the online appearance of key officials within the Department of Defence Production to deceive their targets.

To get more targets to open the phishing mails, they used a wide range of subjects – from topics of general interest such as holiday camp in Rajasthan’s Jaisalmer, pension, provident fund, appraisal, an education loan application, and telephone directory to more professional subjects like the IAF



headquarters' public relations policy, unspecified invitations, concept paper for defence export, and minutes of review meetings.

The cyber-attackers sought to exploit the goodwill of many military-run and private entities that are widely recognised in defence circles. Website domains mimicking those of the Indian Computer Emergency Response Team (CERT-In), the Centre for Land Warfare Studies (CLAWS), Delhi Cantt's Army Public School, and the Army Welfare Education Society which runs hundreds of army schools, were created and included in the espionage campaign to earn the trust of victims.

### **Modus Operandi**

The attackers have been using a variety of techniques and tools to deliver malware into targeted systems, with phishing emails being the preferred method. Malicious ZIP archives or executable and linkable format (ELF) files – that can run on different processor types – were delivered to target mailboxes.

ELF binaries are designed to monitor directories for specific file types, exfiltrating them to external servers.

The BlackBerry report said the group relied heavily on ELF binaries to infiltrate the Linux-based operating system MayaOS that has indigenously developed for the defence sector.

The group also developed Python-based downloaders and Windows binaries that perform similar functions.

It deployed an "all-in-one" espionage tool based on Google's open-source language called GoLang with capabilities to find and exfiltrate files with popular file extensions, take screenshots, upload and download files, and execute commands.

In addition, it continues to use ISO images as an attack vector as first reported by India Today.

These attacks leveraged cross-platform programming languages such as Python, GoLang, and Rust and exploited web services like Telegram, Discord, and Google Drive to export the stolen data.

### **Pakistani Origin**

Researchers at Blackberry found traces suggesting the involvement of Pakistan-based actors. For example, the time-zone variable for a file extracted from a malicious delivery package was set to "Asia/Karachi," a Pakistani time zone.

Similarly, an ISO image used in the espionage campaign was submitted from Multan and a remote IP address linked to the phishing emails was traced to CMPak Limited, which is Pakistan-based and owned by China Mobile.

A 2018 report by cybersecurity firm Lookout said it believed Transparent Tribe was associated with the Pakistani military.

<https://www.indiatoday.in/india/story/pakistani-hacker-make-in-india-defence-programs-espionage-osint-2544545-2024-05-27>

## **Akash, Pinaka, BrahMos, Tejas – India Banks On ‘Big Weapons’ To Emerge As World’s Top 10 Defense Exporters**

India is one of the largest weapons importers and is now looking to break into the exclusive club of weapons exporters. India’s defense exports crossed ₹21,000 crores (\$2.63B) for the first time, Defence Minister Rajnath Singh recently announced. India banks on ‘Big Weapons’ to double its export that includes LCA Tejas, BrahMos Missile, Light Combat Choppers, Pinaka MLRS, Akash SAM etc.

Military exports have been a major goal for the defense industries worldwide. This helps the industry independently support its defense research and development and production without relying on government funding for its growth, development, and expansion.

Consequently, most of the defense industrial base in developed countries focuses on defense exports, with the top 10 defense exporters mainly from North America and Western Europe. From 2019 to 2023, the United States and Western Europe accounted for 72% of global defense exports.

Defense exports provide a country with monetary benefits and help strengthen its diplomatic relations with other nations. Countries with domestic defense industrial bases often prefer to export weapons to friendly countries.

The Cold War era witnessed a remarkable example of Soviet arms supply to India, which helped the Soviets to strengthen their bilateral ties with India.

According to Fact Sheet 2024 of the Stockholm International Peace Research Institute (SIPRI), there are currently 66 countries in the world exporting arms. The top five arms exporters are the USA, France, Russia, China, and Germany, accounting for 75% of global defense exports.

Over the past decade, several new players, such as South Korea and Turkey, have joined the exclusive group of defense exporters. India is also striving to secure its position on the global arms export list. As a result, defense exports have been a central focus of the Indian defense industry since 2015.

As of 2020, India is ranked 23rd on SIPRI’s list of global arms exporters list. To further enhance India’s position in the arms export market, the Indian Government has taken several policy initiatives. Setting a target of \$5 billion in defense exports by 2025 is a testament to the Government’s commitment to promoting India’s defense exports.

In March 2024, the Government released the numbers of defense exports for the financial year 2023-24. For 2023-24, India’s defense exports reached ₹21,083 Crores (\$2.68 billion). For this year, 32.6% growth was registered compared with the previous financial year. The share of the private sector was 60% compared with 40% of the public sector.

Before 2015, the Indian defense industry was mainly focused on catering to the domestic demands of the Indian armed forces. As a result, defense exports were marginal. For 2013-14, exports were roughly around ₹686 Crore, which has grown to ₹21,083 for the year 2023-24, almost 31 times in the past decade.

**India’s Defence Exports from 2014 to 2024**

Years	Export Value (INR)
2013-14	₹686
2014-15	₹1941
2015-16	₹2059
2016-17	₹1522
2017-18	₹4682
2018-19	₹10746
2019-20	₹9116
2020-21	₹8435
2021-22	₹11067
2022-23	₹15918
2023-24	₹21,083

Source: Department of Defence Production, Ministry of Defence, Government of India.

India currently exports defense products to 84 countries. These include defense hardware such as patrol vessels, low-band radars, anti-tank weaponry, armored vehicles, torpedoes, bulletproof jackets, small arms, artillery guns, rocket launchers, sensors, and night vision devices.

Being part of the global supply chain, the defense sector also exports essential components to large manufacturers such as Boeing and Airbus. Thus, Indian defense exports are largely dominated by non-core technology-based products. Compared with core technology-based products such as fighter planes, submarines, and tanks, these systems are low-cost.

Therefore, to increase the value of its exports, India needs to focus on high-end technology-based weapon systems. So far, India has successfully developed a few high-end technology defense products indigenously in all three domains of warfare.

In the air domain, India has developed a Light Combat Aircraft (LCA), Tejas, an Advanced Light Helicopter (ALH), Dhruv, a Light Combat Helicopter (LCH), Prachand, and a Light Utility Helicopter (LUH). In the land domain, it has developed the Main Battle Tank (MBT) Arjun and several howitzers and MLRS. Likewise, India has designed and constructed several vessels for offensive and defensive roles in the sea domain.

All these defense products are complete weapon systems, which means their exports include other auxiliary accessories. For example, fighter aircraft exports include a complete weaponry package,

flight simulators, hangers, Line Replaceable Units (LRUs), and Maintenance Repair and Overhaul (MRO).

Exports of complete weapon systems lead to buyers' lifelong dependency on keeping the system operational until its technical life. Thus, such exports ensure long-term revenue generation, which is not the case with the export of components and assemblies.

Therefore, to emerge as a key defense exporter in the international arms market, the Indian defense industry has to identify the potential market for its products. Accordingly, the focus must be on the development of such weapon systems.

Apart from developing high-value defense platforms such as tanks, fighter aircraft, and large displacement vessels, the Indian defense industry can work on developing weapons and ammunition that can be integrated into the existing aircraft, tanks, and vessels used worldwide.

The Israeli defense industry is a remarkable example. The industry develops various types of weapons and ammunition as a whole system, such as armored carriers, artillery guns, tanks, etc.

However, their defense industry also focuses on developing sensors, missiles, ammunition, combat systems, defensive mechanisms, radars, communication systems, and battle management systems that can be integrated with any platform, whether of Russian or Western origin.

These types of product-based exports heavily contribute to Israel's overall defense exports. India has been a traditional buyer of Israeli-made systems. Several Israeli-origin weapons, ammunition, sensors, combat, management systems, and communication systems have been incorporated with French, Russian, and Indian platforms used by the Indian armed forces.

Thus, the Indian defense industry must focus on the potential market and offer the products accordingly.

To bolster defense exports, the Government of India can explore other policy alternatives such as a line of credit, expanding the role of defense attaches, Technology transfer followed by setting a production line in the buyer country, joint development, or production.

The Government of India is currently focusing on lines of credit and expanding the role of defense attaches to boost defense exports. At present, most of the exports proposed are under the line of credit mechanism.

Nonetheless, Indian-made defense products face multiple challenges in the international arms market, such as competition from established players, reliability, and after-sales service.

The sale of the ALH Dhruv helicopter to Ecuador was an epic example of how the Indian defense industry faced legal challenges from the buyer country in response to the aircraft's crashes due to poor maintenance.

Therefore, the Government of India must address the core concerns of its defense industry. This includes research and development, production, quality control, and after-sales support. Only then can the goal of becoming a major arms supplier in the global market be achieved in the long run.

[https://www.eurasiantimes.com/decoding-indias-defence-exports/#google\\_vignette](https://www.eurasiantimes.com/decoding-indias-defence-exports/#google_vignette)

*Mon, 27 May 2024*

## **South Korea completes development of long-range SAM system**

South Korea's Defense Acquisition Program Administration (DAPA) has completed the development of its long-range surface-to-air missile (L-SAM) system, the country's Ministry of National Defense (MND) said on 27 May.

According to the MND, the L-SAM fulfilled its “technical development goals and was judged suitable for combat” in a recent DAPA test on the system.

The production of the L-SAM will initiate in 2025, and the system is scheduled to be deployed to the military in the late 2020s, the MND said.

DAPA subsidiary Agency for Defense Development (ADD) has been developing the L-SAM with local military technology firm LIG Nex1 since 2019.

The system is a part of South Korea's indigenous ballistic missile defence (BMD) architecture known as the Korea Air and Missile Defense (KAMD) system, which comprises the L-SAM, the Cheongung II medium-range SAM (M-SAM), the US-supplied MIM-104 Patriot SAM, and the low-altitude missile defence (LAMD) capability.

According to the MND, the L-SAM is a terminal-stage upper-layer defence system that intercepts ballistic missiles at a higher altitude than the Cheongung II.

It can intercept “an enemy missile at an altitude of 50–60 km when it reaches its peak altitude, and the missiles that [the] L-SAM cannot intercept are intercepted by terminal-stage lower-level defence systems such as [the] Patriot (PAC-2/PAC-3) and [the] Cheongung II at an altitude of around 40 km,” the MND added.

[https://www.janes.com/defence-news/news-detail/south-korea-completes-development-of-long-range-sam-system#:~:text=South%20Korea's%20Defense%20Acquisition%20Program,MND\)%20said%20on%2027%20May](https://www.janes.com/defence-news/news-detail/south-korea-completes-development-of-long-range-sam-system#:~:text=South%20Korea's%20Defense%20Acquisition%20Program,MND)%20said%20on%2027%20May).

## **THE ECONOMIC TIMES**

*Mon, 27 May 2024*

## **Iran further increases its stockpile of uranium enriched to near weapons-grade levels**

Iran has further increased its stockpile of uranium enriched to near weaponsgrade levels, a confidential report by the United Nations' nuclear watchdog said Monday. The report, seen by The

Associated Press, said Iran now has 142.1 kilograms (313.2 pounds) of uranium enriched up to 60% - an increase of 20.6 kilograms (45.4 pounds) since the last report in February. Uranium enriched at 60% purity is just a short, technical step away from weapons-grade levels of 90%.

Iran's overall stockpile of enriched uranium stands at 6201.3 kilograms (13671.5 pounds), which represents an increase of 675.8 kilograms (1489.8 pounds) since the last report by the International Atomic Energy Agency.

In its current report, the IAEA also said Tehran has not reconsidered the agency's September 2023 decision of barring the most experienced nuclear inspectors from monitoring its nuclear program but added that it expected Iran "to do so in the context of the ongoing consultations between the Agency and Iran."

The IAEA also said that the deaths of Iran's President and Foreign Minister in a helicopter crash have caused a pause in the UN nuclear watchdog's talks with Tehran over improving cooperation. In its current report, the IAEA said that Iran suggested in a letter dated May 21 that discussions related to the cooperation between the IAEA and Iran "be continued in Tehran 'on an appropriate date that will be mutually agreed upon'."

Iran has maintained its nuclear program is peaceful, but the IAEA chief has warned Tehran has enough enriched uranium for "several" nuclear bombs if it chose to do so.

<https://economictimes.indiatimes.com/news/defence/iran-further-increases-its-stockpile-of-uranium-enriched-to-near-weapons-grade-levels/articleshow/110472567.cms>

## Science & Technology News

# ThePrint

*Mon, 27 May 2024*

## **Scientists find way to boost supercapacitors' energy storage. It could change how we charge devices**

Researchers at the University of Colorado Boulder, along with those from Poland and the UK, have devised a way to improve supercapacitors without using batteries— a development that could increase energy storage capacity and potentially change the way we charge electronic devices today.

The findings were published in the peer-reviewed journal PNAS Friday.

Supercapacitors are devices that hold large amounts of energy to discharge in bursts, such as braking mechanisms in vehicles or turning-on devices. As next-generation energy storage devices start to become the norm in industries around the world, researchers have increasingly been delving into their nano- and micro-scales of material structure to understand how to perfect them.

The team of researchers from the US, Poland, and the UK set about trying to understand how to improve supercapacitor energy capacity and experimented with various porous materials for building one. They demonstrated that differences in chemical charges in atoms and ions can cause a flow of electricity, despite a complete lack of chemical reactions, which is what produces power in batteries today.

The researchers, under project head Ankur Gupta, note that this electrolyte transport within such porous materials used to build supercapacitors can be explained using basic electricity laws written by famed physicist Gustav Kirchhoff, which are a staple part of electricity basics studied in school and college. As a consequence, they suggest an addendum that can be applied to porous materials.

This discovery could help develop more efficient energy storage devices that could substantially reduce charging times for everything from laptops to electric vehicles.

“We modified Kirchoff’s Laws for electrolyte transport and suggested that Kirchoff’s voltage law needs to be modified to include electrochemical potential, and not just electric potential,” Gupta, whose lab is called LIFE — Laboratory of Interfaces, Flow, and Electrokinetics — told ThePrint.

In their paper, the authors specifically talk about the use of materials that are deemed porous at nanoscales or have nanopores. In such structures, molecules containing ions are unable to latch onto the surface, splitting up into their respective component charges and inducing an electrochemical potential difference that makes electricity flow.

Based on their model of porous materials with large surface areas, the authors conclude that their methodology offers a way to achieve a higher efficiency flow that does not rely on chemical reactions, but works only on the flow of ions. According to the paper, this opens up immediate possibilities for constructing various 3D-printed electrodes and improving supercapacitor performance. Additionally, the team shows that their findings are supported by direct numerical simulations.

### **Highways of charge flow**

With supercapacitors and other materials that have to do with the flow of electricity, materials offer more advantages when understood at a nanometer level. Within porous materials, the large number of pores drastically increases the surface area of a material.

Thus, when a salt like sodium chloride is added to it when energy is applied, the nanopores do not allow the entire molecule to bind to the surface. Instead, the salt molecule splits into a sodium ion and a chloride ion, creating a separation of charge and inducing the flow of electrochemical current.

To understand the implications of the findings, Gupta likens the flow of electric current and the flow of electrochemical current to a map route and a dense network of highways — electricity flow in a material is like drawing a map route from point A to B, but electrochemical flow in porous material is the nitty gritty that makes up the various roads and highways and the convoluted paths vehicles take to physically get from point A to B.

And for his team to get here, they started off thinking about other porous material that allows for the flow of liquids.

“The basic idea is that there is a lot of porous material in nature, or mechanical engineering, for example. Water flows in wells, both oil and water, and it is aided by porous materials. We wanted to use some of those principles and apply them to an electrochemical system,” explained Gupta.

The flow of electrochemical charge through membranes is not fully understood yet, and understanding these dynamics in the porous material is necessary for cutting-edge energy storage devices. Supercapacitors have been in use for nearly 50 years, and today are already used heavily in not just regenerative braking in the automotive sector, but also for power backup and UPS, household alarms, even flashes for photography, and any other applications that require short bursts of large amounts of power.

### **Applications of findings**

Gupta explains that there have been significant strides in supercapacitor research in the last 15 years or so. Batteries continue to remain the main focus for energy storage, but the destructive nature of batteries is one of the main reasons researchers today are even more interested in electrochemical flow.

The team isn't the only one working on supercapacitors and porous material. However, they are the first to introduce a model to predict electrolyte transport in complex networks of nanopores using modified Kirchhoff's laws.

As the next steps, the team plans to characterise such nanopore systems to standardise them and conduct further experiments using eventual 3D printing.

“Some electric buses in China are powered by supercapacitors,” said Gupta. Since buses make very frequent stops, they charge at each station for a short period and store enough energy until the next station. Public transit is a very obvious use case, he explains.

“This promises to be a good thing because supercapacitors rely less on chemical reactions, with no risk of explosions, and they can even replace batteries in some cases. There has to be a conscious effort at finding such materials for the future.”

<https://theprint.in/science/scientists-find-way-to-boost-supercapacitors-energy-storage-it-could-change-how-we-charge-devices/2103418/>



*Tue, 28 May 2024*

## **Agnikul Cosmos attempted to launch Agnibaan rocket twice, launch called off**

Agnikul Cosmos initially deferred the launch because of irregularities during the prelaunch procedures during a health check, early in the morning around 06:15 hours IST. Another attempt was made at 09:25 hours, but the flight was put on hold during the automated launch sequence, five seconds before liftoff. Finally, the launch attempt was called off.



The Suborbital Technology Demonstrator (SOrTeD) mission is for evaluating the performance of the Agnibaan rocket, and is the second private Indian rocket launch after the Vikram-S launch by Skyroot Aerospace on 18 November, 2022. The launch attempt was livestreamed by IN-SPACE.

### **The Agnibaan flight marks a number of firsts**

Agnibaan rocket has the world's first and only 3D printed rocket engine that was produced as a single unit. SOrTeD uses thrust vectoring of the actuators over the engine, allowing the rocket to execute a controlled vertical ascent. This will be the first test flight for the rocket. The rocket was also launched from the first private launchpad in India.

### **Agnibaan rocket to be launched from Sriharikota**

The launch will eventually take place from ALP-01, the private launch pad of Agnikul Cosmos at Sriharikota. Agnikul Cosmos has set up its own launch pad and mission control centre at ISRO's spaceport in Sriharikota. These facilities were opened in 2022 in preparation for the launch, which was delayed multiple times in the lead up to the launch because of hiccoughs during prelaunch procedures. Such delays are normal for hardware that is being developed.

The prelaunch procedures began ten hours before the flight, with the loading of the fuel into the rocket. The programme was uploaded to the flight computer, with the launch director giving a final clearance after assessing the condition of the hardware and the environment. According to the planned flight profile, the rocket was to reach an altitude of eight kilometres, before splashing down into the Bay of Bengal, seven kilometres from the launch pad.

<https://www.news9live.com/science/agnikul-cosmos-attempted-to-launch-agnibaan-rocket-twice-launch-called-off-2552628>

