

Feb
2021

समाचार पत्रों से चयित अंश Newspapers Clippings

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

खंड : 46 अंक : 35 18 फरवरी 2021

Vol.: 46 Issue : 35 18 February 2021



रक्षा विज्ञान पुस्तकालय
Defence Science Library
रक्षा वैज्ञानिक सूचना एवं प्रलेखन केंद्र
Defence Scientific Information & Documentation Centre
मेटकॉफ हाउस, दिल्ली - 110 054
Metcalf House, Delhi - 110 054

CONTENTS

S. No.	TITLE	Page No.
DRDO News		1-8
DRDO Technology News		1-8
1.	National workshop cum orientation programme at DRDO-MZU North-East Science and Technology Center, Mizoram University, Aizwal	1
2.	First test of air-to-air missile Astra Mk II likely on February 18	2
3.	Army's financial powers enhanced to speed up weapons procurement	3
4.	India's Defense Export Strategy: Balancing China in the Indian Ocean Region	4
5.	Meet Indian Army's 'Made In India' Arjun MBT MK1A with automated target tracking capabilities	6
6.	U'khand disaster ITBP-DRDO team reaches artificial lake site	7
7.	Uttarakhand flash floods: rescue team shows lake formed in Chamoli after disaster	8
Defence News		9-14
Defence Strategic National/International		9-14
8.	Increased outlay for BRO in Budget 2021-22 to boost border infrastructure	9
9.	सीमा पर बुनियादी ढांचे को बढ़ावा देने के लिए बजट 2021-22 में बीआरओ के लिए बढ़ा परिचय	9
10.	Union Cabinet approves enhanced delegation of financial powers under Capital Procurement to Deputy Chiefs and Command Chiefs of Armed Forces	10
11.	केंद्रीय मंत्रिमंडल ने पूंजीगत खरीद के अंतर्गत सशस्त्र बलों के उप प्रमुखों और कमान प्रमुखों की वित्तीय शक्तियों में बढ़ोतरी को मंजूरी दी	11
12.	HAL spends ₹6,783 cr in 5 years to push indigenisation, value-addition	12
13.	PLA preps for Round 2 of disengagement, parks heavy vehicles in depth areas	13
14.	RTSYS delivers 2 SIERA systems to the Indian Navy	14
Science & Technology News		15-20
15.	Reduced nickel content and improved stability and performance in ceramic fuel cells	15
16.	Researchers report switching material between semiconductor and metallic states	17
17.	Self-assembly induced luminescence of Eu ³⁺ -complexes for bioimaging application	18
COVID-19 Research News		20
18.	New research finds drive-through mass-vaccination clinics could alter covid-19 trajectory	20



**Press Information Bureau
Government of India**

Ministry of Defence

Wed, 17 Feb 2021 7:30PM

National workshop cum orientation programme at DRDO-MZU North-East Science and Technology Center, Mizoram University, Aizwal

A three-day national workshop cum orientation programme from 17-19 Feb 2021, at DRDO-MZU North East Science and Technology Center (NESTC), Mizoram University, Aizwal was inaugurated today by Secretary DD R&D and Chairman DRDO Dr. G Satheesh Reddy in virtual mode. NESTC has been jointly established by DRDO and Mizoram University in Feb, 2019 to facilitate basic and applied research by utilizing the knowledge base of faculty and researchers at Mizoram University besides engaging other research institutions of Northeast region.

The objective of the workshop is to orient the Researchers and Faculty members of the North East Region to understand the futuristic research and technology requirements of defence & security, to nurture the local talent for providing scientific solutions to local problems and to generate interest in areas relevant to Armed Forces with a vision to promote Atmanirbhar Bharat policy of GOI.

In his address, Chairman DRDO emphasized the requirement of research by utilising the local talents of various universities/institutes of northeast states. He encouraged the faculty/researchers to



formulate and submit innovative ideas and join hands with DRDO in making the country self-reliant in defence and security. Emphasising the importance of long-term partnership between Academic Institutes & DRDO, he highlighted the need of collaboration of universities, researchers and industries with DRDO labs for contributing in main stream research for the country. He also stressed the possibility of exploring research opportunities in the areas of development of products and technologies for high altitude, extreme environmental conditions, cyber security and the like.

Spread over three days, this national workshop has three thrust areas namely, Management of Agro-Bio Resources, Environment and Waste Management, Engineering Technology and Material Science. In this workshop, 35 concept notes from 13 universities of eight north east states (Mizoram, Assam, Meghalaya, Manipur, Arunachal Pradesh, Tripura, Nagaland and Sikkim) will be presented and evaluated by a team of DRDO scientists and NESTC faculty. The workshop will be attended by more than 100 faculty members. During this orientation programme, discussion of faculty/researchers with DRDO scientists will enable in understanding key defence concepts in

which research projects can be undertaken. The technological developments proposed through these concepts and research ideas will help in articulating newer technological products of defence interest.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1698818>



Thu, 18 Feb 2021

First test of air-to-air missile Astra Mk II likely on February 18

*As many as 8,000 people from at least seven hamlets
will be shifted to temporary shelters ahead of the test*

By Hemant Kumar Rout

Bhubaneswar: India's latest Beyond Visual Range (BVR) air-to-air missile Astra Mk II is all set to move out of the drawing board as the Defence Research and Development Organisation (DRDO) is likely to conduct its first developmental trial this week.

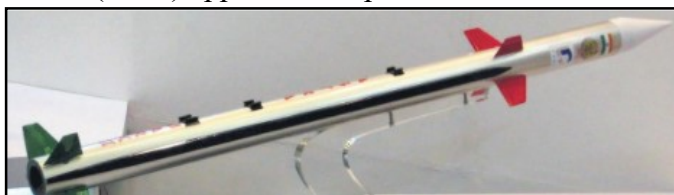
Defence sources said the indigenously developed missile will be flight tested from a ground launcher being set up at launching complex III of Integrated Test Range (ITR) off Odisha coast on Thursday. The initial trials of the successor of Astra Mk I will be to test the weapon system's ballistic performance. Once the safe release of the missile from the ground launcher and its propulsion and navigation are validated, it would be test fired from a fighter aircraft.



The IAF tableau with the Astra missile and a Rafale jet on display at Rajpath. (Photo | Shekhar Yadav, EPS)

A team of defence scientists and technical officers are camping at the test facility for the much awaited mission of the year. "The test window is from February 18 to 20. The missile has already been integrated with the launcher and the final check-ups are on. If everything goes as per plan, the missile will be fired on the first date," sources said. The go ahead for Astra Mk II came nearly seven months after the Defence Acquisition Council (DAC) approved the procurement of Astra Mk I for the Indian Air Force (IAF) and Navy.

While the previous version of Astra missile has a range of about 110 km, its advanced variant can strike targets 160 km away. Equipped with improved jammer resistance and dual pulse motor having thrust vector control, the Astra Mk II is latest among the air-to-air missiles of its class. The DRDO has developed an indigenous seeker to improve the performance of the missile and replace the Russian radio frequency seeker used in the Astra Mk I.



A model of Astra missile

Sources said the missile will be powered by Solid Fuel Ducted Ramjet (SFDR), which will enhance its performance and increase the strike range. Procurement of Astra Mk I for the IAF was approved after it completed ground tests and air trial from a Sukhoi 30 MKI aircraft. Process is on to integrate the missile with the Made in India Tejas fighter jet.

Meanwhile, prior to the Mk II test, the DRDO has decided to evacuate people residing within two km radius of the ITR as a safety measure. As many as 8,000 people from at least seven hamlets will be shifted to temporary shelters ahead of the test.

Balasore district administration has been asked to make arrangements and complete the evacuation of villagers before 8 am on the scheduled date. The people shifted for the mission will be compensated as per Ministry of Defence (MoD) norms.

<https://www.newindianexpress.com/states/odisha/2021/feb/17/first-test-of-air-to-air-missile-astra-mk-ii-likely-on-feb-18-2265176.html>

Business Standard

Thu, 18 Feb 2021

Army's financial powers enhanced to speed up weapons procurement

On November 8, 2018, the financial powers of the vice chiefs of the three services were enhanced five-fold for revenue procurement, with an enhanced ceiling of Rs 500 crore

By Ajai Shukla

Continuing the trend of enhancing the military's financial powers for buying weapons and equipment, the Union Cabinet on Wednesday enhanced the financial powers of officers at the level of theatre commanders and Deputy Chief of Army Staff (DCOAS).

“According to the approval... financial powers up to Rs 100 crore has been delegated to General Officer Commanding-in-Chief (GOC-in-C), Flag Officer Commanding-in-Chief (FOC-in-C), Air Officer Commanding-in-Chief (AOC-in-C),” a defence ministry release stated.

Further, financial powers up to Rs 200 crore have been delegated to Deputy Chief of Army Staff/ MGS (Master General Sustenance), COM (Chief of Material), AOM (Air Officer Maintenance), DCIDS (Deputy Chief Integrated Defence Staff) and ADG ICG (Additional Director General Indian Coast Guard), the MoD stated.

These enhanced powers will apply for procurements under the category of Other Capital Procurement Procedure (OCPP) in the Defence Acquisition Procedure-2020 (DAP 2020).

“This delegation of powers within service headquarters and up to (theatre) command level for items of capital nature such as overhauls, refits, upgrades etc, will enhance the utility of existing assets and will facilitate faster processing and implementation of projects for modernisation of armed forces to meet the security challenges of the nation,” the defence ministry said.

The Cabinet has also enhanced the military's financial powers in the Make-I category of procurement, under which the government funds up to 70 per cent of the prototype development cost.

The Chief of Integrated Defence Staff to the Chairman Chiefs of Staff Committee (CISC), Vice Chief of Army Staff (VCOAS), Vice Chief of Naval Staff (VCNS), Deputy Chief of Air Staff (DCAS), and Director General Coast Guard have now been granted powers to sanction government support up to Rs 50 crore towards cost of prototype development.

This is part of an ongoing trend that places greater onus on the military for low-value capital and revenue procurements. On November 8, 2018, the financial powers of the vice chiefs of the three services were enhanced five-fold for revenue procurement, with an enhanced ceiling of Rs 500 crore.

This was done in order to allow the military to augment its arms and ammunition reserves in order to enhance their operational preparedness.

On June 27, 2018, the Defence ministry delegated enhanced financial powers to the Defence Research and Development Organisation (DRDO) with the intention of “neutralising the ill-effects of over-centralisation and facilitate quicker decision making.” The financial powers of the DRDO Chief were doubled from Rs 75 crore to Rs 150 Crore, and for the Directors General (DGs) enhanced from Rs 50 crore to Rs 75 crore.

Similarly, on July 15, 2020, the defence ministry, citing the “prevailing situation along the Northern Borders and the need to strengthen the armed forces”, delegated to the armed forces the power to progress “urgent capital acquisition cases up to Rs 300 crore.”

https://www.business-standard.com/article/economy-policy/army-s-financial-powers-enhanced-to-speed-up-weapons-procurement-121021701416_1.html

THE | DIPLOMAT

READ THE DIPLOMAT, KNOW THE ASIA-PACIFIC

Thu, 18 Feb 2021

India's Defense Export Strategy: Balancing China in the Indian Ocean Region

The Aero India 2021 airshow shows India is hoping to boost its defense exports to IOR countries

By Prakash Panneerselvam

India's defense export strategy is strongly rooted in the geopolitics of the Indo-Pacific region. The recently held Aero India 2021 airshow in Bengaluru in the southern state of Karnataka shows that India is priming for strong defense cooperation with Indian Ocean Region (IOR) countries in the face of growing Chinese influence in the region.

The airshow showcased India's air superiority capability by performing aerial stunts and displayed various advance weapon systems developed by Indian defense manufacturers. During the airshow, the Indian Ministry of Defense (MoD) released the list of 156 defense items cleared for export, including some of India's most advanced weapon systems like BrahMos supersonic cruise missiles, the Advanced Towed Artillery Gun System (ATAGS), Pinaka multi-barrel rocket launchers, and the Combat Management System, which are hallmarks of the Indian defense sector.



Credit: Aero India 2021

The major highlight of the Aero India show was the Indian Ocean Region (IOR) Defense Minister's Conclave 2021 organized by the Indian MoD to promote defense cooperation among the participating countries. The defense minister's conclave clearly displayed India's determination to build close cooperation and engagement among the countries in the IOR.

IOR countries have to balance or counter the new situations they face on account of China's rise, its economic power and aggressive military posturing. This posturing has led to a feeling of political discomfort among many countries in the region, prompting them to seek alternate avenues of cooperation and collaboration with other major regional and external powers. The rise of China as a dominant player in the Indo-Pacific region poses new security challenges in this region. Data from the Stockholm International Peace Research Institute (SIPRI) shows that the Philippines, Vietnam, Indonesia, Singapore, and Taiwan have all increased their arms imports in recent years.

Meanwhile, China, which has already found a place in the global defense market, is partnering with Pakistan to sell the jointly developed export variant JF-17 fighter aircraft in Asia. This will eventually bring Pakistan, which otherwise has no expertise in exporting defense technology, into the arms market. The China-Pakistan nexus is a serious concern for India and it would seriously jeopardize India's position as a regional power.

India has made rapid strides in defense technology in recent years and is well placed to take up initiatives for exporting defense equipment in the region. The Defense Research and Development Organization (DRDO) along with various Public Sector Undertakings (PSUs) and the private sector have developed various products for the Indian armed forces. It has also developed expertise in the arena of integrating equipment from diverse sources with different industry standards. This has allowed Indian PSUs to develop their own set of sensors, navigation kits for fighter aircraft,

and upgraded electronic warfare suite for platforms of diverse origin, besides being able to offer standard spares and maintenance service for the same. Most of the systems developed by DRDO have already found a place in various operations of the Indian armed forces. This proves that DRDO-developed systems are already benchmarked with international standards and therefore can be exported.

There is huge demand in the international market for different types of weapon systems. Indian exports in the recent past include HMS-X2 sonars to Myanmar, Cheetal helicopters to Afghanistan, Dhruv Helicopters and bulletproof jackets to Nepal, Sukhoi 30 avionics and MIG spare parts to Malaysia, offshore patrol vessels to Mauritius, and spare parts for Jaguar aircraft to Oman. The most recent big ticket sale was a contract for supplying SWATHI Weapon Locating Radar to Armenia. In October 2020, India also gifted the diesel-electric submarine INS Sindhuvir – renamed UMS Minye Theinkhathu – as part of its strategic outreach to Myanmar. This deal was a significant because it boosted the capabilities of a country right next to India in the IOR. At the same time, India's submarine is far superior to what China offered to Myanmar.

India constitutes less than 1 percent of the world's total arms exports. As per the latest estimates, India's defense exports of equipment and other systems rose to 107.5 billion rupees (roughly \$1.5 billion) in 2018-2019, compared to 15.2 billion rupees in 2016-2017. Meanwhile the Indian government is looking at a target of reaching \$3-5 billion in exports in the next two years. The MoD's Department of Defense Production (DDP) is steering a Defense Export Promotion abroad and has announced various policy measure to streamline export promotion.

Still, in comparison with other Tier-II arms exporting countries (China, Brazil, Turkey, and South Korea) which have established a significant presence in global defense markets, India is still lagging behind. China, which was until recently one of the largest importers of defense equipment, has become more self-reliant for its military needs and now delivers arms to 44 countries, mostly in Asia and Africa. Likewise, South Korea, Turkey, Israel, and Brazil which largely relied on Western powers for technology in the past, have been able to penetrate and capture defense markets across the world. Although India has made significant advancements in defense technology using Russian and Western technology it has not utilized defense exports to its fullest potential.

Prominent economist Dr. Vijay Kelkar's testimony to the standing committee on defense 2008-2009 has interesting implications for how to promote India's defense exports. At the time, Kelkar said that it is "important not only in terms of industry but also it has a political and strategic dimension that the country should become an exporter of defense technology." In the wake of growing insecurity in the Indian Ocean region, regional countries view India as a strong contender to counter China's expansionist policy. Defense exports can become one aspect of India's foreign policy where New Delhi can make substantial gains in bilateral relationships.

(Prakash Panneerselvam is an assistant professor at the National Institute of Advanced Studies (NIAS), Bengaluru.)

<https://thediplomat.com/2021/02/indias-defense-export-strategy-balancing-china-in-the-indian-ocean-region/>



Thu, 18 Feb 2021

Meet Indian Army's 'Made In India' Arjun MBT MK1A with automated target tracking capabilities

By Anuj Tiwari

Prime Minister Narendra Modi on February 14 handed over the indigenously-developed Arjun Main Battle Tank (Mark 1A) vehicles to the Indian Army. This upgraded MBT Arjun Mark-1A tank has cleared validation trials in December 2018. Compared to the earlier version, the Mark 1-A boasts an improved gunner sight, fitted with automated target tracking capabilities.

Upgraded Arjun Mark-1A -

The upgraded Arjun Mark-1A Main Battle Tank is widely regarded as India's response to the Russian-made T-90S 'Bhishma' tanks that currently form the bulk of India's armoured vehicle regiments.

Rs 8,400 crore cost -

As per the latest reports, the Defence Ministry had recently approved the induction of 118 Arjun Mark 1A tanks into the Indian Army at a cost of Rs 8,400 crore.

Made in India -

The tanks were to be manufactured by the DRDO's Combat Vehicles Research and Development Establishment in Chennai, in collaboration with 15 academic institutions, eight laboratories and numerous other MSMEs.

Automated target tracking capability -

In comparison to the older version tanks, Mk1a tanks boast an improved gunner sight and fitted with automated target tracking capabilities.

Equipped with -

Weighing 68 tonnes, the Mark 1-A is equipped with a 120mm main gun and stands as an upgraded version of the original Arjun Main Battle Tank.

Most formidable self-protective tanks -

As per reports, the numerous improvements made to the tank based on the Army's recommendations have transformed it into one of the nation's most formidable self-protective tanks.

First-round kill capabilities -

The MK-1A's gun is operated via a computerised integrated fire control that allows for high first-round kill capabilities.

Works in all lighting conditions -

It also incorporates day-and-night stabilised sights.

Battle-winning efficacy -

Arjun MK 1 Alpha is a "contemporary tank in the world with battle-winning efficacy," officials have said.

Suitable for operations in the plains -

According to an ET report, India has a robust tank force, but all of them are heavy main battle tanks - T72s, T90s and the indigenously developed Arjun considered more suitable for operations in the plains. While these tanks have been sent to the Himalayan border as well.

<https://www.indiatimes.com/news/india/indian-army-new-made-in-india-arjun-mk1a-tank-534517.html>

U'khand disaster ITBP-DRDO team reaches artificial lake site

New Delhi: A joint team of the ITBP and DRDO on Wednesday reached a high-altitude artificial lake in Chamoli district of Uttarakhand that is suspected to have been formed after the recent flash floods.

The lake is created at a place called Murenda which is estimated to be about 5-6 hours trek uphill from Raini village that bore the maximum brunt of the February 7 disaster, officials said.

"This is the first team to reach the lake at ground zero. The ITBP and Defence Research and Development Organisation personnel will analyse any possible threat posed by this artificial lake formed due to the recent flash floods," Indo-Tibetan Border Police (ITBP) spokesperson Vivek Kumar Pandey said.

Earlier, an aerial view of the lake was taken through helicopter sorties and satellite imagery.

The five-member team, led by ITBP Assistant Commandant Sher Singh Butola, will set up a camp and create a helipad near the lake so that a chopper could bring in more experts and logistics to study possible threats that this lake could pose to villages and infrastructure downstream, he said.

The team-- comprising personnel of ITBP's 1st battalion based in Joshimath, climbers from its specialised mountaineering and skiing institute based at Auli and a local guide-- will also find ways to create slits or channels for smooth discharge of the lake water so that it does not perpetuate any damage, Pandey said.

The border force released videos and photos that showed the clear blue-water lake to be calm and officials said it looks to be 250 meters wide while they refused to hazard any guess about its depth.

"The lake is suspected to have been created after a heavy volume of water hurtled down the Alaknanda river system due to a possible glacier burst on February 7."

"It is important to study the lake so that contingencies can be prepared and early warnings can be issued in case there is a possibility of its breach," another senior officer said.

The confirmed death toll in the disaster has now 58 while 146 people are stated to be missing.

Eleven bodies have also been recovered from a big tunnel at the National Thermal Power Corporation's Tapovan-Vishnugad project site till now where about 30-35 workers are estimated to have been trapped.

(This story has not been edited by THE WEEK and is auto-generated from PTI)

<https://www.theweek.in/wire-updates/national/2021/02/17/del73-ukd-floods-lake.html>

Uttarakhand flash floods: rescue team shows lake formed in Chamoli after disaster

ITBP and DRDO officials today reached the exact spot from where the lake has been formed. The video also shows destruction caused due to the glacier disaster

Edited By Kritika Bansal

Dehradun: Another team of rescue officials on Wednesday reached the basecamp at a lake which has been formed over Rishiganga after the glacier disaster in Uttarakhand's Chamoli disaster. The lake, which is situated at a height of more than 9,000 feet, is hard to reach for officials all nearby roads have been washed away due to the flash floods.

An Indo Tibetan Border Police (ITBP) team accompanied by officials of the Defence Research and Development Organisation (DRDO) on Wednesday reached the exact spot from where the lake has been formed. ITBP and DRDO officials carried out a recce and started working on developing a helipad in the vicinity.

ITBP recorded a video of the lake which showed how it looks up close, along with the destruction caused by the glacier disaster.

A team of State Disaster Response Force (SDRF) was the first to reach the artificial lake on Tuesday and had a tough time getting there on foot.

SDRF officials had to walk through forests and steep gorges with the help of ropes for 12-13 hours to reach the place where they set up a basecamp.

How rescue team managed to reach the lake:

"The route to the lake via Pang village was washed out. We tried to reach it through another village Muraina but with no roads in sight we didn't know which way to approach the lake situated at around 2800 metres," said Inspector Sanjay Upreti who was part of the 12-member SDRF team led by Commandant Navneet Bhullar that went to the lake on foot.

"Steep gorges had replaced roads that had been washed out up to 500 metres here and there. On the basis of an idea formed about its possible route during an aerial recce undertaken earlier and help from a local guide we reached a place about an hour short of the lake where we set up a camp office before sunset.

"When we reached the lake we saw that the area near it had been hit by a compound avalanche. There was swamp all around which contained sludge, stones, trees and blocks of ice each the size of a car," he said.

<https://www.india.com/news/india/uttarakhand-flash-floods-rescue-team-shows-lake-formed-in-chamoli-after-disaster-watch-video-4429984/>



Location from where artificial lake formed in Uttarakhand's Chamoli district after disaster. (Photo: Screenshot from ITBP video)

Defence Strategic: National/International



Press Information Bureau
Government of India

Ministry of Defence

Wed, 17 Feb 2021 3:03PM

Increased outlay for BRO in Budget 2021-22 to boost border infrastructure

Union Budget 2021-22 has proposed increased funding for Border Roads Organisation (BRO) to boost infrastructure in frontier areas. Allocation for road development projects in border areas has been raised from Rs 5,586.23 crore to Rs 6,004.08 crore for Financial Year 2021-22. The budget for maintenance of border roads has gone up from Rs 750 crore to Rs 850 crore, while the capital works allocation has been revised upwards to Rs 2,500 crore from budgetary provision of Rs 2,300 crore for Financial Year 2020-21.

This increased allocation shall facilitate procurement of modern construction plants, equipment and machinery to enhance the pace of construction warranted by strategic imperatives. A large share of increased funding will be used for better upkeep of strategic roads in the border areas and it will also give a major boost to construction of strategically important roads, tunnels and bridges along the northern and north-eastern borders.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1698660>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Wed, 17 Feb 2021 3:03PM

सीमा पर बुनियादी ढांचे को बढ़ावा देने के लिए बजट 2021-22 में बीआरओ के लिए बढ़ा परिव्यय

केंद्रीय बजट 2021-22 में सीमावर्ती क्षेत्रों में बुनियादी ढांचे को बढ़ावा देने के लिए सीमा सड़क संगठन (बीआरओ) के लिए धन बढ़ाने का प्रस्ताव किया गया है। सीमावर्ती क्षेत्रों में सड़क विकास परियोजनाओं के लिए आवंटन 5,586.23 करोड़ रुपये से बढ़ाकर वित्तीय वर्ष 2021-22 के लिए 6,004.08 करोड़ रुपये कर दिया गया है। सीमावर्ती सड़कों के रखरखाव का बजट 750 करोड़ रुपये से बढ़कर 850 करोड़ रुपये हो गया है, जबकि पूंजीगत कार्य आवंटन को संशोधित कर वित्तीय वर्ष 2020-21 के लिए 2,300 करोड़ रुपये के बजटीय प्रावधान से 2,500 करोड़ रुपये कर दिया गया है।

इस बड़े हुए आवंटन से रणनीतिक अनिवार्यताओं द्वारा आवश्यक निर्माण की गति को बढ़ाने के लिए आधुनिक निर्माण संयंत्रों, उपकरणों और मशीनरी की खरीद में सुविधा होगी। बढ़ी हुई फंडिंग का एक बड़ा हिस्सा सीमावर्ती क्षेत्रों में रणनीतिक सड़कों के बेहतर रखरखाव के लिए इस्तेमाल किया जाएगा और इससे उत्तरी एवं पूर्वोत्तर सीमाओं के साथ रणनीतिक रूप से महत्वपूर्ण सड़कों, सुरंगों और पुलों के निर्माण को भी बड़ा बढ़ावा मिलेगा।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1698725>



Press Information Bureau
Government of India

Ministry of Defence

Wed, 17 Feb 2021 7:09PM

Union Cabinet approves enhanced delegation of financial powers under Capital Procurement to Deputy Chiefs and Command Chiefs of Armed Forces

The Union Cabinet today approved enhanced delegation of Financial Powers under Capital Procurement to levels below Vice-Chief of Armed Forces. As per the approval, under Other Capital Procurement Procedure (OCP) of Defence Acquisition Procedure-2020, financial powers up to Rs.100 crore has been delegated to General Officer Commanding-in-Chief (GOC-in-C), Flag Officer Commanding-in-Chief (FOC-in-C), Air Officer Commanding-in-Chief (AOC-in-C) at Services Command and Regional Commanders, Indian Coast Guard (ICG) and powers up to Rs. 200 crore has been delegated to Deputy Chief of Army Staff (CD & S)/ MGS (Master General Sustenance), COM (Chief of Material), AOM (Air Officer Maintenance), DCIDS (Deputy Chief Integrated Defence Staff) and ADG ICG (Additional Director General Indian Coast Guard).

This delegation of powers within Service Headquarters and up to Command Level for items of Capital nature such as overhauls, refits, upgrades etc. will enhance the utility of existing assets and will facilitate faster processing and implementation of projects for modernization of Armed Forces to meet the security challenges of the nation.

The Cabinet has also approved enhanced financial powers in the Make-I category under which Government funding up to 70% of the prototype development cost is available for Design & Development of equipment, systems, major platforms or upgrades thereof. Chief of Integrated Defence Staff to the Chairman Chiefs of Staff Committee (CISC), Vice Chief of Army Staff (VCOAS), Vice Chief of Naval Staff (VCNS), Deputy Chief of Air Staff (DCAS), and Director General Coast Guard (DG(CG)) have now been given powers to sanction Government support up to Rs.50 crore towards cost of prototype development. Financial powers have also been enhanced for other competent financial authorities under 'Make-I' in line with Government's vision of 'Atmanirbhar Bharat' and 'Make in India' for a robust defence industrial ecosystem.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1698811>



Wed, 17 Feb 2021 7:09PM

केंद्रीय मंत्रिमंडल ने पूंजीगत खरीद के अंतर्गत सशस्त्र बलों के उप प्रमुखों और कमान प्रमुखों की वित्तीय शक्तियों में बढ़ोतरी को मंजूरी दी

केंद्रीय मंत्रिमंडल ने पूंजीगत खरीद के अंतर्गत सशस्त्र बलों में वाइस चीफ से निचले स्तर के अधिकारियों की वित्तीय शक्तियों में बढ़ोतरी को आज मंजूरी दे दी। इस मंजूरी के अनुसार, रक्षा अधिग्रहण प्रक्रिया-2020 की अन्य पूंजी खरीद प्रक्रिया (ओसीपीपी) के तहत, सेना के तीनों अंगों की कमानों में जनरल ऑफिसर कमांडिंग-इन-चीफ (जीओसी-इन-सी) को, फ्लैग ऑफिसर कमांडिंग-इन-चीफ (एफओसी-इन-सी) को, एयर ऑफिसर कमांडिंग-इन-चीफ (एओसी-इन-सी) को एवं भारतीय तटरक्षक (आईसीजी) के क्षेत्रीय कमांडरों को 100 करोड़ रुपये तक की वित्तीय शक्तियां प्रदान की गई हैं। और उप सेनाध्यक्ष (सीडी एंड एस)/एमजीएस (मास्टर जनरल सस्टीनेंस), सीओएम (चीफ ऑफ मटेरियल), एओएम (एयर ऑफिसर मंटेनेंस), डीसीआईडीएस (डिप्टी चीफ इंटीग्रेटेड डिफेंस स्टाफ) और एडीजी आईसीजी (अपर महानिदेशक भारतीय तटरक्षक) को 200 करोड़ रुपये तक की शक्तियां सौंप दी गई हैं।

पूंजीगत प्रकार के साजोसामान जैसे ओवरहौल, रिफिट, अपग्रेड इत्यादि हेतु सैन्य मुख्यालयों के भीतर एवं कमान स्तर तक वित्तीय शक्तियों का सौंपा जाना मौजूदा परिसंपत्तियों के इस्तेमाल में वृद्धि करेगा एवं देश की सुरक्षा चुनौतियों को पूरा करने में सशस्त्र बलों के आधुनिकीकरण की परियोजनाओं के कार्यान्वयन तथा उनको तेज़ी से पूरा करने की प्रक्रिया में योगदान देगा।

मंत्रिमंडल ने मेक-1 श्रेणी में बढ़ी हुई वित्तीय शक्तियों को भी मंजूरी दे दी है जिसके तहत प्रोटोटाइप विकास लागत का 70 प्रतिशत तक सरकारी वित्तपोषण उपकरणों, प्रणालियों, प्रमुख प्लेटफार्मों या उसके उन्नयन के डिजाइन और विकास के लिए है। चीफ ऑफ इंटीग्रेटेड डिफेंस स्टाफ, चेयरमैन, चीफ्स ऑफ स्टाफ कमिटी (सीआईएससी) वाइस चीफ ऑफ आर्मी स्टाफ (वीसीओएस), वाइस चीफ ऑफ नेवल स्टाफ (वीसीएनएस), डिप्टी चीफ ऑफ एयर स्टाफ (डीसीएस) और महानिदेशक तटरक्षक (डीजीसीजी) को अब प्रोटोटाइप विकास की लागत की दिशा में 50 करोड़ रुपये तक की सरकारी सहायता को मंजूरी देने का अधिकार प्रदान किया गया है। एक मजबूत रक्षा औद्योगिक पारितंत्र के लिए 'आत्मनिर्भर भारत' और 'मेक इन इंडिया' के सरकार के दृष्टिकोण के अनुरूप मेक-1 के तहत अन्य सक्षम वित्तीय प्राधिकरणों के लिए वित्तीय शक्तियों में भी वृद्धि की गई है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1698907>

HAL spends ₹6,783 cr in 5 years to push indigenisation, value-addition

Hindustan Aeronautics Limited (HAL), a defence aerospace company, in a bid to push indigenisation and value addition to products, has made research and development (R&D) spend to the tune of ₹6,783 crore in the last five years.

“The company has been the flag bearer for the country in the aviation sector and has contributed immensely towards indigenous capability development in this niche segment.



This was possible due to the continued focus on technology upgradation and innovative business initiatives,” said R Madhavan, Chairman and Managing Director, HAL.

“HAL with this strategy, has achieved success in building Advanced Light Helicopter (both utility and weaponised version). Many of its in-house R&D projects undertaken includes LCH, LUH, HTT-40, TEJAS, MK-1A which are in the final stages of design and development and will be commercially produced in the next couple of years,” he added.

The company has 10 R&D centres within the premises and are co-located with production units for ease of manufacture and all are Centre for Military Airworthiness & Certification (CEMILAC) approved centres.

With a strong production pipeline, the company has been earmarking close to 10 percent of its operating profit after tax for R&D efforts. Last five years, the company has been consistent in its R&D spend. The following are the annual R&D spend: Financial year 2015-16 (₹1,191 crore), FY 2016-17 (₹1,284 crore), FY 2017-18 (₹1,612 crore), FY 2018-19 (₹1,464 crore) and FY 2019-20 (₹1,232 crore).

Intellectual Property

On the Intellectual Property (IP) front, the company in fiscal 2019-20 filed 201 IPR applications, which takes its cumulative figure to 1,823 IPRs. In all, 140 IPRs have been granted during 2019-20 again taking its cumulative IPRs numbers to 318.

The company has also prioritised its focus on participation of academia-industry linkage. Over the years, the company has established chairs at IITs and IISc to benefit from technological developments and their application in our R&D programs. The collaborations with IITs and IISc is also seen as talent acquisition and for aeronautical research. HAL has also been focusing on enhanced participation by specialised start-ups in R&D and technology development.

<http://www.indiandefenseneews.in/2021/02/hal-spends-6783-cr-in-5-years-to-push.html>

RTSYS delivers 2 SIERA systems to the Indian Navy

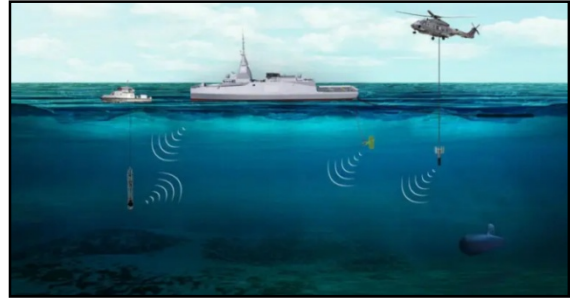
RTSYS has been awarded a contract from Bharat Electronics Limited (BEL) for the delivery of 2 SIERA systems allowing the characterization and the calibration of Indian Navy's new generation hull-mounted and variable depth sonars

SIERA is a lightweight autonomous system towed at variable immersion from a dedicated boat, enabling to measure the performance of both active and passive sonar system (hull-mounted sonars, variable depth sonar, dipping sonars, sonobuoys, submarine sonars) in real-time or through a delayed signal processing).

Easy to deploy, SIERA is also very well-known by the most reputable sonar manufacturers and shipyards who use it for their own performance assessment during Sea Acceptance Test thanks to the various acoustic emissions and receptions from 500Hz to 32 kHz.

With this new important success RTSYS strengthens its position as key supplier of Navies worldwide in one of its main sectors of expertise that are ASW, MCM, AUVs and PAM.

<https://www.navalnews.com/naval-news/2021/02/rtsys-delivers-2-siera-systems-to-the-indian-navy/>



SIERA sonar measurement and calibration system aims to characterize the performance of underwater acoustic systems (hull-mounted sonars, dipping sonars, towed sonars, buoys). RTSYS image.

PLA preps for Round 2 of disengagement, parks heavy vehicles in depth areas

Beijing suddenly deciding to restore status quo ante has surprised many in the Indian establishment

By Shishir Gupta

Indian military planners point to the presence of large number of tank transporters at area headquarters of the People's Liberation Army (PLA) at Rudok and Xiadullah across Rezang La and Karakoram Pass respectively as an indication that the Chinese Army has plans to move armour from the East Ladakh front lines to depth areas in Xinjiang and Tibet — part of the disengagement along the Line of Actual Control (LAC) in Ladakh that ends a 10-month standoff between PLA and the Indian Army.

“All I can say is that the disengagement process is moving on well, though the date of next meeting of military commanders is yet to be decided,” said a senior Indian official who asked not to be named.

The military commanders of the two countries have met nine times to facilitate the disengagement, although the breakthrough is recent.



The withdrawal spans several friction areas along LAC. The scale of the withdrawal, the planners said, shows the extent to which Beijing had built up its military presence in the area.

[A handout photo released by Indian Army on February 16, 2021 shows the disengagement process between Indian Army and China's People's Liberation Army from a contested area in the western Himalayas, in Ladakh region.\(Reuters\)](#)

Analysts said a combination of smart manoeuvring by Indian troops, resolve from New Delhi, and non-military pressure brought to bear on Beijing on both the diplomatic and economic fronts. While the Northern Command of Indian Army on Tuesday released pictures to confirm withdrawal of armour by both sides, there is evidence of the presence of around 28 tank transporters on the southern banks of Spanggur Tso, near Rezang La ridgeline, to ferry armour from the front-line to the depth areas, the people cited in the first instance added. Spanggur Tso, a bitter water lake, houses the Moldeo garrison of PLA on its banks. Although the PLA withdrawal is on track, Beijing's decision to suddenly restore status quo ante on both banks of Pangong Tso has baffled many within the Indian security establishment.

While a section of national security planners believes that this withdrawal is tactical and driven by internal considerations, others believe that Beijing acted to stem the rapid slide in bilateral relations. However, one thing on which both agree is that China will have to be watched very carefully for the remaining part of the year before coming to any conclusion.

Since February 10, there has been intense activity between finger 4 and finger 7 mountainous spurs on the north banks of Pangong Tso with no less than 25 vehicles, 10-12 tanks and 14 tents being seen at Srijap complex, east of finger 8 of the lake.

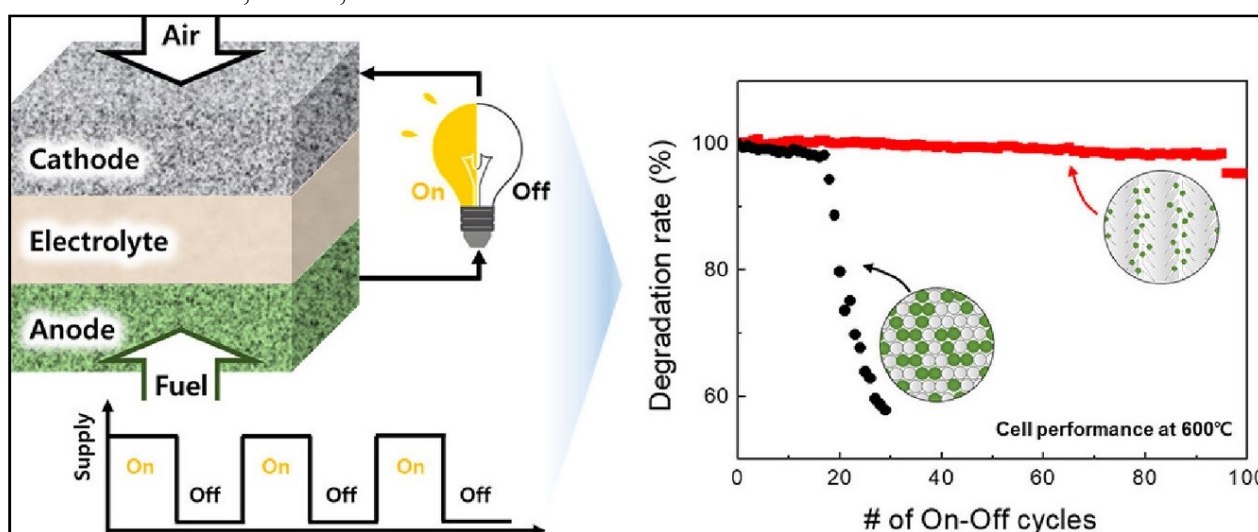
At Rudog, which has been PLA headquarters since the 1962 war and is situated 63 kilometres diametrically opposite Rezang La in occupied Aksai Chin, at least 250 heavy military vehicles are being used to transport deployed troops to depth areas.

At Xiadullah, again a PLA headquarter since 1962 and 96 kilometres across Karakoram Pass, as many as 12 tank transporters are being used to ferry tanks from deployments across the Daulet Beg Oldi sector. PLA is known to have deployed its strategic missiles near Xiadullah.

<https://www.hindustantimes.com/india-news/pla-preps-for-round-2-of-disengagement-parks-heavy-vehicles-in-depth-areas-101613513045526.html>

Reduced nickel content and improved stability and performance in ceramic fuel cells

A research team in Korea has developed a ceramic fuel cell that offers both stability and high performance while reducing the required amount of catalyst by a factor of 20. The application range for ceramic fuel cells, which have so far only been used for large-scale power generation due to the difficulties associated with frequent start-ups, can be expected to expand to new fields, such as electric vehicles, robots, and drones.



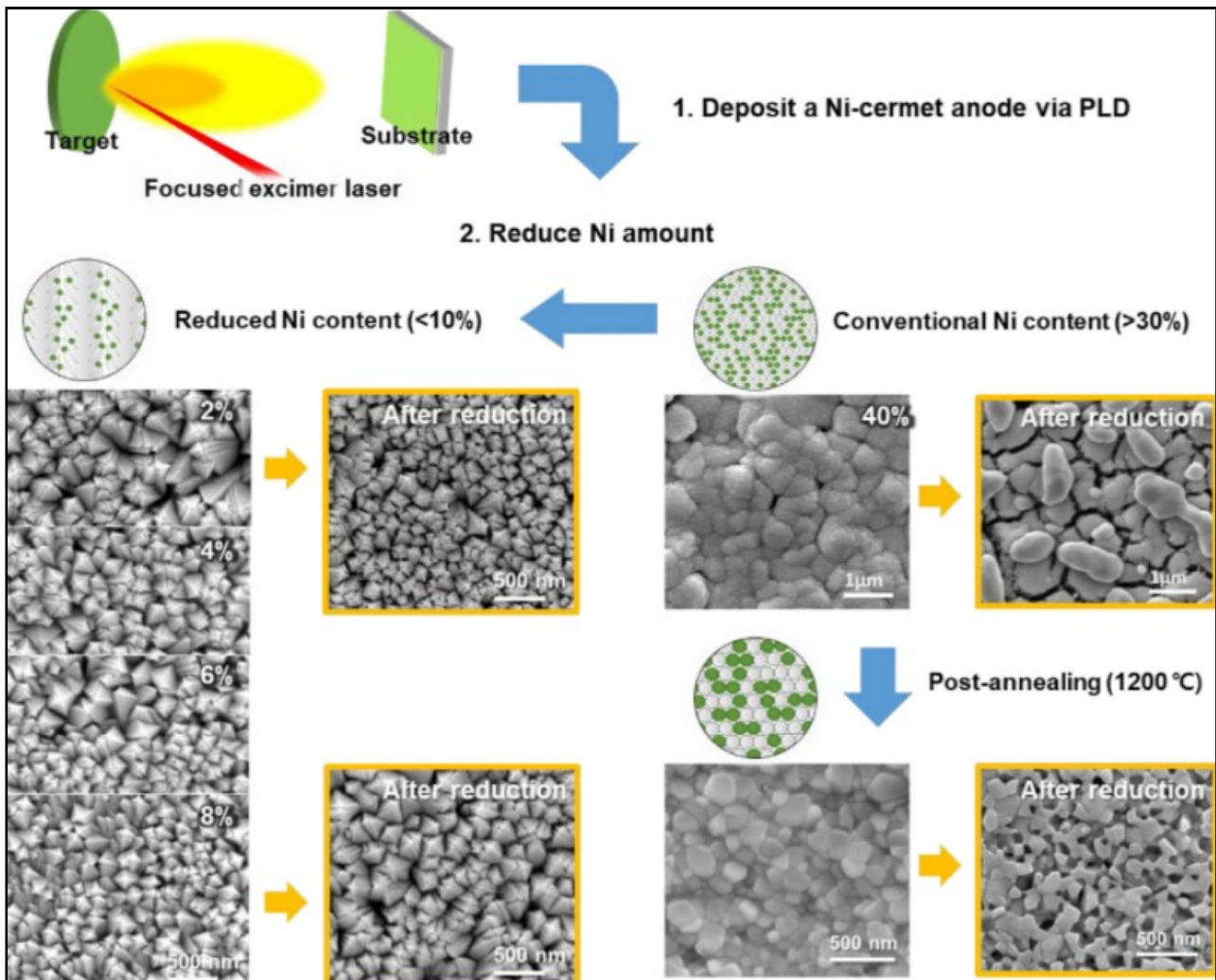
Conceptual diagram of oxidation-reduction cycle of ceramic fuel cells and Comparison of New Concept vs. Deterioration Rate of Conventional Fuel Plates Credit: Korea Institute of Science and Technology (KIST)

Dr. Ji-Won Son at the Center for Energy Materials Research, through joint research with Professor Seung Min Han at the Korea Advanced Institute of Science and Technology (KAIST), has developed a new technology that suppresses the deterioration brought on by the reduction-oxidation cycle, a major cause of ceramic fuel cell degradation, by significantly reducing the quantity and size of the nickel catalyst in the anode using a thin-film technology.

Ceramic fuel cells, representative of high-temperature fuel cells, generally operate at high temperatures—800 °C or higher. Therefore, inexpensive catalysts, such as nickel, can be used in these cells, as opposed to low-temperature polymer electrolyte fuel cells, which use expensive platinum catalysts. Nickel usually comprises approximately 40% of the anode volume of a ceramic fuel cell. However, since nickel agglomerates at high temperatures, when the ceramic fuel cell is exposed to the oxidation and reduction processes which accompany stop-restart cycles, uncontrollable expansion occurs. This results in the destruction of the entire ceramic fuel cell structure. This fatal drawback has prevented the generation of power by ceramic fuel cells from applications which require frequent start-ups.

In an effort to overcome this, Dr. Ji-Won Son's team at KIST developed a new concept for an anode which contains significantly less nickel, just 1/20 of a conventional ceramic fuel cell. This reduced amount of nickel enables the nickel particles in the anode to remain isolated from one another. To compensate for the reduced amount of the nickel catalyst, the nickel's surface area is drastically increased through the realization of an anode structure where nickel nanoparticles are

evenly distributed throughout the ceramic matrix using a thin-film deposition process. In ceramic fuel cells using this novel anode, no deterioration or performance degradation of the ceramic fuel cells was observed, even after more than 100 reduction-oxidation cycles, in comparison with conventional ceramic fuel cells, which failed after fewer than 20 cycles. Moreover, the power output of the novel anode ceramic fuel cells was improved by 1.5 times compared to conventional cells, despite the substantial reduction of the nickel content.



Schematic of design and fabrication processes for proposed anode. Credit: Korea Institute of Science and Technology (KIST)

Dr. Ji-Won Son said, "Our research into the novel anode fuel cell was systematically conducted at every stage, from design to realization and evaluation, based on our understanding of reduction-oxidation failure, which is one of the primary causes of the destruction of ceramic fuel cells."

Dr. Son said, "The potential to apply these ceramic fuel cells to fields other than power plants, such as for mobility, is tremendous."

The research results were published in *Acta Materialia*.

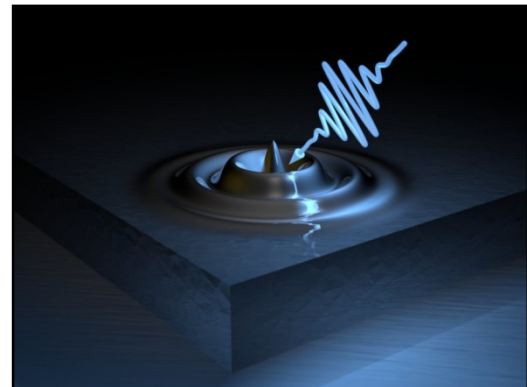
More information: Jung Hoon Park et al, A nanoarchitected cermet composite with extremely low Ni content for stable high-performance solid oxide fuel cells, *Acta Materialia* (2020). DOI: [10.1016/j.actamat.2020.116580](https://doi.org/10.1016/j.actamat.2020.116580)

<https://phys.org/news/2021-02-nickel-content-stability-ceramic-fuel.html>

Researchers report switching material between semiconductor and metallic states

A group of researchers from the Fritz Haber Institute of the Max Planck Society and the Humboldt-Universität zu Berlin have found out that a semiconductor can be converted to a metal and back by light more easily and more quickly than previously thought. This discovery may increase the processing speed and simplify the design of many common technological devices.

Much of the technology used today relies on transistors. They connect many of the materials that make up these devices, and are essential for any kind of data processing. Because transistors are so important, scientists and engineers have long tried to optimize them by modifying their material properties so that they can be used more flexibly. Now, a team of researchers from the Fritz Haber Institute of the Max Planck Society and the Humboldt-Universität zu Berlin has found an important clue on how to achieve that.



Ultrashort light flashes transform a semiconductor to a metal - in just 0.00000000000002 seconds. Credit: Samuel Palato

Transistors are often made up of semiconductors, materials that conduct electricity but not quite as well as metals. In common transistors, several semiconductors are combined to control an electrical current.

Unfortunately, this limits the performance and size of the device they are built in to. "Basically, it would be ideal to have just one material that can do it all, whenever you need it," says Julia Stähler, Professor at the Humboldt Universität zu Berlin, who led the study at the Fritz Haber Institute.

Though the conductivity of semiconductors can be altered by a chemical process called "doping," this technique, in which atoms of the semiconductor are replaced with other atoms, has limitations. The properties of a material can be changed, but will permanently remain so. Researchers seek a material that can switch between different properties. Julia Stähler's group has found an answer to this question: light.

The scientists involved in this study have investigated the popular semiconductor zinc oxide and figured out that by illuminating it with a laser, the semiconductor surface can be turned into a metal—and back again. This "photo-doping" is achieved by photoexcitation: The light modifies the electronic properties such that electrons suddenly move freely and an electrical current can flow, as it would in metal. Once the light is switched back off, the material also quickly goes back to being a semiconductor.

"This mechanism is a completely new and surprising discovery," says Lukas Gierster, lead author and Ph.D. student in Stähler's group. "Three things in particular have surprised us: For one, photo- and chemical doping behave so much alike despite being fundamentally different mechanisms; two, gigantic changes can be reached with very low laser power; and three, switching the metal on and off happens quickly."

The conversion to a metal only takes 20 femtoseconds, i.e. 20 millionth of a billionth of a second. The speed of the re-formation of the semiconductor was especially astonishing as it was orders of magnitude faster than in previous studies. In other words, light is an ultrafast switch that has the force to alter the semiconducting properties of zinc oxide to a metallic behavior reversibly.

This discovery could be highly beneficial for high-frequency device applications and ultrafast optically controlled transistors by increasing processing speed and simplifying device design. "Our gadgets could become faster—and thus smarter," Julia Stähler says and adds: "Low-power,

ultrafast switching of conduction properties will provide us with high speed and design flexibility." She and her group are convinced that the same will prove true for other semiconducting materials, so that their discovery will likely reach much further than just zinc oxide.

More information: L. Gierster et al. Ultrafast generation and decay of a surface metal, *Nature Communications* (2021). DOI: [10.1038/s41467-021-21203-6](https://doi.org/10.1038/s41467-021-21203-6)

Journal information: [Nature Communications](https://phys.org/news/2021-02-material-semiconductor-metallic-states.html)
<https://phys.org/news/2021-02-material-semiconductor-metallic-states.html>



Thu, 18 Feb 2021

Self-assembly induced luminescence of Eu^{3+} -complexes for bioimaging application

The unique properties of rare earth (RE) complexes including ligand-sensitized energy transfer, fingerprint-like emissions and long-lived emissions, make them promising materials for many applications, such as optical encoding, luminescence imaging/sensing and time-resolved luminescence detection. In particular, the use of RE luminescent materials for in vitro and in vivo imaging can easily eliminate the autofluorescence of organisms and any interference from background fluorescence. However, most RE complexes have poor solubility and stability in aqueous solution, and their luminescence can be easily quenched by nearby X-H ($X = \text{O}, \text{N}, \text{C}$) oscillators, which limits their further applications in aqueous solutions and bioimaging. Consequently, improving luminescence performance as well as dispersibility has become a key issue to expand the application of RE complexes. Till now, extensive efforts have been devoted to increasing the luminescence intensity of RE complexes, such as increasing structural rigidity, adjusting coordination numbers, replacing ligand C-H bonds with C-F bonds and changing the electron-donating or electron-withdrawing characteristics of substituents.

Recently, assembly-induced emission materials, such as room temperature phosphorescence materials and aggregation-induced emission luminogens have become research hotspots. Compared to these emitting materials, RE complexes possess a relatively complicated sensitized luminescence mechanism. In the sensitization processes of RE complexes, the energy transfer from the excited triplet state of the ligands to the excited state of the RE ions is the main cause of emission. Therefore, increasing the possibility of intersystem crossing to the ligand triplet excited state and reducing the non-radiative decay would be beneficial to the luminescence of RE complexes.



Credit: CC0 Public Domain

Recent studies have shown that supramolecular assembly can build highly water-dispersible nanostructures through non-covalent intermolecular force, which would allow the RE complexes to be applied in more areas. However, it is difficult to predict the assembly and to control the particle size distribution by simply dispersing RE complexes into host matrices. As known, self-assembly driven by intermolecular forces, such as hydrophobic—hydrophobic, hydrogen bonding, and aromatic $\pi - \pi$ stacking, has a high degree of orientation and predictability, and is a powerful strategy for synthesizing nanostructures with precise sizes and shapes. At the same time, such intermolecular interaction forces can change the intermolecular distance, limit the rotation of the ligand molecules, and regulate the energy transfer from the ligands to the central RE ions.

Here, a new strategy was proposed to obtain size-controlled Eu^{3+} -complex nanoparticles (Eu-NPs) with self-assembly induced luminescence (SAIL) characteristics without encapsulation or hybridization. The amphiphilic Eu^{3+} -complex possessing carbazole derivative ligands, with highly π - π conjugated electron structure, could self-assemble into Eu-NPs with excellent water dispersibility and controllable particle size in aqueous solution. Researchers envisaged that adjusting the molecular polarity of the ligands and transferring the RE complexes from the organic phase to the water phase could cause the RE complexes to assemble into NPs with good water-dispersibility. By studying the changes in luminescence lifetimes and quantum yields in aqueous solution, they found that self-assembly could effectively shield the water molecules in the luminescent center and thus reduce the quenching effect of the water molecules from the vibration of the O-H bond. And when the molecules are self-assembled together, they restrain each other and the movement within the molecules is restricted.

This will greatly limit the intramolecular rotation or vibration of Eu^{3+} -complexes, thus resulting in the enhancement of luminescence in aqueous conditions. Also, this system could be used for bioimaging application for the detection of temperature and HClO by steady-state fluorescence and time-resolved assay. In this sense, the SAIL activity of the self-assembled RE complexes system proposed here has ushered the trend for the development of RE light conversion systems and their integration in bioimaging and therapy applications.

More information: Ping-Ru Su et al, Self-assembly induced luminescence of Eu^{3+} -complexes and application in bioimaging, *National Science Review* (2021). DOI: [10.1093/nsr/nwab016](https://doi.org/10.1093/nsr/nwab016)
<https://phys.org/news/2021-02-self-assembly-luminescence-eu3-complexes-bioimaging-application.html>



Thu, 18 Feb 2021

New research finds drive-through mass-vaccination clinics could alter covid-19 trajectory

Researchers Use Data from the H1N1 Pandemic to Model Pathway to Achieve Faster Vaccination to Stem COVID-19 Crisis

INFORMS Journal on Applied Analytics Key Takeaways:

- *Although waiting times in walk-up clinics are shorter, people preferred the convenience of drive-through clinics.*
- *People believe drive-through clinics are safer, more convenient and less contagious.*
- *You can vaccinate a large number of people without a lot of waiting and confusion using a drive-through clinic.*

CATONSVILLE, Md., Feb. 17, 2021 /PRNewswire/ -- Policymakers at all levels of government are racing to vaccinate hundreds of millions of people to save lives and blunt the deadly COVID-19 pandemic.

New research published in the *INFORMS Journal on Applied Analytics* provides a simulated model for drive-through clinics that can be used for mass COVID-19 vaccinations based on the successful use of such a clinic to address H1N1.

The paper, "Lessons from Modeling and Running the World's Largest Drive-Through, Mass Vaccination Clinic," looks at data from The Louisville Metro Public Health and Wellness department during the H1N1 vaccinations. The authors, Sunderesh Heragu of Oklahoma State University and Thomas van de Kracht of Vanderlande Industries, note that a total of 19,318 residents were vaccinated via a drive-through and a walk-up clinic over 1.5 days – nearly two-thirds of whom specifically used the drive-through clinic. The authors found that people preferred the convenience of drive-through clinics because they perceived it was safer, more convenient and less contagious.

"As policymakers address how to bolster mass vaccinations for COVID-19, drive-through vaccination sites offer a means to inoculate people faster and with less waiting and confusion as compared to other mass vaccination approaches," said Heragu, a Regents professor and head of the School of Industrial Engineering and Management at OSU. "This could readily be done in literally every single community, transforming the trajectory of the COVID-19 pandemic once and for all."

<https://www.prnewswire.com/news-releases/new-research-finds-drive-through-mass-vaccination-clinics-could-alter-covid-19-trajectory-301230146.html>

