Sl. No.	IIT Ropar List of Recent Publications with Abstract Coverage: March, 2026
A	**Book Chapter(s)**
1.	Data preparation, collecting, cleaning, and managing datasets in generative AI V Dutt, **S Singh**, GK Sethi - Generative AI for Remote Sensing of the Environment: Book Chapter, 2026 **Abstract:** The importance of high-quality, diverse, and well-structured data undergirds model performance, fairness, and reliability by detailing collection, cleaning, and management practices. Different sources of data, including public sets, proprietary records, web scraping, and crowdsourcing, are reviewed alongside ethics such as consent, privacy, and mitigating bias. The chapter elaborates on cleaning methods such as normalization, outlier discarding, and modality-specific preprocessing for text, images, and audio with recourse to popular tools such as Pandas, OpenCV, NLTK, and Librosa. Recommendations for dataset structuring, versioning, scalability, security, and automation of the workflow are surveyed to ensure sustainable management. Typical pitfalls, such as bias, scalability, scarcity in narrow fields, and quality degradation during training, are complemented by pragmatic solutions. Practical case studies highlight the preparation of Wikipedia text for language generators, curated face datasets for GANs, and multimodal datasets for creative tools. The chapter concludes with future directions, including the incorporation of automation through AutoML, synthetic data integration, federated learning, and adherence to fast-evolving regulations. Overall, the emphasis is on the importance of disciplined, repeated preparation of data, which is as essential as the architecture of the model for tapping the full potential of generative AI. It encourages practitioners to insist on quality and governance from the beginning.
2.	Government strategies to economically support the cleaning of water bodies in India A Gani, A Hussain, **S Pathak** - Wastewater to Resource Recovery: Applying the Circular Economy Toward Sustainable Development: Book Chapter, 2025 **Abstract:** This chapter examines the various approaches undertaken by the Indian government to provide financial support for the nationwide cleanup of water bodies. It explores the programs, resources, and policies intended to address the worldwide issue of water pollution, which poses significant environmental and public health hazards. The chapter also provides an overview of the current condition of India's water bodies, identifying the main contaminants and their sources. The changes in government interventions over time, from earlier rules and regulations to modern integrated approaches, have also been discussed. The study includes significant national initiatives that demonstrate the government's dedication to preserving and restoring clean water bodies, such as the Swachh Bharat Abhiyan, the National River Conservation Plan, and the Ganga Action Plan. A comprehensive review is conducted on the economic support mechanisms, which encompass the creation of pollution control boards, public financial allotments, and the application of the polluter pays concept. The chapter delves into novel financing mechanisms that sustainably support water-cleaning initiatives, including international funding, green bonds, and public–private partnerships. Along with adopting eco-friendly practices and infrastructure, the chapter also emphasizes the use of technology and data analytics in the monitoring and management of water quality. The chapter concludes with a thorough examination of the achievements and difficulties associated with the Indian government's economic approaches used for water body cleansing. It makes policy proposals to improve the strategies that are now in place, highlighting the necessity of integrated and sustainable economic models to guarantee the long-term preservation and cleanliness of India's essential water resources.

3.	Historical climate dynamics and regional variability in the Arabian Peninsula: Trends in temperature and precipitation patterns **RK Tiwari**, N Arora, **S Singh, V Sood** - Climate Change in the Arabian Peninsula: Challenges and Pathways to Solutions: Book Chapter, 2026 **Abstract:** This chapter examines the historical trends of climate change over the Arabian Peninsula, emphasizing significant transformations in temperature and precipitation patterns over the past two to three decades. The analysis is based on a comprehensive review of literature, incorporating observational datasets such as Climate Research Unit (CRU), CPC Merged Analysis of Precipitation (CMAP) and Tropical Rainfall Measuring Mission (TRMM), along with statistical techniques including the Mann–Kendall test, Sen's slope estimator and the seasonal-Kendall metric. Observational data indicates a pronounced warming trend across the region, with notable spatial variability. Studies based on both station data and global gridded datasets confirm a significant rise in annual mean temperatures, with warming trends being more spatially coherent and statistically significant than those observed for maximum temperatures. The most substantial warming has been recorded over the eastern and southeastern areas of the peninsula, particularly in countries like Oman and the United Arab Emirates (UAE). Site-specific station records further reveal that mean temperature increases in some locations are occurring at rates 1.5 to 3.5 °C times higher than the global average. Seasonal analyses highlight variations in warming trends, with significant increases in both maximum and minimum temperatures during certain periods. In contrast to temperature trends, precipitation patterns across the Arabian Peninsula exhibit lower spatial coherence. While most of the Arab world does not show clear increasing or decreasing trends in precipitation, specific regions such as northern Oman and Qatar have experienced notable drying trends during certain seasons. The influence of global climatic phenomena, including the El Niño-Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO), further contributes to climate variability in the region, reinforcing its vulnerability to global climatic teleconnections. While regional climate models and Intergovernmental Panel on Climate Change (IPCC) projections have often been scrutinized for potential exaggeration, observational data suggest that, in some cases, they may have even underestimated the extent of warming in the Arabian Peninsula. This underscores the importance of localized climate assessments and adaptive planning to inform sustainable development and enhance long-term resilience in the region.
4.	Lung cancer: Akt/PKB signaling dysregulation, potential proteomic techniques, therapeutic strategies, and future perspectives B Bilal, **JA Malik**, S Manahil - Proteomics: A Promising Approach for Cancer Research: Proteome Signaling Dysregulation in Cancer, Therapeutic Interventions, and Future Perspectives, Volume 2: Book Chapter, 2026 **Abstract:** According to the fact sheet published in 2020 by the Global Cancer Observatory owned by the World Health Organisation (WHO), 19,292,789 cancer cases were reported, among which 2,206,771 reported cases were of lung cancer alone, constituting about 11.4% of the total cancer cases. In 2020, the deaths reported due to cancer were 9,958,133, of which 1,296,144 (18%) were due to lung cancer, which was higher than the aggregate of deaths due to breast, colorectal, and prostate cancer. Lung cancer has emerged to be the second most common cancer all across the globe, and is the most common cancer reported among men and second most common type of cancer in women. Nonsmall cell lung cancer (NSCLC) and small cell lung cancer (SCLC) are the two primary types of lung cancer. The NSCLC forms the most common type, comprising about 81% of the total cases, while the SCLC is the most aggressive, growing and metastasizing more rapidly, accounting for about 14% of cases. Since most cases of lung cancer are not diagnosed until a very late stage, the treatment for the disease is very less effective or ineffective at all, resulting in the fatality of the disease. The available treatments for lung cancer, which include

	surgery, chemotherapy, and radiotherapy, have less therapeutic effects. These cannot cure most lung cancers. Thus, new strategies and therapies are very much needed. Akt (protein kinase B or PKB) regulates a variety of cellular processes, including metabolism, cell survival, cell growth and proliferation as well as angiogenesis. Evidence clearly suggests that Akt has a very important role in lung cancer and resistance to various therapies. Akt pathway-targeted inhibitors and the available therapies can enhance the efficiency of lung cancer treatment by decreasing the risk of secondary resistance. In this chapter, we first consider lung cancer and then shed light upon the Akt-mediated signaling in lung cancer and management strategies.
5.	Remote sensing satellite datasets, preprocessing techniques, and tools for agricultural land cover classification N Sharma, K Kaur, **S Singh** - Generative AI for Remote Sensing of the Environment: Book Chapter, 2026 **Abstract:** Precise classification of agricultural land cover via satellite remote sensing is essential in crop status tracking, the prediction of yield, and improving farm management. This study examines some of the widely used satellite data, such as Landsat and Sentinel-2, with a view to studying how they have been utilized in agricultural monitoring. The datasets are contrasted with their sensor technologies, the bands they cover in terms of the spectrum, their spatial resolution, and temporal resolution to reveal the advantages and limitations that each of them presents in different contexts. The study also emphasizes the need to implement preprocessing methods, such as radiometric calibrations and atmospheric corrections, to ensure the accuracy and certainty of satellite data before further analysis. Furthermore, the article identifies typical software tools, such as Google Earth Engine and ENVI, and elaborates on their characteristics in terms of satellite imagery and land cover classification procedures. The capabilities provided by these software packages range from cloud computing to image analysis and are garnering more of a following among remote sensing practitioners at present. This work has contributed to researchers and practitioners by identifying appropriate remote sensing resources for agricultural land cover mapping through a comparative analysis of datasets and processing tools. Knowledge of the strengths and weaknesses of datasets and tools enables fellow users to optimize the use of satellite images for making informed decisions about their effective application in monitoring and classifying agricultural conditions.
6.	Robotic assistance in vertical farming **E Singla**- Assistive Robotics: Perspectives, Challenges, and Firmware: Book Chapter, 2026 **Abstract:** The variations and demand for food commodities is ever-increasing, and that leads to attention of authorities toward supply-chain process for suburban and central urban areas. Much of the agricultural production in India occurs in rural areas. Due to this, the produce needs to be transported to urban areas where there is a higher demand for food commodities because of the larger population. As agricultural produce is a perishable commodity, this often results in degradation of quality of the products before reaching the destination. Both these factors have led to development of commercial agriculture near urban areas. A new concept called vertical farming is being explored and researched to modernize agriculture. Vertical farming is a concept that utilizes the third dimension of space in the vertical direction to increase the number of crops that can be cultivated in a certain area. In vertical farming, the plants are kept in pipes or trays stacked on top of each other. The peculiarity is that the pipes or trays do not contain soil, as opposed to traditional farming where the crops are grown in soil. In vertical farming, the contents of the pipes depend on the nutrient supply mechanism. There are three types of such mechanisms: hydroponics, aquaponics, and aeroponics. Generally, the setup is in a closed space with environmental conditions like light, temperature, and humidity controlled artificially. This forms another advantage of vertical farming, i.e., the plants can be grown independent of weather or climate

	conditions. For realization of agricultural practices on high-rise vertical farms, where human intervention is quite laborious, robotic assistance would be an effective solution. The agricultural processes like seeding, transplanting, harvesting, health-monitoring, and nutrient–water supply can be planned for robotic assistance. However, the requirements and complexities of these tasks to be performed are different, such as reach, orientation, payload capacity, and even end-effect or types required for each process. In addition to this, complexities can arise from variation in the amount of clutter due to a difference in the plants' height. In such cases, an individual robotic configuration may not serve all the purposes; rather, each task may require a different configuration, planning strategies, and/or maintenance skills. Purchasing a large number of robotic systems, as per requirement, is never economical in the agricultural field, which is a bottleneck in the utilization of robotic assistance in farming. This chapter would cover the general utilization of robotic systems in agricultural processes, importance, and challenges in vertical farming and utilization of robotic assistance in all major processes. Besides, this chapter would also cover the possible solutions for handling the challenges of vertical farms through reconfigurable robotic systems.
7.	Technical note on lightweight aircraft materials **A Singh,** S Samanta - Aerospace Engineering Materials: Applications, Modelling, and Sustainability: Book Chapter, 2026 **Abstract:** The lightweight materials are characterized by low density and an increase in strength-to-weight ratio. In addition, the lightweighting operation entails the use of high-end materials and new and efficient engineering technologies to certify the mechanical part to reserve and develop their practical and real-life functions by use of a reduced mass of raw material. Generally, typical applications of lightweight materials used are the optimal composite of high-performance formulations, that is, composites, and the optimization of structures with computational manufacturing schemes, and structures are manufactured with the aid of the most recent engineering techniques, like additive manufacturing, hot forming, and foam metals. Lightweight design is primarily important in ultralight aviation, where it can enable long flights. The fundamental principle of lightweight strategy is to reduce the use of materials and guarantee the absence of differences and even greater technical performance. Throughout this chapter, the author gives a close analysis of some of the lightweight materials that are currently being utilized in the production of aircraft parts.
B	**Conference Proceeding(s)**
8.	A phase noise improved charge pump for low jitter PLL **H Mehra, MK Singh**, R Nagulapalli, **M Sakare** - Irish Signals and Systems Conference: Signalling our Strength (ISSC), 2025 **Abstract:** In type-II Phase Locked Loop (PLL) systems, the charge pump plays a vital role by linking the phase frequency detector (PFD) to the loop filter (LF), thereby regulating the control signal applied to the voltage-controlled oscillator (VCO). However, charge pump based PLLs are susceptible to significant noise and current mismatch, primarily due to random variations in CMOS device parameters, which can degrade the loop's accuracy, increase jitter, and impact overall phase noise performance. A charge pump is proposed in this work that equalizes the currents of source and sink. By ensuring better matching between current sources and sinks, the charge pump phase noise is significantly reduced. An operational amplifier (opamp) is placed in the charge pump in such a way that it ensures equal source and sink current. The post simulation results show -127.29dBc/Hz phase noise at 1MHz offset frequency, which is 2.18 dB less as compared to the conventional charge pump. The proposed charge pump is designed to produce 100µA current for a type-II PLL in 65nm CMOS process. A 1.6ps jitter accumulated in proposed circuit based PLL

	which is integrated from 10 Hz to 100 MHz that shows 29.5% improvement compared to the conventional one. The layout of the presented charge pump occupies 8987μm2 area. The proposed charge pump based PLL has 3.6dBc/Hz lower figure of merit (FOM) on comparing with alternative charge pump based PLL in the literature.
9.	A software-in-loop cyber-physical simulator for cyber contingency analysis in smart grids **A Swati, R Sodhi** - IEEE PES Innovative Smart Grid Technologies Conference Europe (ISGT Europe), 2025 **Abstract:** The present-day modern power systems are cyber-physical systems, wherein a contingency could be natural (operating) or man-made (cyber). This calls for an extension of the conventional power system contingency analysis (PSCA). The conventional PSCA mainly considers possible power or network outages, and tries to assess their impact on the performance of the physical PS. However, in order to include cyber contingencies into the analysis, an interdependent cyber and physical layers of the PS must be considered. To this end, this paper presents a simple yet effective NS3 and MATLAB based software-in-loop simulation setup to identify vulnerabilities in cyber-physical power systems (CPPS). The working of the set-up is illustrated using a denial-of-service (DoS) attack in the cyber layer (CL) in the IEEE 14-bus system, leading to the identification of the critical attack path that an attacker may exploit to cause maximum damage to the CPPS.
10.	BloBS-FL: A robust architecture of blockchain based decentralized split federated learning **S Mishra, Y Prajapati, K Aggarwal, S Pal** - 18th International Conference on COMmunication Systems and NETworks (COMSNETS), 2026 **Abstract:** Modern distributed machine learning paradigms face critical challenges in balancing privacy preservation, communication efficiency, and Byzantine resilience. This paper introduces BloBS-FL, a hybrid architecture that integrates split learning with blockchain-based decentralized federated learning. Our architecture partitions model training between client-side feature extractors and server-side classifiers. BloBS-FL employs Practical Byzantine Fault Tolerance (PBFT)-based consensus for poison attack resistance. Experimental results on network intrusion detection datasets demonstrate 93.5%, and 90% accuracy with MNIST and CICIDS-2017 datasets. BloBS-FL reduces communication overhead and resolves the problem of privacy via split learning making the architecture suitable for secure applications.
11.	CDAN: Contextual detail awareness network for image super-resolution **Inderjit, A Bharadwaj, JS Sahambi** - IEEE International Conference on Internet of Things and Intelligence Systems (IoTaIS), 2025 **Abstract:** Deep learning-based methods have achieved remarkable success in high-quality single-image restoration. In multi-scale feature learning, Super-Resolution (SR) approaches primarily focus on leveraging variable receptive fields; however, this often leads to increased model complexity. To address these challenges, we propose a lightweight network called the Contextual Detail Awareness Network (CDAN) for Single Image Super-Resolution (SISR). At the core of CDAN is the Contextual Multi-scale Residual Block (CMRB), which employs dilated convolutions with a fixed kernel size to extract fine-grained details. This design enables effective capture of contextual multi-scale features, which are further refined through an attention mechanism. The CDAN architecture achieves state-of-the-art performance across several benchmark datasets, while remaining computationally efficient and using significantly fewer parameters than existing SISR methods.
12.	Combined absorption and compression-based radiant cooling system for medium-capacity office buildings in hot-dry climates

	G Singh, R Das, S Kumar - International Conference on Modeling, Simulation and Optimization (CoMSO), 2026 **Abstract:** Radiant cooling system (RCS) has been an emerging air-conditioning method that has created a niche because of its primary energy saving and healthier indoor air characteristics. However, operating the RCS with renewable energy is rare due to necessity of compression chiller-based radiant system in the dedicated outdoor air system (DOAS). For including solar energy in the RCS, the presented work undertakes an EnergyPlus-based investigation to predict the electricity savings of vapor absorption chillers (VAC). Evaluations are compared with conventionally used design of the RCS, in which both radiant and DOAS units were functioned through compressor units. A triple-floor building layout amounting floor space of nearly 4,950 m^2 is examined. Performance assessments were performed in relation to savings in grid-dependent electricity, load outlines, and sustained conditions described by zonal temperature and humidity, emissions, coefficient of performance (CoP) and allied metrics. Results portray that the VAC-based RCS saves nearly 28% of annual electricity and net emissions, as compared to the customary design. Temperature and relative humidity vary nearly between 20 °C–26 °C and 36% - 55%, respectively. For the suggested design, annually-averaged CoP of the VAC and the DOAS chiller were obtained as 0.36 and 2.83, respectively.
13.	Detection of snow/ice over Western Himalayas using scatterometer with google earth engine **RK Tiwari, V Sood,** S Singh, V Dutt - International Geoscience and Remote Sensing Symposium (IGARSS 2025), 2025 **Abstract:** A scatterometer is one of the active microwave sensors utilised in a variety of applications over land and nonland such as sea-ice and oceanography. Since the first launch of the scatterometer in 1976, a variety of scatterometers were launched by the different space agencies especially to observe the wind direction and wind speed. But with the advancement in technical specifications and algorithms various applications were also explored over the land surface such as in agriculture, water hydrology, snow-ice and snow water equivalent due to its nature of the sensitivity towards the water contents within the land in the form of snow or soil. In this article, the scatterometer data has been processed using Google Earth Engine (GEE) over western Himalayas. The SCATSAT-1 data has been utilized to detect the snow/ice. Two classifiers i.e., random forest (RF) and support vector machine (SVM) have been tested for SCATSAT-1 dataset. The experiment results confirm the effectiveness of each classifier in the detection of snow/ice cover maps over western Himalayas. This study is beneficial for the accurate estimation of snow/ice at a larger scale along with decadal record of the scatterometer dataset.
14.	Efficient drone charging by utilizing complementary transverse and longitudinal pickup coil structures **S Jain, A Sharma** - IEEE Radio and Antenna Days of the Indian Ocean (RADIO), 2025 **Abstract:** This paper introduces a complementary receiver (Rx) coil arrangement with integrated rectifiers designed to enhance the wireless drone charging efficiency. Central to the design is a transverse pickup (TP) Rx coil structure, where adjacent coils are wound in opposite directions and positioned just 17 mm above the drone's landing gear. This configuration complements the longitudinal magnetic (H_z)-field capturing conventional Rx coil placed at 50 mm altitude. The geometrical parameters of the TP coils are precisely optimized using electromagnetic simulations to maximize the capture of the lateral H-field emanated by the transmitter (Tx) coil. Experimental results validate this design's effectiveness, demonstrating that using a DC voltage combining technique to add the rectified outputs of each coil constructively significantly improves performance. The proposed system achieves a high rectified voltage of 30.5 V while reducing the load on the conventional Rx coil and lowering the required Tx input power. This enables

	deployment of lower-voltage rating rectifiers and lower current ratings for both Tx and Rx coils, paving the way for a compact, lightweight, and energy-efficient solution for drone charging.
15.	Enhancing power distribution system resilience through cyber-attack detection with hankel matrix analysis **MA Khan, M Shahrukh, R Sodhi,** T Soni - IEEE PES Conference on Innovative Smart Grid Technologies (ISGT), 2026 **Abstract:** Ensuring a resilient system operation under extreme conditions such as cyber-attacks is crucial, particularly when Distributed Generators (DGs) rely on neighbors information exchange for frequency regulation, voltage restoration, and power sharing. To this end, a novel cyberattack detection scheme is proposed in this paper that enhances the resilience of secondary control systems against both, the node and the communication link attacks. The proposed detection method utilizes the Hankel matrix to identify a wide range of cyber-attacks, including step, ramp, and simultaneous multi-link intrusions, while effectively distinguishing them from natural disturbances like faults or load variations-significantly reducing false alarms. The effectiveness of the proposed detection scheme is validated through detailed simulations on a 4-DG AC microgrid system under various attack scenarios, demonstrating its superior accuracy in detecting and locating stealthy and complex attacks and provides a cost-effective, scalable solution that does not depend on network reconfiguration.
16.	Intramedullary nailing in long bone fractures: A review of clinical outcomes and complications M Sandhu, **N Kumar,** RS Sawhney, G Kaur - 7th International Symposium on Advanced Electrical and Communication Technologies (ISAECT), 2026 **Abstract:** With an emphasis on intramedullary nailing technique (IMN), straight bone fractures, primarily those of the femur, tibia, and humerus, are surgically resolved. DMIs to soft tissues, early healing, early ambulation, and early weight bearing are some of the advantages of IM nailing. IMN is also crucial for lengthy bone fractures since it permits internal fixation without using external fixators, which can cause stiff joints. IM much bone nailing is its focus. IMN minimizes soft tissue injury and permits stable fixation. This adheres to the PRISMA protocol. Four locations of IMN were found in a PubMed search on fractured long bones that covered the years 2019 to 2024. The article presents the complications of the intramedullary bone fractures and its outcomes.
17.	IoT-enabled energy convergence architecture and insights for smart grids **H Anumala** - IEEE 7th PhD Colloquium on Emerging Domain Innovation and Technology for Society (PhD EDITS), 2025 **Abstract:** IoT Devices provide vast amounts of data that includes energy data that can be analyzed to provide energy consumption and production insights to end users and organizations.Proposed paper introduces a novel IoT Centric Energy Management Architecture for distributed real time energy monitoring. Standard Energy models and communication API (Application Programming Interfaces) are proposed for measuring and distributing energy requirements and consumption from various energy sources and transferring the same to IoT Cloud. Proposed grid-level forecasting and risk-aware alerting framework that couples baseline quantile forecasters for site consumption-C and solar-S with a lightweight RAG-style augmentation that injects regime knowledge (heatwave, storm/cloud ramps, holiday patterns) to correct residual bias. Net-load is formed as N=C-S. The system achieves high point-forecast fidelity of 0.94-0.99 and the RAG augmentation reduces MAE/RMSE relative to the baseline and improves peak-event detection area under the precision-recall curve (AUCPR).
18.	MDNet: Multi-scale detail-aware network for low-light image enhancement **A Bharadwaj, Inderjeet, JS Sahambi -** IEEE International Conference on Internet of Things and Intelligence Systems (IoTaIS), 2025

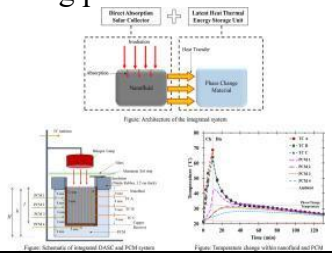
	Abstract: Low-light image enhancement remains a challenging problem due to the difficulty of restoring both global structures and fine-grained details under poor illumination. In this paper, we propose MD-Net (Multi-scale Detail-aware Network), a novel deep learning framework designed to address this challenge by leveraging a hierarchical encoder-decoder architecture. MD-Net processes input images at multiple spatial resolutions to extract and integrate features across scales, enabling the network to enhance images with improved clarity, contrast, and detail. The architecture incorporates two key modules: High-Level Information Awareness (HLIA), which captures global semantic and contextual cues, and Multi-Level Feature Aggregation (MLFA), which effectively fuses features from different receptive fields to preserve textures and fine details. Experimental results demonstrate that MDNet achieves superior performance over existing state-of-the-art methods, producing visually pleasing results and achieving competitive quantitative scores across standard low-light image enhancement benchmarks.
19.	MisConfAI: A framework for detecting configuration vulnerabilities in complex systems **S Juneja, G Yadav** - 23rd IEEE International Symposium on Network Computing and Applications (NCA), 2025 **Abstract:** Configuration vulnerabilities have emerged as a critical challenge in securing complex information systems. Unlike traditional software bugs, these vulnerabilities originate from insecure system settings in components such as databases, web servers, and cloud environments. Common misconfigurations such as using default credentials, enabling skip-grant-tables=1, or setting bind-address=0.0.0.0 can significantly compromise security, leading to issues like unauthorized access (CWE-287) and unintended public network exposure (CWE-284). Despite progress in automated vulnerability scanning and patch management, configuration-related issues remain inadequately addressed due to their contextual dependencies and the limitations of conventional tools in interpreting system semantics. In this work, we present MisConfAI, a transformer-driven framework for automated detection of configuration vulnerabilities. MisConfAI first models syntactic variations and lexical deviations in configuration files, then maps risky settings to known vulnerability classes (e.g., CWE) and compliance standards such as the CIS Benchmarks. We evaluate its efficacy across multiple pre-trained language models, including BERT, CodeBERT, RoBERTa, ELECTRA, and XLNet. To ensure operational fidelity, the framework is coupled with a dynamic analysis layer that provisions containerized testbeds via Docker to replicate real-world deployment environments.
20.	Natural calamities demand more rescuers: Exploring connectivity time dynamic graphs **A Saxena, M Kaushik** - 39th International Symposium on Distributed Computing (DISC 2025), 2026 **Abstract:** We study the exploration problem by mobile agents in Connectivity Time dynamic graphs. The Connectivity Time model was introduced by Michail et al. [JPDC 2014] and is arguably one of the weakest dynamic graph connectivity models. We prove that exploration is impossible in such graphs using $^{(n-1)(n-2)}/_{2}$ mobile agents starting from an arbitrary initial configuration, even when agents have full knowledge of system parameters, global communication, full visibility, and infinite memory. We then present an exploration algorithm that uses $^{(n-1)(n-2)}/_{2} + 1$ agents equipped with global communication, 1-hop visibility and O(log n) memory.
21.	Numerical solution of a nocturnal solar still coupled with air-rock bed thermal storage tank **R Yadav,** A Singh, A Kumar, R Das, RP Singh - 17th International Conference on Contemporary Computing (IC3), 2025

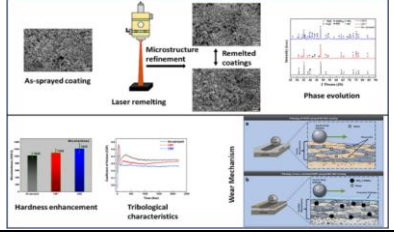
	Abstract: A comprehensive numerical model is formulated to analyze the nocturnal performance enhancement of a double-basin solar still combined with a rock bed thermal energy storage (TES) system. The TES unit, thermally charged via a solar air heater during daylight hours, supplies stored heat during off-sunshine periods to sustain water evaporation. Coupled transient heat/mass transfer differential equations governing the thermal behavior of the solar still, TES tank, and air heater are formulated and solved numerically. Explicit solutions for basin water and glass cover temperatures, as well as distillate yield, are obtained. Model validation against a benchmark study demonstrates excellent agreement, confirming the model's reliability. Comparative analysis indicates superior nocturnal productivity relative to conventional configurations, with discrepancies in existing models attributed to oversimplified thermal interaction assumptions. The present work establishes a robust predictive framework for evaluating the thermal response of solar stills integrated with TES, particularly under diurnal cycle variations.
22.	PELC: Power-efficient and low-cost IoT-based real time operating system enabled solution for biodiversity application **K Singh, MK Sandhu, S Kumar** - IEEE International Conference on Internet of Things and Intelligence Systems (IoTaIS), 2025 **Abstract:** Biodiversity conservation is an essential component of healthy ecosystems, and evidence of their decline in the face of multiple factors is a serious concern. Existing solutions are based on high-end processor devices, which have a complex nature in terms of structure and requirements for Linux and other heavy operating systems. Hence, the proposed system builds a biodiversity system on a resource-constrained hardware platform that features a lightweight Zephyr-based real-time operating system (RTOS). The designed system drives multimedia applications decisively and in power-efficient form by exploiting various features of RTOS, including parallel task scheduling, resource management, and synchronization between tasks. The system also designed a customized printed circuit board (PCB) that includes an nrf5340 system-on-chip (SoC), camera, SD card, 4G module, and power management circuit for providing an integrated solution for stable operation. Due to the IoT-based application, the message queuing telemetry transport (MQTT) protocol is used for transmitting and receiving captured data to the cloud. The proposed system also offers a cloud-based processing architecture to manage the captured data on the cloud for real-time operation. The developed web page and web portal enable remote monitoring of captured data and inferences of insect species classification.
23.	Pilot-assisted receiver design for non-coherent distributed transmission in 5G-NR **A Karmakar, A Ahmad, S Agarwal** - IEEE Future Networks World Forum: Beyond Connectivity: 6g for a Sustainable and Intelligent Future (FNWF), 2026 **Abstract:** In this paper, we propose a receiver design for non-coherent distributed transmission (NCDT) in 5G NR systems that eliminates the need for feedback or strict transmitter coordination. Unlike conventional coherent approaches that rely on precise synchronization and continuous feedback to emulate MISO systems, our method leverages standardized 5G NR pilot symbols and statistical detection to enable reliable distributed transmission. The receiver estimates channel magnitude, as well as phase and frequency offsets, using maximum likelihood estimation, and performs symbol detection through a likelihood ratio test framework. Simulation results under 5G channel conditions show that the proposed receiver design remains effective under offset-induced interference and achieves reliable performance in an NCDT system without feedback and synchronization.
24.	Polymer matrix sand composites for enhanced ballistic impact resistance **M Thakur, N Nakka, J Bommiditha, SS Sai, S Bansal, RK Munian, SS Padhee** - Advances in Multidisciplinary Analysis and Optimization (iNCMDAO 2024), 2026

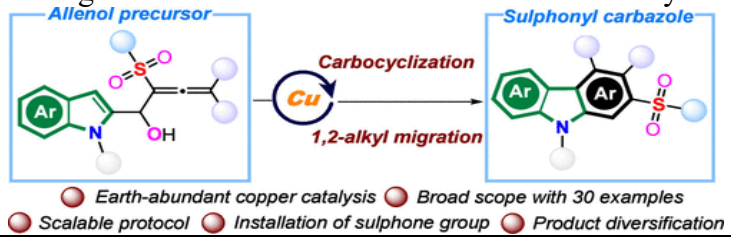
	Abstract: With the ever-increasing threat of ballistic impact, it is essential to provide a solution that is not only effective but also economical. A majority of studies contribute toward alternatives to monolithic structures by incorporating sandwiched cores, which are often prone to core crushing and delamination. This often limits the multi-hit capabilities of the structure. In recent years, sand-based composites have emerged as a potentially cost-effective solution. In this ongoing effort, the current investigation aims to offer more robust protection against varied ballistic impacts and potential ballistic threats. This research investigates the enhancement of ballistic impact resistance in polymer matrix sand composites (PMSCs) through the inclusion of sand in a graded fashion, resulting in a tunable solution. The tailoring of various mechanical properties, such as modulus, impact strength, and hardness, enables different layers within a single structure, offering potential advantages as the projectile pierces through the thickness. The gradation creates a stepwise structure, with a prime base impact zone densely graded with inclusions that are brittle and hard enough to erode the projectile. Further gradation involves a less dense region providing tensile strength, which can reflect the tensile wave and reduce impact energy. In the preceding study, composites were fabricated and subjected to a battery of tests, including tensile testing, Izod impact testing, and hardness testing, to comprehensively evaluate their mechanical and physical properties also Homogenized properties were extracted so as to critically observe the PMSCs behavior upon variations in constituent elements. In the current study, the properties extracted from variations in constituent elements are utilized for developing different layers in a structure. Simulation studies of varied gradation configurations are conducted, and the potential advantages of layering sequences are studied. Preliminary projectile impact studies provide initial insights into gradation performance. The experimental and simulation results reveal that varying the size and volume fraction of sand content markedly influences the mechanical properties and ballistic resistance of the composites, underscoring the potential of PMSCs as cost-effective and environmentally sustainable Composites for advanced ballistic protection applications.
25.	Potential applications of google earth engine in earth observation: A systematic review S Singh, **V Sood, RK Tiwari** - International Geoscience and Remote Sensing Symposium (IGARSS), 2025 **Abstract:** Google Earth Engine (GEE) as a cloud-based platform plays a significant role in analysing, processing and visualising satellite images. GEE integrates the multipetabyte catalogue of satellite imagery and geospatial datasets for scientists, researchers, academicians and developers. The major application areas included forest or wildfire, drought monitoring, disaster management, plant disease, food security, water management, climate monitoring and environmental protection. It offers various data products such as surface temperature, climate, atmospheric, weather, high-resolution imagery via Landsat and Sentinel series, moderate resolution imagery via MODIS, terrain, land cover, cropland and other geophysical data. In this article, we will explore the potential applications of GEE in earth observations along with a meta-analysis of previous records of the publications. In addition, the flow working model of the GEE cloud-based platform has also been summarised along with advanced algorithms and integration of advanced tools. This article allows the reader to explore the potential of GEE on earth exploration with the help of advanced algorithms.
26.	Revolutionizing air mobility: Cutting-edge infrastructure for safe air corridor navigation N Gupta, **A Ahmad, D Salwan, S Agarwal…** - IEEE Future Networks World Forum (FNWF), 2026 **Abstract:** The development in the automation sector and aircraft design has enabled significant innovations in the urban aviation sector, particularly in advanced air mobility (AAM). AAM includes on-demand air transportation services for both cargo and passengers by utilizing unmanned aerial system (UAS) or other small aircraft like electric vertical takeoff and landing

	(eV-TOL) vehicles. These vehicles operate within designated pathways known as "Air Corridors."Air corridors are performance-based controlled airspaces where UASs adhere to specific protocols, including skylane assignment, route availability, traffic control, collision avoidance, etc. In this paper, we explore the urban air mobility (UAM) ecosystem, with an emphasis on the air corridors. We propose a novel design concept for building the infrastructure to support safe operations in the air corridors. Specifically, our proposed design entails utilizing a multi-beam subarray antenna system that can keep the UAS within the air corridor and detect malicious objects within the air corridor to avoid collision. Moreover, we present a case study to demonstrate the operation of an air corridor. Finally, we highlight the challenges involved in implementing the proposed air corridor concept.
27.	Studying the single and ensemble of NV center emission for enhanced magnetic field sensitivity **A Redhu, RV Nair** - 2025 IEEE Photonics Conference (IPC), 2025 **Abstract:** We investigate high-density ensembles of nitrogen-vacancy (NV) centers in diamond for quantum sensing. Stable NV-charge states are observed under high-power excitation. Enhanced photon emission yields over fivefold sensitivity improvement compared to single NVs, demonstrating the potential of ensembles for high-performance sensing applications.
C	**Article(s)**
28.	A comparative experimental study of CA6NM turbine steel protection by thermal-sprayed ceramic coatings under accelerated conditions V Sharma, S Bhandari, **H Singh,** V Khanna - Journal of Materials Engineering and Performance, 2026 **Abstract:** This study investigates the slurry erosion performance of three ceramic coatings, namely, Cr_2O_3, Al_2O_3, and $Al_2O_3 + 13TiO_2$ sprayed onto the 13Cr4Ni (CA6NM) turbine steel using the detonation gun (D-Gun) coating spray method under accelerated hydro-erosive conditions. The coatings were characterized to analyze their micro-structural and mechanical properties. Results indicate that, among all the as-sprayed coatings, the Al_2O_3 coating have shown the highest erosion rate, whereas the Cr_2O_3 coating alone has exhibited the lowest erosion rate. The coating's erosion resistance is primarily influenced by its increased microhardness, lower porosity, and dense microstructure. Additionally, the scanning electron microscopy (SEM) study of the eroded specimens reveals that the $Al_2O_3 + 13TiO_2$ and Al_2O_3 coatings exhibited brittle behavior. In contrast, the Cr_2O_3 coating has shown mixed behavior.
29.	A motion flow guided MicroNet framework for micro expression recognition M Verma, **SK Vipparthi,** M Abdel-Mottaleb - Journal of Visual Communication and Image Representation, 2026 **Abstract:** The micro-expression recognition (MER) has gained high attention in real-world applications: human–computer inter action, depression estimation, virtual reality, etc. However, MER systems still face difficulty in capturing the subtle information with spatial appearance of micro expressions. This paper proposes an efficient motion flow-guided MicroNet framework for MER, comprising a motion flow generator (MFGen) and an avalanche feature (AFeat) block. The MFGen extracts temporal changes in expressive regions by analyzing pixel motion intensity across frames, while the AFeat block captures spatiotemporal features through a multi-lateral complementary feature (MCFeat) block, which elicits coarse and deep edge responses from multi-scale receptive fields. The MicroNet estimates momentary variations and learns affective appearance features of micro-expressions. Its efficacy is evaluated through experiments on two setups using six datasets: CASME-I, CASME-II, CAS(ME), SAMM, SMIC, and COMPOSITE,

	with validation schemes demonstrating generalization and robustness. Eight ablation experiments further validate the role of each module.
30.	A multiphasic core–shell flurbiprofen and ciprofloxacin-loaded nanofibrous dressing cures infected burns *via* dual control of infection and inflammatory response **M Kamboj**, J Kaur**, V Rathi**, S Preet, **A Poundarik**, **B Das** - Biomaterials Science, 2026 **Abstract:** Burn injury treatment is usually accompanied by significant challenges, such as microbial growth and chronic inflammation. A multifunctional nanofibrous dressing with biphasic chemical properties is fabricated to regulate infection and inflammation in infected burns simultaneously. Hydrophobic polymer polycaprolactone (PCL) and hydrophilic polymer chitosan (CS) were used to fabricate a core–shell nanofibrous dressing that encapsulates the anti-inflammatory drug flurbiprofen (FLB) and the antibacterial drug ciprofloxacin (CIP). The dressings PCL–CS/FLB–CIP were characterized using TEM, FESEM, contact angle measurements, and FTIR spectroscopy. The phase boundaries in the fibers result in controlled release of both drugs, i.e., 70 h and 80 h, CIP and FLB, respectively, in vitro. The dressings exhibited significant ROS scavenging activity and in vitro biocompatibility over NHDF cells, with good cell adhesion for up to 7 days. The in vitro antibacterial properties exhibited maximum inhibition at 50–60 h against Staphylococcus aureus and Escherichia coli. Furthermore, the effect of FLB release showed immunomodulatory efficacy of the dressings when determined against macrophage-like THP-1 cells. Furthermore, the in vivo healing potential of the dressings was determined over infected burns with Staphylococcus aureus in BALB/c mice and this group showed significant healing on day 18 compared to the untreated group. Bacterial growth inhibition, re-epithelization, neovascularization, collagen reappearance, and orientation were determined using the colony count method, and H&E, MT, and VG staining, respectively. Also, evidence from IHC staining confirmed secondary skin organ formation. The PCL–CS-based dual drug delivery system provides synergistic enhanced therapeutic efficacy and could be a solution to the simultaneous challenges in burn wounds**.**
31.	A novel integration of direct absorption solar collector with thermal energy storage: A proof–of–concept investigation **AS Kashyap,** V Bhalla, **H Tyagi** - Applied Thermal Engineering, 2026 **Abstract:** Direct absorption solar collectors exhibit higher thermal efficiency compared to flat plate collectors; however, their continuous operation is constrained by the intermittent nature of solar energy. This limitation can be effectively addressed through integration with phase change material– based thermal energy storage. With this background, the present study investigates the thermal performance of a novel integrated direct absorption solar collector coupled with phase change material storage during complete charging–discharging cycle, with the primary objective of demonstrating extended thermal retention of heated nanofluid during discharging phase. Initially, a two–dimensional axisymmetric model was developed in COMSOL Multiphysics to simulate the radiative heat transfer within nanofluid contained in a copper receiver and the simultaneous heat transfer to the adjacent phase change material during the charging process. The computational results indicated that during 10–minute charging at an incident irradiation of 2.08 W/cm^2, the average nanofluid temperature increased from 22 °C to 73.4 °C storing 2650.92 J of sensible heat, and the average PCM temperature increased from 22 °C to 33.3 °C, storing 5800 J of combined sensible and latent heat. Following the computational analysis, an extensive experimental study was conducted with four integrated configurations comprising different combinations of nanofluid, phase change material, and insulation, for a complete charging–discharging cycle. With an optimized amorphous carbon–based nanofluid of 40 mg/l, configuration–4 (nanofluid with PCM and insulation) achieved a peak nanofluid temperature of 65.2 °C after 10 min of charging, and maintained nanofluid above 26 °C (higher than initial and

	ambient temperature) for 175 min of discharging, representing a 3.12 times improvement in thermal retention compared with baseline configuration. The computational and experimental results showed a relative error of 7.41% for average nanofluid temperature, and 1.63% for average phase change material temperature. Overall, the integrated system demonstrates strong technical feasibility for continuous solar thermal conversion with simultaneous energy storage, enabling effective utilization of stored heat during periods of solar intermittency. 
32.	A quercetin nanocarrier-loaded dual network injectable hydrogel for mesenchymal stem cells (MSCs) delivery targeting osteoarthritis **A Mukherjee, S Mitra,** N Chaudhuri, RK Sodhi, K Mukherjee, **B Das** - Small, 2026 **Abstract:** Osteoarthritis (OA) is a progressive, chronic disorder of the musculoskeletal system affecting more than 500 million individuals globally. Current treatment strategies primarily provide palliative care, with limited potential to alter disease progression or reverse tissue deterioration. Stem cell transplantation holds promising results. But poor cell retention and survival due to ROS and inflammation in OA lead to subpar therapeutic outcomes. In this study, we developed a dual-network gelatin methacrylate (GelMA) and κ-carrageenan-based injectable hydrogel loaded with antioxidant quercetin-PLGA nanoparticles for stem cell delivery to treat OA. Physicochemical studies demonstrated stable gelation, controlled degradation, and self-healing properties. In vitro studies revealed that the sustained release of quercetin effectively scavenged intracellular ROS, reduced the expression of pro-inflammatory factors such as IL6, COX2, NFκβ, and TNFα, and increased the expression of TGFβ, IL4, SOX9, COL2, and ACAN, which are responsible for inflammation control and cartilage tissue regeneration. The sustained release of nanoparticles also enhanced the M1-to-M2 macrophage transition and collagen II deposition. In vivo studies demonstrated that the nanoparticle-loaded stem cell-encapsulated hydrogel increased glycosaminoglycan deposition, reduced inflammation, and improved joint mobility and cartilage repair. Thus, this antioxidant hydrogel-based cell delivery system demonstrated suitability for OA therapy.
33.	A UAV-assisted SWIPT-enabled access point for BLE-based batteryless IoT sensor node **VK Malav, S Bansal, S Kumar, A Sharma -** IEEE Journal of Radio Frequency Identification, 2026 **Abstract:** The deployment of numerous Internet of Things (IoT) sensor nodes (IoTSNs) with batteryless operation is required in rural/harsh environments to reduce the maintenance cost related to battery replacement and achieve self-sustainable operation. To fulfill this requirement, an RF-based wireless power transfer (WPT) technique is used at the IoTSN, and an unmanned aerial vehicle (UAV)-based access point (AP) is utilized to provide the necessary RF power. In particular, a simultaneous wireless information and power transfer (SWIPT) transmitter technique (*Tx*) is used at the AP, where WPT is used to wirelessly energize the IoTSN. while wireless information transfer (WIT) is used to collect sensor data from the IoTSN. The conventional *Tx* systems are designed for only communication applications. In contrast, in this study, the simulation and measurement results demonstrate that the proposed *Tx* system achieves SWIPT operation with a latency of 10 seconds at a distance of 16 meters in a real environment. The system uses a relay-controlled battery power operation to make it more energy-efficient, resulting in a 449.24%

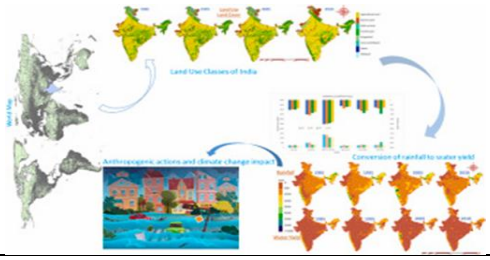
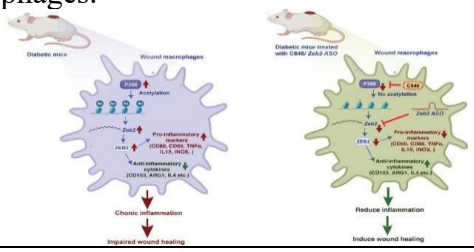
	increase in operational lifetime, thereby making it suitable for UAV-based BLE-IoTSN applications in harsh environments.
34.	Ab initio potential energy surface of NC 4 N-He: Rotationally inelastic collisions and rate coefficients **G Kaur, P Chahal, TJD Kumar** - Physical Chemistry Chemical Physics, 2026 **Abstract:** The rotational dynamics at the quantum level of dicyanoacetylene (NC_4N) with helium (He) is studied in the temperature range of 1–100 K. Cross sections for the rotational transitions are obtained and used in the estimation of the rate coefficients. An *ab initio*-derived potential energy surface (PES) for the NC_4N−He system was generated at the CCSD(T)/aug-cc-pVTZ level of theory, considering NC_4N as a rigid rotor. The PES exhibits a global minimum with a well-depth of −43.84 cm^{-1} and an angle of 67.5°. Legendre expansion coefficients were obtained through analytical fitting and subsequently employed in the calculation of rotational cross sections. The first bending vibration for the NC_4N molecule is at 107 cm^{-1}, and cross sections were computed for collisional energies up to 107 cm^{-1} using the close-coupling method. Resonances are observed in cross sections for lower collisional energy. The rate coefficients were calculated for temperatures ranging from 1 to 100 K. In the NC_4N–He collision system, rotational transitions corresponding to $\Delta j = 2$ are the most prevalent and exhibit higher rate coefficients compared to other transitions. The new rate coefficients obtained will help to accurately interpret NC_4N rotational spectra and abundance in interstellar clouds.
35.	Advancing wear resistance of HVOF-sprayed WC-NiCr coatings through laser remelting NK Singh, SS Rao…**H Singh**, PP Bandyopadhyay - The Journal of Thermal Spray Technology, 2026 **Abstract:** Thermal-sprayed coatings frequently exhibit inherent defects, including porosity, microcracks, and weak mechanical bonding, which deteriorate their overall quality. Laser remelting offers an effective means to refine the microstructure of these coatings and results in limiting these defects. In this regard, the current study investigates the effect of laser remelting (LR) at 300 W and 500 W on the microstructure, mechanical properties, and tribological performance of HVOF-sprayed WC-NiCr coatings. Laser remelting significantly refined the coating microstructure, reducing porosity and enhancing phase stability. The microhardness increased by 8% (LM1, 300 W) and 19% (LM2, 500 W) due to improved WC precipitation and the formation of secondary oxides. Tribological tests demonstrated a 27% reduction in the coefficient of friction (COF) and a 19% decrease in wear rate for LM2, attributed to the formation of protective tribolayers, including WO_3 and $NiWO_4$. Additionally, surface roughness (Sa) was reduced by 39%, contributing to smoother wear tracks and lower material loss. These findings highlight laser remelting as an effective post-processing technique to enhance the wear resistance, surface integrity, and mechanical robustness of HVOF-sprayed WC-NiCr coatings. The improved tribological performance suggests that laser-remelted coatings can serve as a sustainable and high-performance alternative to cobalt-based coatings, particularly for applications in aerospace, mining, and energy sectors, where extreme wear conditions prevail. 
36.	Age structure and inflation dynamics in pacific island economies A Letlet, K Rai, **B Garg**- Bulletin of Monetary Economics and Banking, 2026

	Abstract: This study uses the panel of six Pacific Island Countries (PICs) to investigate the relationship between changing age structures and inflation. The findings suggest that both aggregated and disaggregated shares of the working-age population exert disinflationary pressure. This supports the life cycle hypothesis, which postulates that people in their productive years tend to save and produce more than they consume, fostering economic stability and managing inflation. Conversely, the findings indicate that old-age dependency contributes to inflationary pressures. These insights underscore the importance of demographic dynamics in shaping inflation trends and provide valuable guidance for policymakers aiming to maintain price stability.
37.	Copper-catalyzed intramolecular carbocyclization/1,2-migration reaction of allenols to access substituted 2-sulfonyl carbazoles **P Singh, P Nain**, MV Mane, **AC Shaikh** - Organic Letters, 2026 **Abstract:** A copper-catalyzed intramolecular cascade carbocyclization/1,2-migration of C-2 indolyl-allenol has been achieved to construct the library of 2-sulfonyl carbazoles, which possess considerable biological significance. This modular protocol is operationally simple, exhibiting a broad substrate scope with consistently high yields. Additionally, gram-scale synthesis, product diversification of 2-sulfonyl carbazoles, and DFT studies of the catalytic cycle have been performed. Overall, this study unfolds a new strategy for the one-pot synthesis of sulfonyl carbazoles, which holds significance in medicinal and material chemistry. 
38.	Coupled dynamics of resource competition and constrained entrances in a multi-lane bidirectional exclusion process **AK Pandey, AK Gupta** - SciPost Physics Core, 2025 **Abstract:** Motivated by the role of limited particle resources in multi-species bidirectional transport processes observed in various biological and physical systems, we investigate a one-dimensional closed system consisting of two parallel lanes with narrow entrances, where each lane accommodates two oppositely directed particle species. Each particle species is linked to a separate finite reservoir, which is coupled to both lanes and regulates the entry rates of particle into the lanes. To analyze the effect of finite particle reservoirs on the stationary properties of the system, we employ a mean-field theoretical framework to characterize the density profiles, particle currents, and phase behavior, complemented by a boundary layer analysis based on fixed point methods to capture spatial variations near the boundaries. The impact of individual species population, quantified by species-specific filling factors, is systematically examined under both equal and unequal conditions. For equal filling factors, system undergoes spontaneous symmetry breaking and supports both symmetric and asymmetric phases. In contrast, for unequal filling factors, only asymmetric phases are realized, with the phase diagram exhibiting up to five distinct phases. A striking feature observed in both scenarios is the emergence of a back-and-forth transition, along with a non-monotonic dependence of the number of phases on the filling factors. All theoretical findings are extensively validated through stochastic simulations based on the Gillespie algorithm, confirming the robustness of the analytical results.
39.	Development and characterization of functionally graded Al–SS316L material via hybrid cold spray and wire arc additive manufacturing **P Kumar, J Kumar, H Singh** - Progress in Additive Manufacturing, 2026

	Abstract: Fabricating dissimilar metal functionally graded materials (FGMs) such as Al–SS316L remains a challenge due to metallurgical incompatibility and brittle intermetallic formation in fusion-based additive manufacturing. This study demonstrates the development of Al–SS316L FGMs using a hybrid manufacturing approach that combines Wire Arc Additive Manufacturing (WAAM) and Cold Spray Additive Manufacturing (CSAM). In this work, SS316L wall fabricated by WAAM was coated with a 3 mm thick coating of aluminum (Al) by cold spray to create a graded structure. Post-deposition heat treatment at 350 °C/2 h and 450 °C/1 h was carried out to reduce work hardening effect and enhance densification without promoting intermetallic formation at the interface. Microstructural analysis revealed that the as-sprayed aluminum coating exhibited a typical splat morphology with the presence of intersplat porosity, which got significantly densified upon heat treatment, reducing porosity from 4.2 ± 1.3 to $1.5 \pm 0.5\%$. Microhardness measurements showed significant work hardening in the as-sprayed coating (48.3 $HV_{0.05} \pm 5$) compared to the feedstock powder (23.9 $HV_{0.01}$). After heat treatment, the hardness decreased, reaching 30.1 $HV_{0.05} \pm 3.5$ at 350 °C/2 h and further reducing to 25.1 $HV_{0.05} \pm 3.5$ at 450 °C/1 h, which is close to the original feedstock hardness. In comparison, the WAAM-fabricated SS316L sample showed a considerably hardness of 188 $HV_{0.3} \pm 6$, consistent with its fusion-based processing and dense microstructure. Fracture surface analysis indicated a transition from inter-splats decohesion in the as-sprayed state to few micro-void coalescences at 450 °C/1 h, confirming improved cohesion of the Al layer. Scratch test demonstrated that heat treatment reduced the coefficient (COF) and improved scratch stability, reflecting improved cohesion of the coatings. EDS map and line scans across the CS–WAAM interface confirmed the absence of intermetallic compounds, ensuring interface integrity. This hybrid approach offers a viable pathway for fabricating metallic FGMs with tailored properties for different applications. The novelty of this work lies in the development of a hybrid additive manufacturing route using WAAM and CS as primary processes, followed by heat-treatment as a secondary process to develop FGMs.
40.	Dynamic characteristics of jointed rock masses with a natural rubber latex dampening layer under seismic loading conditions **S Rohilla, R Sebastian** - International Journal of Geomechanics, 2026 **Abstract:** In rock dynamics problems, evaluating the dynamic characteristics of a jointed rock mass during the propagation of shear waves generated by seismic and other explosive loading is of utmost importance. The effectiveness of natural rubber latex (NRL) as a dampening layer in rock joints has been investigated. The effectiveness of joint spacing on the dynamic response of rocks has been studied using gypsum plaster samples with one to four horizontal joints layered with a 3-mm-thick NRL filling. The dynamic characteristics were evaluated using resonant column (RC) and cyclic torsional shear (CTS) tests across varying strain amplitudes, confining pressures, and loading frequencies. The results revealed that NRL-filled joints consistently exhibited reduced shear modulus and enhanced damping ratios compared to plain jointed specimens. The influence of joint spacing, confining pressure, strain amplitude, and frequency was quantified using regression analysis, showing that NRL-filled specimens were more responsive to joint spacing, while plain joints were more affected by strain amplitude and confining pressure. The viscoelastic nature of NRL contributed to improved energy dissipation, particularly under cyclic loading, in which CTS tests showed greater damping sensitivity than RC. The Ramberg–Osgood and modified hyperbolic models were used to fit the experimental results acquired from RC and CTS tests. These findings confirm that incorporating NRL in jointed systems can substantially improve attenuation characteristics under seismic-type loads. This study offers a practical material-level solution for mitigating dynamic amplification in jointed rock masses, providing a foundation for further exploration in field-scale geotechnical applications.
41.	Electrocatalytic oxidation of methanol: Role of thorium (Th) doping in MoSe2 S Yadav, R Pawar, **R Ahuja** - RSC Applied Interfaces, 2026

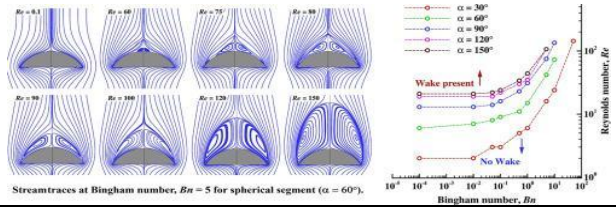
	Abstract: This study investigates the interaction of methanol (CH_3OH) with transition metal dichalcogenides (TMDCs), focusing particularly on the effect of thorium (Th) doping on the methanol oxidation reaction (MOR). Density functional theory (DFT) and periodic energy decomposition analyses reveal that Th doping enhances methanol adsorption through stronger orbital and electrostatic interactions, as supported by d-band center shifts and charge transfer analysis. Among various reaction pathways, methanol dehydrogenation via the CHOH* intermediate is identified as the most favorable due to its low Gibbs free energy. Electrochemical analyses show an onset potential of 1.02 V vs. RHE, a peak current density of 0.20 mA cm^{-2}, and remarkably low charge-transfer resistance, attributed to Th-induced electronic modulation. The calculated mass activity (M_A) of Th-doped $MoSe_2$ is 0.400 A mg^{-1}, surpassing several reported Pt-based catalysts, including Pt/gCN (0.310 A mg^{-1}) and Pt/NiCo-LDH (0.379 and 0.205 A mg^{-1}). CO stripping experiments and spectroscopic analyses (^{13}C NMR and FTIR) confirm complete CO oxidation. This work establishes Th-doped $MoSe_2$ as a robust and poison-resistant catalyst for sustainable energy applications, combining experimental validation with atomic-scale insights.
42.	Encoding and decoding of brain dynamic functional connectivity for ADHD diagnosis D Girish, YH Chan**, S Gupta**… - IEEE Journal of Biomedical and Health Informatics, 2026 **Abstract:** Recent studies have demonstrated strong associations between the changes in dynamic functional connectivity (FC) and both behavioral and cognitive functions. The sliding window technique is the most widely used method for evaluating dynamic FC; however, it faces two key challenges: distributional shifts across windows and high dimensionality, as FC is computed across windows of the entire time series. To address these issues, we propose BRAINMAP (Bi-level Representation using Attention for INterpretability with Mamba-Aided Prediction) to model the dynamic FC of the brain. BRAINMAP employs the Optimal Transport technique to correct distributional shifts across sliding windows and leverages Graph Neural Networks (GNNs) in conjunction with a hybrid approach that integrates an attention mechanism and the Mamba block to effectively capture spatiotemporal features for functional MR images. Finally, we introduce a novel Top-K sliding window feature selection algorithm to induce sparsity in dynamic FC. We conducted an extensive evaluation of our model for diagnosing Attention Deficit Hyperactivity Disorder (ADHD) using three resting-state fMRI datasets: ADHD-200, UCLA, and CNI-TLC, which comprise a total of 447 subjects with ADHD and 845 typically developing controls. Our architecture outperformed existing state-of-the-art dynamic FC models in ADHD detection, achieving improvements ranging from 3% to 12% across the three datasets. We demonstrate that our proposed model produces robust biomarkers, most notably the connection between the dorsal attention network and the visual network. Using an association study, we further establish the clinical relevance of the identified biomarkers.
43.	Enhanced electron-phonon coupling due to layered-perovskites octahedral tilting in hole doped cuprate superconductor I Isha… **R Ahuja**, VG Sathe, NP Lalla, AK Yogi - Journal of Physics: Condensed Matter, 2026 **Abstract:** The electron–phonon (e-ph) coupling is crucial in explaining various ordering phenomena such as superconductivity and charge density waves (CDW) which has been invoked to explain Cooper pair formation leading to superconductivity, however, the origin of charge state mechanism is not yet fully understood. Here we study the role of e-ph coupling in understanding the interplay of the structural phase transition, CDW transition, superconducting transition, and flat electronic band dispersion in the La$_{2-x}$Sr$_{x}$CuO$_4$ (x = 0.15) superconductor. We employed high-resolution temperature dependent x-ray diffraction and Raman scattering measurements in combination with first-principles calculations across the phase-transitions. We

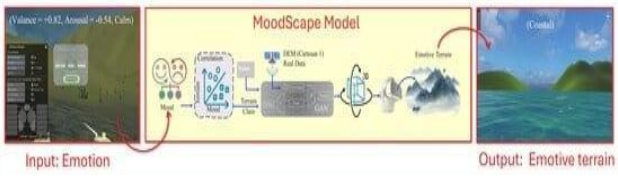
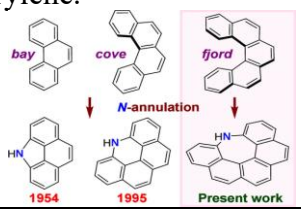
	unveil the dominant role of CuO$_6$ octahedra distortion and tilting which suggests the presence of strong e-ph coupling that gradually develops high alternating CuO$_6$ octahedra rotations [in-phase (+ve) and anti-phase (-ve); ϕ $\approx$ 3°)] which can further enhanced e-ph coupling below the structural-phase transition (T_s = 150 K), leading to the symmetry-breaking. We observe that the local distortion of CuO$_6$ including tilting and phonon modes at $\cong$ 430, 360, 225, and 100 cm^{-1} may associated with CDW correlations below T_s. Further, our theoretical calculations across the superconducting transition suggests the presence of strong hybridization of Cu 3d with O 2p orbitals, indicating the role of alternating CuO$_6$ octahedra tilt in the electronic structure of La$_{2-x}$Sr$_{x}$CuO$_4$. Thus, the octahedral tilt played a crucial role in the origin of the CDW phase.
44.	Graphics processing unit accelerated Helmholtz equation solver in two dimensions using the traditional Born series formulation for linear and nonlinear media in biomedical ultrasound U Mandal, **J Singh,** BT Cox, RK Saha - Journal of the Acoustical Society of America, 2026 **Abstract:** This study numerically solves inhomogeneous Helmholtz equations modeling acoustic wave propagation in homogeneous and lossless, absorbing and dispersive, and inhomogeneous and nonlinear media. The traditional Born series (TBS) method has been employed to solve such equations. Simulated pressure field patterns for a linear array of acoustic sources (a line source) estimated by the TBS procedure exhibit excellent agreement with that of a standard time domain approach (the K-WAVE toolbox). For instance, the maximum absolute error of normalized pressure amplitude made by the proposed technique for the homogeneous and lossless medium is with respect to the latter method. The TBS scheme, though iterative, is a very fast method. For example, the graphics processing unit (GPU)-enabled CUDA C code implementing the TBS procedure for calculating the pressure field for the homogeneous and lossless medium is 102× faster than the K-WAVE module and also 4× faster than the corresponding central processing unit C code for the computational domain considered in this study (4096 x 4096). The findings of this study demonstrate the effectiveness of the TBS method for solving inhomogeneous Helmholtz equation, while the GPU-based implementation significantly reduces the computation time. In this work, the capability and performance of the method have been tested in two dimensions only.
45.	Holistic assessment of India's water security using coupled climate-human intervention models **S Pathak,** D Jato-Espino, C Zevenbergen - Environmental Research, 2026 **Abstract:** Water resources planning and quality governance plays a crucial role in socio-economic growth, development, public health, and ensuring food and energy security. However, managing it is increasingly challenging due to the effects of climate change and human interventions. Sub-catchment scale modeling has become a practical approach to addressing these spatial and temporal variations. The InVEST model, developed by the Natural Capital Project, is a reliable solution to estimate water quality and resources as it adopts a robust technique for understanding water security for socio-economic progress. This study attempts to understand water security across four decades by examining dynamic shifts in climate variability. The analysis stratifies India into six major physiographic divisions reflecting variations in physical features, geological structure, and topographic relief, which collectively influence the nation's landscape, climate, and ecosystems. Land use and land cover was categorized to eight categories revealing a decrease in forest, barren land, and snow/glacier areas, while agricultural land, urban areas, wetlands, water bodies, and rangelands showed an increasing trend. Despite these shifts, the percentage of mean rainfall converted to water yield across the decades remained relatively consistent, estimated at 38%, 36%, 33%, and 32% for the years 1985, 1995, 2005, and 2018, respectively. Additionally, it has been observed that potential evapotranspiration has significantly increased spanning across four decades. This trend states that the climate change and human interventions have drastically impacted the potential evapotranspiration across decades but not much significant change has been

	observed in precipitation. The potential evapotranspiration is the driving factor that contributes to more frequent flooding and drought events. To mitigate these challenges, careful evaluation of urban land use classes is recommended to minimize environmental impacts and hydrological stability. 
46.	Hyperglycemia-induced P300/CBP acetyltransferase drives ZEB2-mediated pro-inflammatory macrophages and delays wound healing **S Roy, D Patra, P Ramprasad,** S Sharma…**D Pal -** JCI insight, 2026 **Abstract:** Chronic hyperglycemia changes the expression of various transcription factors and mRNA transcripts that impair cellular functionality and delay wound healing. Zinc finger E-box-binding homeobox 2 (ZEB2), a key transcription factor, maintains tissue-specific macrophage identities; however, its role in regulating macrophage polarization during wound healing under hyperglycemic conditions remains unclear. Here, we found that persistent hyperglycemia increases ZEB2 expression in wound macrophages via histone acetylation, contributing to chronic inflammation and delayed wound healing. Exposure to high glucose levels activated P300/CBP, a transcriptional coactivator involved in histone acetylation, which enhanced ZEB2 expression in wound macrophages. The forced expression of ZEB2 shifted macrophage polarity toward a proinflammatory state by upregulating myeloid lineage-directed transcription factors. Conversely, silencing Zeb2 at the wound site reduced hyperglycemia-induced macrophage inflammation. Topical application of C646, an inhibitor of P300, at the wound edges of streptozotocin-induced high-fat diet-fed diabetic mice significantly decreased ZEB2 expression, reduced inflammation, and accelerated wound healing. Therefore, targeted inhibition of P300 represents a promising therapeutic strategy for improving diabetic wound healing by modulating ZEB2-driven inflammation in wound macrophages. 
47.	Immunity in harmony: Utilizing overlapping epitopes for tuberculosis and COVID-19 Protection **K Pasricha, S Prajapati, T Lamba, JA Malik, MA Khan, S Nanda, MA Zafar, NM Tripathi, A Bandyopadhyay, JN Agrewala** - Protein and Peptide Letters, 2026 **Abstract:** Introduction: The BCG vaccine, widely administered against tuberculosis, has also been linked to reduced incidence of bacterial and viral infections, particularly those affecting the respiratory tract. Its antigens enhance innate immune responses and contribute to therapeutic effects, such as those observed in bladder cancer. Notably, reduced COVID-19 incidence has been reported in BCG-vaccinated populations from TB-endemic regions. Methods: To investigate this hypothesis, immunoinformatics tools were employed to identify overlapping CD4, CD8, and B-cell epitopes shared between Mycobacteria and SARS-CoV-2. The most promising CD8 epitope was synthesized using the SPPS-Fmoc method, and antigen-specific T-cell proliferation was evaluated by CFSE dye-dilution assay. Additionally, the expression of pro- and anti-inflammatory

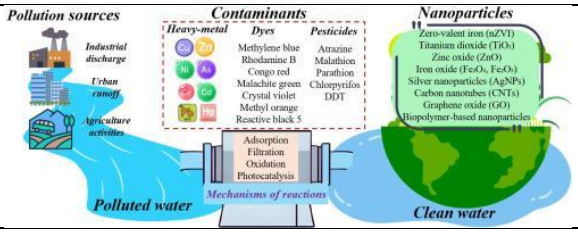
	molecules was assessed using qRT-PCR. Results: Multiple overlapping T-cell and B-cell epitopes were identified between Mycobacteria and SARS-CoV-2. The T-cell epitopes displayed promiscuous binding characteristics, high immunogenicity, and strong affinity for both HLA class I and class II alleles. Experimental validation using the most immunodominant T-cell epitope confirmed its ability to induce proliferation and differentiation of T cells isolated from COVID-19-vaccinated individuals. Discussion: The overlapping T-cell and B-cell epitopes identified through this approach may provide broader and more robust protection than initial exposure to virus-specific antigens, which the immune system encounters for the first time during infection or vaccination. This strategy may therefore support the rapid and effective development of future vaccines, particularly against emerging pathogens. Conclusion: The findings suggest that the higher level of protection observed in TB-endemic countries during recent pandemics may be attributable to cross-reactive mycobacterial antigens that stimulate protective immunity.
48.	Influence of varying seismic hazard and underlying soil on the efficacy of rocking foundation for an RC frame-shear wall building system **R KKK**, MK Rajamanickam, **Z Naorem, P Haldar** - Journal of Structural Design and Construction Practice, 2026 **Abstract:** Reinforced concrete (RC) frame-shear wall building systems are widely adopted in India due to their high strength and stiffness, making them effective in resisting lateral seismic forces. However, their performance during extreme seismic events has revealed limitations, particularly in terms of structural resilience. Foundation rocking is a novel approach for enhancing the seismic resilience and has caught the eye of several researchers. However, allowing the foundation to rock will result in the increase of displacement caused by rotations at the base of the foundation which may cause permanent settlements depending on the underlying soil properties. This study investigates the potential of foundation rocking as an innovative strategy to enhance the seismic resilience of high-rise RC frame-shear wall buildings. Four varying degrees of foundation rocking that can be allowed without compromising the integrity of the building system were analyzed to ensure structural integrity while improving performance. The seismic behavior was assessed through key parameters, including maximum superstructure displacement, peak moment at the foundation, settlement of underlying soil, self-centering ratio, and tipping over ratio. Results demonstrate that the displacements induced by rocking remain within the permissible limits outlined in Indian standards. Additionally, rocking foundations effectively reduce peak moments during seismic events, thereby lowering the seismic demand on the superstructure. The calculated self-centering and tipping over ratios confirm adequate safety margins for all considered scenarios. Overall, the study concludes that controlled foundation rocking significantly enhances the seismic resilience of RC frame-shear wall systems, offering a promising direction for earthquake-resistant construction in India.
49.	Intermetallic synergy between CeOx-Co accelerates the selective production of p-xylene from PET plastic waste over core-shell type cobalt phyllosilicates catalysts **A Manal, R Srivastava** - Journal of Materials Chemistry A, 2026 **Abstract:** The catalytic upcycling of PET waste into value-added aromatics, particularly p-xylene (PX), has attracted considerable research interest. Nevertheless, the rational design of non-precious metal catalysts capable of achieving high PX selectivity while simultaneously ensuring long-term structural and catalytic stability remains a significant challenge. Herein, CeO_x-modified Co-phyllosilicate (Co-PS) core–shell structured catalysts were synthesized using a single-step approach, yielding a crystalline 2 : 1 phase of sandwich-like layered phyllosilicate. Controlled Ce incorporation induced structural and electronic modulation, forming a strong CeO_x–Co interfacial site within a flower-like Co-PS architecture. Among the series, the $Ce_{3.0}Co$@Co-PS catalyst achieved complete PET conversion with a PX yield of 93.2%. Notably, the catalyst also

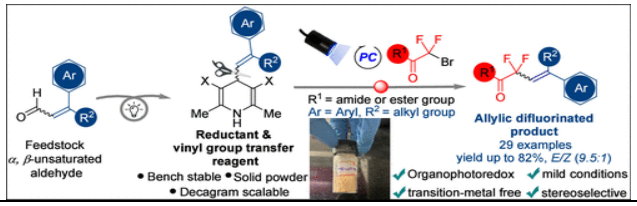
	demonstrated excellent performance for real and mixed PET waste, even in the presence of additives, showcasing broad substrate scope and practical utility. Comprehensive investigation revealed that the introduction of Ce induces Co^0 exsolution from the Co-PS framework, accompanied by lattice distortions and partial delamination of the phyllosilicate structure. Characterization, kinetics, and FT-IR studies revealed that the strong CeO_x–Co interfacial sites, characterized by enhanced oxygen vacancies and strong acid sites, promoted ester C 00000000 00000000 00000000 00000000 11111111 00000000 11111111 00000000 00000000 00000000 O bond activation; meanwhile, hydrogen spillover across the interface facilitated efficient ester bond hydrogenolysis. The comparative assessment revealed that $Ce_{3.0}Co$@Co-PS achieved a high PX formation rate (11.3 $mmol_{PX}\ g_{metals}^{-1}\ h^{-1}$) with a low environmental impact. This work presents a selective, sustainable catalytic strategy for the efficient upcycling of PET into liquid aromatics.
50.	Investigating the transition from ploughing to shearing in micromilling of additively manufactured Ti6Al4V **S Imam, G Saraf, CK Nirala, A Agrawal** - Nanotechnology and Precision Engineering, 2026 **Abstract:** Compared with wrought Ti6Al4V, additively manufactured (AM) Ti6Al4V exhibits more severe machining difficulties owing to its lower thermal conductivity and higher hardness. AM components often possess lower ductility, anisotropic microstructures, residual stresses, and porosity-related defects, further complicating post-printing micromachining. With the growing demand for miniaturized and high-precision components, micromilling remains a crucial technique for producing features such as microgrooves and channels, and is expected to retain its importance for machining AM Ti6Al4V. However, micromilling faces challenges such as ploughing, excessive tool wear, and high specific cutting forces. This study examines the influence of ploughing and shearing on tool wear, surface morphology, burr width, surface roughness, and specific cutting force across varying feed rates and axial depths of cut. The results indicate a transition from ploughing to shearing as the feed rate and depth increase, improving cutting efficiency. Surface morphology efficiency improves from 81% to 97% (width) and from 75% to 98% (depth). Tool wear is highest at low feed rates and shallow depths owing to rubbing, while larger depths increase wear owing to greater tool engagement. Intermediate depths showed reduced wear. The percentage difference between experimental and ideal specific cutting forces decreases from 63% to 4% with increasing feed rate and depth. Surface roughness improves with increasing feed, but deteriorates at the highest depths, while burr width decreases with both parameters.
51.	Microplastics (< 40 µm) in commercial bottled drinking water from India: Advanced spectroscopic characterization, source attribution and human exposure risk **VS Pawak, VA Loganathan, M Sabapathy** - Results in Engineering, 2026 **Abstract:** The pervasive presence of microplastics (MPs) in drinking water has raised global concerns regarding human health and environmental safety. This study presents a comprehensive investigation of MP contamination in bottled drinking water from six major Indian brands, employing fluorescence microscopy, scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy, and Micro-Raman spectroscopy for detailed characterization. All samples showed the presence of microplastics (MPs), with concentrations ranging from 808 to 1888 particles per liter, surpassing levels reported in most international studies. A closer look at their morphological studies showed that the majority, about 56.7%, were fragments, and more than 91% of the microplastics measured were smaller than 40 µm. Polymeric identification revealed that polyethylene terephthalate (PET), polystyrene (PS), polyethylene (PE), and polypropylene (PP) are the most prevalent polymers, which correspond to commonly used packaging materials. Using optical and fluorescent microscopy, we observed transparent microplastics (54.8%) as the dominant fraction, followed by black and colored particles, suggesting that the bottle body, caps, and handling-induced degradation are the primary sources of MPs. On a body weight basis,

	children were at higher risk of consuming microplastic particles (479.6 MP/kg BW/year). Overall, this study provides data on small-sized microplastics in commercially packaged drinking water and offers comparative insights that support ongoing efforts to improve monitoring methods and packaging solutions. 
52.	Momentum and heat transfer from spherical sections in Bingham plastic fluids **P Suri, SA Patel, T Mondal**, RP Chhabra - Applications in Engineering Science, 2026 **Abstract:** Extensive numerical results on the momentum and heat transfer from several isothermal segments of a sphere submerged in Bingham plastic fluids are presented here. These results embrace wide ranges of particle shapes ($30° \leq \alpha \leq 150°$, where 2α is the angle subtended by the section removed from the sphere) with its flat surface oriented towards to the free stream and of the relevant kinematic parameters, Reynolds number (0.1–150) and Prandtl number (0.1–100) and the rheological parameters ($0 \leq Bn \leq 100$). Included here are also the results for the limiting Newtonian fluid behaviour ($Bn = 0$). Detailed kinematics of the flow is discussed in terms of streamtraces, velocity and isothermal contours and the apparent yield surfaces delineating the yielded and unyielded subdomains present in the flow field. The gross macroscopic behaviour is captured in terms of the hydrodynamic drag coefficient and Nusselt number as functions of Reynolds number, Bingham number and Prandtl number for six cut-sections of the sphere. The Nusselt number bears a positive relationship with both the Reynolds and Prandtl numbers whereas the influence of Bingham number is modulated by the degree of bluntness of the spherical segment, i.e., the value of α. The paper is concluded by presenting predictive correlations for estimating the value of drag coefficient and Nusselt number in a new application and by performing comparisons with limited experimental data.  Streamtraces at Bingham number, $Bn = 5$ for spherical segment ($\alpha = 60°$).

53.	MoodScape: Emotion-informed terrain synthesis for virtual reality system **RK Rai**, R Bansal, **SS Jha** - Multimodal Technologies and Interaction, 2026 **Abstract:** (1) Background: Virtual environments (VEs) significantly influence human emotions through various elements such as lighting, color, and terrain. While the effects of lighting and color on emotions within VEs have been extensively studied, the impact of the terrain remains underexplored. This paper addresses this gap by investigating the correlation between terrain characteristics in VEs and users' emotional states. (2) Methods: We conducted a user study in which participants were exposed to various 3D terrains and used the Self-Assessment Manikin (SAM) to rate their emotional responses (valence, arousal, and dominance). Building on these insights, we propose MoodScape, an automated framework for emotion-informed terrain generation that significantly reduces the need for extensive expertise and manual effort. In the current implementation, continuous SAM valence–arousal targets are discretised into four quadrant-based affect/terrain classes, and this discrete class label conditions DH-CVAE-GAN terrain synthesis. MoodScape designs a generative adversarial network (GAN) architecture called DH-CVAE-GAN, which integrates a dual-head conditional variational autoencoder as the generator alongside a discriminator network to ensure effective and realistic terrain generation. The DH-CVAE-GAN is trained on a satellite-derived digital elevation model (DEM) dataset, which helps the generated terrains reflect realistic geographic patterns. (3) Results: Quantitative and qualitative evaluations on our study sample suggest that MoodScape can generate terrains whose perceived affective tone is broadly consistent with the specified affect-class inputs, indicating potential applications in gaming and exploratory therapeutic Virtual Reality, while formal clinical efficacy remains in future work. 
54.	N-Annulated [5]Helicenes: Syntheses, (Anti)Aromaticity and properties **HK Saha**, Tarun, **V Kumar**, D Mallick, UK Pandey, **S Das** - Organic Letters, 2026 **Abstract:** N-Annulated [5]helicene (NH5) and its dibenzo-extended derivatives are synthesized by cycloisomerization and Scholl-type cyclodehydrogenation methods, respectively. Nitrogen-bridging of fjord-carbons 1 and 14 of [5]helicene endows saddle-like NH5 featuring an antiaromatic azepine core with enhanced orbital overlap between nitrogen and the carbon π-system. N-Annulation results in less stabilized HOMO, a smaller HOMO–LUMO energy gap, red-shifted absorption, fluorescence, paratropic ring current over the azepine unit, and tunable aromaticity of the core relative to pristine [5]helicene. The NH5 derivatives exhibit space-charge-limited current hole mobility on the order of 10–3 cm2 V–1 s–1, which is higher than that of N-annulated PAH, like N-annulated perylene. 
55.	Nanoarchitectonics of porous carbons templated by inorganic metal oxides and alkali metal salts for energy and environmental applications G Singh, J Kunjumon, H Kaur, **N Singh**, G Franklin… - Advanced science, 2026

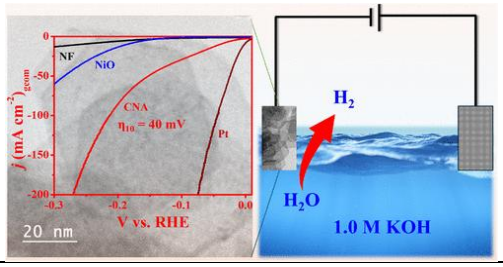
	Abstract: Inorganic nanoparticles are widely used as sacrificial templates for the synthesis of porous carbons due to their good thermal stability, characteristic shapes, tunable sizes, compatibility with carbon precursors, and lower cost and toxicity than conventional silica-based templates. Their use not only ensures the development of hierarchical porosity but also the creation of short-range graphitic domains in the carbon matrix. These qualities make porous carbons suitable for different applications, including adsorption, separation, catalysis, and energy storage and conversion. Within the series of inorganic nanoparticle templates, metal oxides such as MgO, ZnO, Fe2O3, Fe3O4, and MnO2, and alkali metal salts such as NaCl and KCl stand tall as templates. They are thermally and structurally stable, do not react with the carbon precursor, and do not require high-cost, harsh removal methods such as HF washing. This review provides up-to-date discussions of metal oxides (MgO, ZnO, Fe2O3, Fe3O4, and MnO2) and metal salts (NaCl, KCl, and composite salts) to produce porous carbons and addresses other aspects of their structures. This is a focused review that critically analyzes the recently published literature and will serve as a guiding framework for the future design and development of porous carbons.
56.	Nanoparticles for sustainable wastewater treatment: Advances in synthesis, characterization, and remediation applications **R Kumar, M Sabapathy, VS Pawak, R Ranjan**… - Results in Engineering, 2026 **Abstract:** Currently, the demand for safe and clean water is increasing dramatically worldwide. Therefore, the recycling and reuse of wastewater effluents play a crucial role in supplementing the limited availability of clean water. To protect the environment and public health, wastewater treatment is a vital process. Therefore, it is essential to develop and implement advanced wastewater treatment methods that are both highly efficient and economical. Researchers have employed various innovative approaches for treating wastewater. However, Conventional methods for wastewater treatment are costly, require high energy consumption, and often require large land areas, making them unsuitable for many regions. To obtain desirable solutions to these problems, researchers have recently turned to the use of nanoparticles. Nanoparticles present a promising option for water treatment, offering their extensive surface area and improved chemical properties. Recent studies summarized in this review indicate that nanoparticle-based treatment systems frequently achieve removal efficiencies above 90 - 99% for heavy metals and more than 72 - 99.9% degradation efficiency for dyes and organic contaminants under optimized conditions. Despite ongoing research, our understanding in this domain remains relatively limited. This review provides a comprehensive knowledge of the synthesis routes, including physicochemical and green routes, characterization techniques, and the diverse classes of nanoparticles employed in wastewater remediation. Special emphasis is placed on zerovalent metals, metal oxides, carbon-based nanomaterials, and biopolymer-derived nanoparticles for removing toxic metals, organic contaminants, dyes, pharmaceuticals, and pathogens from polluted water sources. Reported studies further demonstrate that magnetic and photocatalytic nanoparticles enable rapid pollutant removal with improved recovery and reuse potential, enhancing process sustainability and reducing operational costs. This study also explores the prospective advancements in nanotechnology and the potential of nanoparticles in enhancing wastewater treatment efficiency, capitalizing on their unique surface properties, chemical characteristics, and tunable surface modification. Overall, nanoparticle-assisted treatment approaches show strong potential for scalable wastewater remediation with reduced treatment time and improved contaminant removal performance compared to many conventional systems. Through a comprehensive review of various classes of nanomaterials, this manuscript aims to explain the advancements in nanotechnology for wastewater management, thereby contributing to knowledge in this field and offering insights into sustainable and cost-effective wastewater treatment strategies.

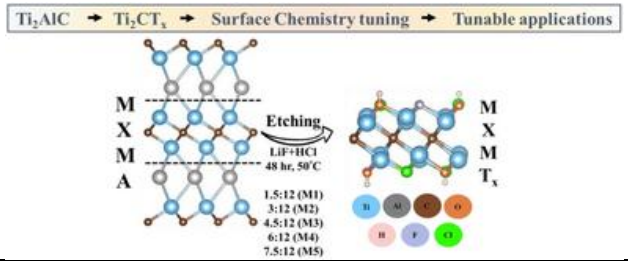
	
57.	NiTi wire welding using Fe, Cu and Ni fillers: multi-objective modelling and AHP–entropy approach to sustainability evaluation SR Parimanik…**S Rathor, R Kant** - Engineering Computations, 2026 **Abstract:** Purpose: This research introduces a comprehensive framework for optimising fibre laser butt welding of NiTi shape memory alloy (SMA) wires, integrating experimental studies, predictive modelling and sustainability evaluation, with particular focus on the tensile strength–corrosion trade-off. Design/methodology/approach – A 43-run central composite design (CCD) experiment was conducted to assess how laser power, pulse duration, frequency, wire diameter and filler powder types (Fe/Cu/Ni) influence tensile strength and corrosion rate. The resulting response patterns were examined using ANOVA and Pareto charts, and three modelling methods – adaptive neuro-fuzzy inference system (ANFIS), particle swarm optimised ANFIS (PSO-ANFIS) and Gaussian process regression (GPR) – were compared. A hybrid AHP–entropy approach was used to benchmark the sustainability of different welding techniques. Findings – ANOVA and Pareto analysis confirmed pulse time, frequency and power as dominant factors for both responses. Fe filler produced tensile strengths over 400 MPa, while Ni filler had the lowest corrosion rate (~0.001298 mm/year) and more uniform weld microstructures, showing a strength–corrosion trade-off. GPR model outperformed others with high accuracy for tensile strength (R^2 = 0.8752; RMSE = 23.9706 MPa) and corrosion rate (R^2 = 0.9565; RMSE = 0.0001 mm/year). Confirmatory tests supported predictions, and fibre laser welding was ranked most sustainable. Practical implications – The integration of predictive modelling with sustainability evaluation offers a strong tool for optimising technical performance and environmental impact in NiTi SMA welding. This study's insights are vital for industrial engineering, where high-performance materials and sustainable manufacturing improve reliability, cut costs and ensure environmental compliance. Originality/value – The proposed methodology offers a novel comparative perspective on modelling strategies, supporting informed decision-making in advanced manufacturing using a relatively small dataset.
58.	Numerical simulation of the thermodynamic and hydrodynamic effects on viscous fingering in partially miscible systems RX Suzuki, HD Moriga, T Ban, **M Mishra**, Y Nagatsu - Physics of Fluids, 2026 **Abstract:** The displacement of a more viscous fluid by a less viscous fluid in porous media or Hele–Shaw cells exhibits fingerlike interfacial patterns known as viscous fingering (VF). Classically, VF dynamics are divided into two categories depending on whether the fluids are fully miscible or immiscible. Recently, attention has been drawn to a third category, namely, VF in partially miscible systems. Our previous numerical study showed that, in such systems, VF patterns can transition to multiple droplet patterns with certain values of parameters. In the present work, we numerically investigate the effects of seven key parameters on partially miscible VF dynamics: (i) Péclet number, (ii) log-mobility ratio, (iii) Korteweg force, (iv) interfacial energy, (v) and (vi) two transport parameters governing mass transfer, and (vii) a parameter for the bulk free energy. We find that fingering patterns are primarily governed by the hydrodynamic parameters (i) and (ii) and the chemical–thermodynamic parameters (iii) and (iv), whereas droplet patterns are mainly controlled by the chemical–thermodynamic parameters (v), (vi), and (vii). This parametric study contributes to improved prediction and control of processes such as enhanced oil

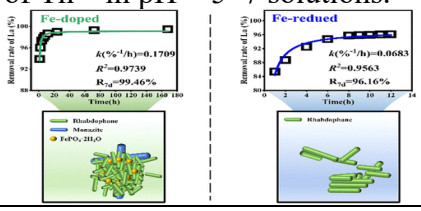
	recovery and CO_2 sequestration, where partially miscible systems arise under high temperature and pressure.
59.	On Narkiewicz problem 22 for number fields associated with certain quadrinomials **T Chatterjee, K Kumar** - Mathematica Slovaca, 2026 **Abstract:** Let $K = \mathbb{Q}(f_0)(\theta)$ be a number field corresponding to the minimal polynomial f(x) = x n + axn−1 + bx + c over the field ℚ, where θ is an algebraic integer. In this paper, we provide sufficient conditions for i(K) = 1 and i(K) = 2, which give a partial answer to the Narkiewicz Problem 22 for these number fields, where i(K) is the index of K. Finally, we provide examples of infinite families of number fields for which i(K) = 1 and i(K) = 2.
60.	Organophotoredox-catalyzed vinyl group transfer reaction: An introduction to 4-Vinyl-1,4-dihydropyridines **AK Mandhotra, SS Aristha, A Chakraborty, S Patel, I Chatterjee** - Organic Letters, 2026 **Abstract:** The visible-light-driven, organophotoredox-catalyzed vinyl group transfer reaction is described. The strategic use of proaromatic, bench-stable, and readily prepared 4-vinyl-dihydropyridine (DHP) derivatives triggers the vinyl group transfer that can couple stereoselectively with fluorinated esters and amides to forge the C(sp3)–C(sp2) bond. The obtained products are transformed into diverse fluorinated scaffolds. Preliminary mechanistic investigations are outlined. 
61.	Power moments of the coefficients of an L-function over a polynomial in six variables NK Godara, **P Tiwari** - Journal of Interdisciplinary Mathematics, 2026 **Abstract:** Let f denote a normalized Hecke eigenform of an even integral weight κ ≥ 2 on the group $SL_2(\mathbb{Z})$. We study power moments of the coefficients of an L-function associated with the eigenform f over square-free positive integers represented by the polynomial.
62.	Precursors for cell-state transitions: Stability, resilience, and predictability in Notch signaling pathways **SN Chattopadhyay, AK Gupta** - Chaos: An Interdisciplinary Journal of Nonlinear Science, 2026 **Abstract:** The Notch signaling pathway is an evolutionarily conserved mechanism crucial for directing cell-state decisions during embryonic devel opment and maintaining adult tissue homeostasis, with aberrations linked to diseases, including oncogenesis. Hence, reliable markers of impending transitions in Notch signaling are essential for predicting deleterious shifts and guiding therapeutic interventions. To develop a reliable predictive framework, we consider a deterministic model incorporating the principal components of the Notch pathway—namely, the Notch receptor; its ligands, Delta and Jagged; and the Notch intracellular domain (NICD)—to elucidate key biochemical processes at the single-cell level [Boareto et al., Proc. Natl. Acad. Sci. U.S.A. 112, E402 (2015)]. This model is then extended into a stochastic formulation via the corresponding chemical master equation to capture intrinsic cellular noise. A bifurcation analysis coupled with stochastic simula tions reveals that variations in external Jagged levels induce multiple cell-state transitions among sender, receiver, and hybrid states. These transitions are predicted using statistical measures, including autocorrelation, variance, heteroskedasticity, and mutual information, whose significance and robustness are rigorously evaluated. Although individual metrics provide effective predictions, composite measures often underperform despite

	the transitions' association with a fold catastrophe. In addition, we assess the resilience landscape using time-series analyses and observe that the variability index outperforms the Jacobian indices. Further basin stability and stochastic potential-well evalua tions indicate that the hybrid state is the fittest. In summary, our study demonstrates cellular transitions in a biologically relevant system and explores the application and limitations of statistical tools as dynamic biomarkers of cellular plasticity.
63.	RASP: Region-aware single use page predictor for SSD workloads **WH Mir, A Rathi, VK Tavva, N Goel** - IEEE Embedded Systems Letters, 2026 **Abstract:** Single use pages degrade SSD performance by causing cache pollution, write amplification, and flash wear. To address this, we propose the Region-Aware Single Use Page Predictor (RASP), a lightweight firmware level mechanism that exploits spatial locality by grouping logical block addresses into fixed size regions. Each region is associated with a confidence score, and a history in region tracking table (RTT). On MSR and Systor workloads, RASP achieves high accuracy (97.67% recall and 80.21% F1-score) in single use page prediction compared to perfect predictor. We leverage RASP to enable the DRAM cache bypassing and single use page aware cache evictions, thereby reducing cache pollution, decreasing flash writes by 8.04% and reducing end to end latency by 11.71% over the baseline, improving SSD performance and lifespan.
64.	Recent advances in drug repurposing for cancer immunomodulation emerging strategies, mechanistic insights, and clinical translation **JA Malik**, H Talkhan, F Fatima, U Hani - Frontiers in Oncology, 2026 **Abstract:** Drug repurposing is a significant strategy in drug discovery, as it saves substantial amounts of time and money. Drugs already approved for other diseases can be repurposed to target cancer. Cancer remains one of the most fatal diseases, and it still does not have a cure. Developing new drug molecules and advancing them from preclinical to clinical stages can take many years, whereas drug repurposing offers a faster alternative. Many repurposed drugs have already progressed to clinical trials. This paper highlights recent advances in how FDA-approved drugs modulate the immune system to enhance host-based immune responses against cancer, and describes the mechanistic pathways through which these drugs act on immune cells. This paper also discusses how targeting macrophages, immune checkpoints on T-Cells, and other immune cell populations can strengthen immunotherapy. In addition, the paper reviews drugs that have advanced to clinical stages and are showing promising results across different cancers, as well as the challenges associated with clinical translation. This paper outlines how drug repurposing can influence the immune system within the context of cancer chemotherapy.
65.	Shell closure impact on preformation probability of 14C cluster N Kaur, G Sawhney, **M Kaur**, A Kaur, H Kaur, S Singh… - Nuclear Physics A, 2026 **Abstract:** We have investigated the preformation probability, *P*0 of 14C cluster () in the radioactive decay of even-even parent nuclei Ra using the preformed cluster decay model (PCM). It is important to point out that the PCM treats *P*0 as a relative quantity, so, even small differences in the fragmentation potential values can cause it to be redistributed among all the possible fragments of the decaying system. By analyzing the calculated values in the considered radioactive decays, it is possible to examine their evolution with increasing neutron numbers and the impact of shell closure. Within the PCM, the ratio of the *P*0 for 14C cluster radioactive (CR) decay to α decay, is found to have the maximum value (, roughly equal to the maximum branching ratio for the CR decays in the trans-lead region) for 222Ra parent nucleus corresponding to the formation of doubly magic daughter 208Pb nucleus (Z=82 and N=126). The ratios of the penetrability for 14C cluster decay to that of α decay, show somewhat similar behavior, as shown by the respective

	Q-values, for the respective parent nuclei and reaches almost closer to unity for the parent nucleus 222Ra. The PCM calculated branching ratios are found to give good comparison with the available experimental data.
66.	Start-of-packet detection using machine learning **S Kaur, A Ahmad, S Agarwal** - IEEE Transactions on Communications, 2026 **Abstract:** With the rapid proliferation of wireless communication systems, accurate Start-of-Packet (SOP) detection is essential for efficient packet reception and decoding. Conventional correlation-based techniques struggle under low signal-to-noise ratio (SNR) and phase/frequency offsets. This paper proposes a Proximity-based Support Vector Machine (P-SVM), a novel SVM-based approach that incorporates Proximity-based weighting and a Distance adjustment function to enhance robustness under such impairments. Evaluated using both simulations and SDR-based experiments, P-SVM consistently outperforms conventional and state-of-the-art methods in Probability of detection, Mean Absolute Error, and Probability of false alarm. Moreover, P-SVM offers reduced implementation complexity, making it suitable for practical deployment.
67.	Structural and bactericidal properties of imidazolium ionic liquid-based micelles of thyme essential oil S Mokni, WM Hassen, **N Singh**, JJ Dubowski - RSC Advances, 2026 **Abstract:** We report the structural and bactericidal properties of the imidazolium ionic liquid (IL)-based micelles of *Thymus capitatus* (thyme) essential oil (EO). The formation of micelles was investigated by contact angle measurements, which revealed a critical micelle concentration (CMC) of 2.5–3 μM for the IL mixed with thyme at 0.2 μL mL^{-1}. The size, stability and self-assembly of EO-IL micelles in water were evaluated by the dynamic light scattering technique. It was determined that the self-dispersed micelles with a ~400 nm diameter remained stable in a water environment for at least 6 months from their formation. The bactericidal properties of micelles investigated against *S. aureus* and *E. coli* under liquid-to-liquid conditions revealed a 6-log reduction in the bacterial concentration from 10^8 CFU mL^{-1} following 1 min exposure. Minimal bactericidal growth of both bacteria was observed under the CMC conditions. These results demonstrate the potential of EO-IL micelles as natural agents that self-disperse in water and kill bacteria at rapid rates.
68.	Styrene-ethylene-butylene-styrene grafted maleic anhydride modified polyamide-12: Printability and impact performance in fused granulate 3D printing A Kumar, D Saxena, N Verma, PM Pandey, **C Sasmal**, SS Banerjee - Polymer International, 2026 **Abstract:** Polyamide-12 (PA-12) is a typically used thermoplastic in additive manufacturing; however, its limited impact toughness and sub-optimal melt rheology restrict its applicability in large-scale fused granulate fabrication. In this work, styrene-ethylene-butylene-styrene grafted maleic anhydride (SEBS-*g*-MA) copolymer was incorporated in PA-12 via melt blending to enhance its impact performance of additively manufactured parts. The affinity between PA-12 and the MA phase of the blend was theoretically predicted using Hansen solubility parameter analysis. The rheological investigation and pressure drop analyses were performed to evaluate the extrudability and printability of the developed PA-12/SEBS-*g*-MA blends. The morphological investigations showed the dispersion and coalescence of SEBS-*g*-MA phase in the continuous PA-12 matrix, and it also revealed a good layer formability for the printed samples for all the blends. The SEBS-*g*-MA loading level significantly improved the Izod impact strength of the additive manufactured parts and showed up to ~600% increase compared to the pristine PA-12 sample. This work provides a promising strategy to develop additively manufactured modified polyamide with improved impact performance for several potential applications. © 2026 Society of Chemical Industry.

69.	Synergistic interactions in nanostructured CuNi2 bimetallic alloy for superior hydrogen evolution reaction kinetics and stability **MK Adak, V Vaishampayan, N Gopinathan, SP Gumfekar -** ACS Applied Energy Materials, 2026 **Abstract:** Green hydrogen represents a highly promising renewable energy resource, and its production through water electrolysis relies on the hydrogen evolution reaction (HER). In this study, we synthesized a low-cost, transition metal-based electrocatalyst, $CuNi_2$ alloy (CNA), via a solvothermal method to generate hydrogen through alkaline water electrolysis. The nanocrystalline, coin-shaped CNA particles displayed a uniform elemental distribution across the catalyst surface. The electrocatalyst exhibited outstanding HER activity and long-term operational stability. Electrochemical measurements performed in a three-electrode configuration with 1.0 M KOH solution yielded overpotentials of 40 ± 2 mV and 152 ± 5 mV at geometric current densities of 10 and 50 mA cm^{-2}, respectively, confirming its high electrocatalytic HER performance. The HER kinetics, characterized by a Tafel slope of 71.7 mV dec^{-1}, indicated that the hydrogen evolution proceeded via the Volmer–Heyrovsky mechanism. Compared with a reference NiO catalyst supported on nickel foam, CNA delivered significantly superior activity, emphasizing the synergistic effect of its bimetallic composition. Further evaluation in a two-electrode water electrolyzer, employing platinum black as the anode catalyst, revealed that the system required a cell voltage of −1.73 V to achieve a current density of −10 mA cm^{-2}. The cell maintained stable electrochemical performance with negligible degradation during a 12 h chronoamperometric test and under stepwise chronoamperometry at varying applied potentials. Post-electrolysis spectroscopic and morphological analyses verified that the catalyst phase remained intact after prolonged operation. This work establishes a cost-effective strategy for synthesizing CNA, elucidates its HER mechanism, and validates its durability and efficiency for practical electrolyzer applications. 
70.	The Effect of Concentration of LiF on the Tunability of Ti2CTx MXene A Singh Kharb, **A Pandey**… **N Sardana**, S Wadhwa… - ChemistrySelect, 2026 **Abstract:** MXenes, a rapidly growing class of 2D transition metal carbides, nitrides, and carbonitrides, offer exceptional electrical conductivity, chemical stability, and tunable surface terminations, making them ideal for applications in energy storage, catalysis, EMI shielding, and flexible electronics. The MILD etching method, utilizing LiF and HCl, minimizes defects and enhances surface control, yet the effect of LiF concentration on MXene quality remains underexplored. This study investigates the modulation of Ti2C MXene properties, including crystallinity, structural integrity, and surface terminations, by varying the LiF molar concentration during the etching process. The structural, morphological, and compositional properties of the synthesized MXene were analyzed using x-ray diffraction and field emission scanning electron microscopy coupled with energy-dispersive spectroscopy. X-ray photoelectron spectroscopy, Raman spectroscopy, and Fourier-transform infrared spectroscopy were employed to investigate the chemical environment, surface terminations, and bonding states. Brunauer–Emmett–Teller analysis revealed enhanced porosity and surface area, demonstrating the material's potential for advanced technological applications. LiF concentration in MILD etching governs the structural

	integrity, surface terminations, and porosity of Ti2CTx MXene, enabling controlled surface chemistry. 
71.	Thermally tunable terahertz q-BIC metasurface using lanthanum hexaferrite R KM, S Biswas, BK Bhowmik, P Dobbidi, **G Kumar** - APL Engineering Physics, 2026 **Abstract:** We report a thermally tunable terahertz quasi-bound state in continuum (q-BIC) metasurface formed by a pair of tilted metal strips on a flexible polyimide film integrated with a disk-shaped pellet of lanthanum M-type hexaferrite (LaM). The design is optimized to generate a symmetry-protected BIC near 0.59 THz, which arises due to the out-of-phase electric dipole in each strip. By simply tilting the strips, the mirror symmetry is broken, which yields an ultra-sharp q-BIC resonance at 0.63 THz. The Q factor follows the expected inverse-quadratic scaling with the asymmetry parameter, with minimal frequency drift. The dominant multipole contributions and radiation patterns are analyzed using multipolar and far-field simulations, while the presence of a distinct vortex at the Γ point verifies the topological nature of the BIC. Furthermore, we perform terahertz time-domain spectroscopy of LaM, which reveals a strong temperature-dependent modulation in the 0.2–1.0 THz range, with a 32% modulation in transmission at 0.6 THz. Finally, the q-BIC metasurface is integrated with LaM to achieve thermal control of the Q-factor and bandwidth of the resonance. Our work highlights a novel approach to achieve THz modulation, which has potential applications in active THz photonic devices.
72.	Trans-corporeally entangled black body: Nnedi Okorafor's africanfuturistic speculative fiction Binti Novella Trilogy **NF Sulficar** - International Journal of English Language and Literature Studies, 2025 **Abstract:** This paper examines trans-corporeal entanglements in Okorafor's speculative Africanfuturistic fiction, the Binti Trilogy. Okorafor's novella narrates the journey of Binti, a Himba girl who traverses through the galaxies, facing various bodily mutations and cultural transformations. Through these changes, she realizes her interconnectedness with the environment, technology, and society. The entangled body of the female protagonist breaks the binaries that give rise to discrimination and undermine Black female bodies. Binti embraces changes that alter her identity and physical nature, dissociating her social position as a Himba girl. This study employs close textual analysis using Stacy Alaimo's theory of trans-corporeality to investigate the fragile and frequently precarious nature of Black female bodies and the societal and psychological problems that trans-corporeal mutations entail. Binti provides a powerful Africanfuturistic lens combined with Black feminist and intersectional ecofeminist perspectives to examine how Okorafor's fiction depicts identity as fluid, relational, and materially embedded in the Black female bodies. The analysis reveals that Binti's altered body destabilizes binary categories of human/alien and natural/technological by depicting the bodily change as a form of adaptive agency rather than loss. Such transformations resist colonial, patriarchal, and ecological exploitation, presenting the Black female body as an active site of negotiation between tradition and futurity.
73.	Ultra-sensitive and selective VS2 phototransistor with the persistent photogenerated current tail AK Yadav, N Kag, **V Singh,** A Dixit - APL Electronic Devices, 2026

	Abstract: Recent development on VS_2 related optical and electronic properties have proposed VS_2 as the potential candidate for the two-dimensional transition metal dichalcogenides for optoelectronic applications. In the present work, CVD synthesized monolayer VS_2 is used to demonstrate as the channel material for phototransistor fabrication with the 2 μm channel length. The extended Raman analysis shows that the monolayer VS_2 consists of absorption coefficient of the order of 10^5 cm^{-1}. The VS_2 phototransistor is capable to senses the microwatt order of illumination and shows selectivity for the 540 nm (green) LED among the 450 (blue), 590 (orange), and 660 nm (red) LEDs. For the 540 nm LED, maximum responsivity reaches more than 46 A/W and detectivity more than 1.48 10^{11} jones for V_{GS} and V_{DS} = 2 V each. Responsibility and detectivity start to reduce with further enhancement of illumination from 5 $\mu W/cm^2$, possibly due to the current saturation. The transient characteristics of the phototransistor under illumination show rise time of ~4.2 s. While there is persistence of decaying drain current for longer time, the phototransistor demonstrates the trap state assisted photogating effect.
74.	Understanding and controlling the trace iron incorporation during Th-Rhabdophane crystallization W Xu… **R Ahuja**, W Luo, W Wang, Z Zhang - Environmental Science & Technology, 2026 **Abstract:** Rhabdophane has an outstanding capacity of accommodating radioactive nuclides and is recognized as a significant host phase for the enrichment of actinides from radioactive waste liquid. Thus, assessing the impact of impurities present in such waste streams on rhabdophane crystallization is critical. This study systematically investigates the effects of Fe^{3+}/Fe^{2+} coincorporation with actinides on the precipitation behavior of rhabdophane. Some specific issues, including lattice occupation of Fe^{3+}, precipitation reaction kinetics, crystal growth affected under the influence of trace iron, and leaching stability, are discussed in detail. The results reveal that the presence of Fe^{3+}, rather than Fe^{2+}, can lower the energy barrier for nucleation and accelerate the transformation of Th-rich nucleus into rhabdophane. The limited uptake of Fe^{3+} with a suggested substitution ratio below 1%, contributes to establishing the stability domain of the rhabdophane phase, whereas excess Fe^{3+} promotes the formation of the $FePO_4{\cdot}2H_2O$ phase, which synergistically enhances the grain growth kinetics of rhabdophane/monazite through an aggregation–adsorption effect. Based on density functional theory of structural energetics, Fe^{3+} occupation is energetically favorable at nonhydrated [LaO_8] sites in rhabdophane, despite the fact that two-thirds of lattice sites are associated with [$LaO_8{\cdot}H_2O$] sites. Intriguingly, amorphous $FePO_4{\cdot}2H_2O$ can act as active sites to facilitate the formation of a surface alteration layer with improving the leaching stability of Th^{4+} in pH = 5–7 solutions. 
75.	Vuln2Action: An LLM-based framework for generating vulnerability reproduction steps and mapping exploits **S Kumari, G Yadav** - Journal of Information Security and Applications, 2026 **Abstract:** Cyber Threat Intelligence (CTI) plays a critical role in understanding and mitigating evolving cyber risks in modern networking environments Despite the availability of structured CTI sources like NVD, CWE, CAPEC, and Exploit-DB, penetration testing remains a largely manual process, especially when reproducing known vulnerabilities. Notably, only 0.4% of vulnerabilities listed in the NVD have corresponding exploits in Exploit-DB, leaving security professionals to manually craft reproduction steps and exploit code, which is error-prone and time-consuming. LLMs such as GPT have demonstrated potential in natural language generation, their application to cybersecurity is limited due to their general-domain training, lack of structured data integration,

	and tendency to produce hallucinated responses. In this paper, we propose *Vuln2Action*, a novel LLM-based framework designed to automate vulnerability reproduction by generating actions and mapping step-by-step exploits. We first construct a semantically enriched dataset that aligns CVE entries with their associated CWE, CPE, CAPEC, and Exploit-DB records using vector-based similarity methods. Our custom NLP pipeline systematically maps and fuses these taxonomies to provide the contextual grounding needed for accurate exploit generation. We also developed a user-friendly graphical interface that enables researchers and practitioners to easily explore relevant attack patterns and mapped exploits. *Vuln2Action* fine-tunes a T5-based model on this curated dataset to produce deterministic and context-aware exploit flows. Although *Vuln2Action* is constrained to Exploit-DB for exploit code, this design choice ensures transparency, reproducibility, and reliance on verified community-sourced proof-of-concepts.