Sl. No.	IIT Ropar **List of Recent Publications with Abstract** **Coverage: March, 2024**
1.	[A note on the normal complement problem in semisimple group algebras](#) **M Khan, H Setia** - Indian Journal of Pure and Applied Mathematics, 2024 **Abstract:** Let FG be the semisimple group algebra of a finite group G over a finite field F. In this article, we obtain a sufficient condition for which G does not have a normal complement in the unit group of FG. In particular, we have studied the normal complement problem for semisimple group algebras of dihedral groups, quaternion groups and groups of order pn, where n = 3, 4 and p is an odd prime.
2.	[A novel graphical technique for multiple harmonic mitigation in a two-level inverter with only two switching angles](#) **P Kalkal, AVR Teja** - IEEE Journal of Emerging and Selected Topics in Power Electronics, 2024 **Abstract:** This paper introduces a novel graphical technique for selective harmonic mitigation (SHM), substantiated by experimental data. This approach identifies maximum modulation indices for different harmonics while adhering to a constraint of two switchings per quarter cycle. The study demonstrates the effectiveness of the technique in mitigating harmonics within this range and optimizes harmonic suppression using variable DC voltages. The research uncovers multiple solution regions, addresses concerns at higher harmonics, and reveals an infinite solution space for selective harmonic mitigation. In particular, the approach achieves a 10% SHM bandwidth under a 5% IEEE 519-2022 standard limit and defines operating zones for enhanced management. The study also covers individual and cluster harmonic mitigation, highlighting the versatile application. The proposed graphical technique solves nonlinear SHM equations with inequalities and provides all possible solutions at every modulation index for single or multiple harmonic mitigations. The proposed technique is experimentally verified using an FPGA-based hardware prototype developed in the laboratory, and the results are presented. It is shown that up to seven harmonics can be simultaneously mitigated at certain modulation indices with only two switchings per quarter.
3.	[A novel lightweight nids framework for detecting anomalous data traffic in contemporary networks](#) Y Kumar, V Kumar, **B Subba** - Journal of Circuits, Systems and Computers, 2024 **Abstract:** Network Intrusion Detection Systems (NIDSs) have been proposed in the literature as security tools for detecting anomalous and intrusive network data traffic. However, the existing NIDS frameworks are computation-intensive, thereby making them unsuitable for deployment in resource-constrained networks with limited computational capabilities. This paper aims to address this issue by proposing computationally efficient NIDS framework for detecting anomalous data traffic in resource-constrained networks. The proposed NIDS framework uses an ensemble-based classifier model comprising multiple classifiers, which enables it to achieve high accuracy and detection rate across a wide range of low-footprint and stealth network attacks. The proposed framework also uses feature scaling and dimensionality reduction techniques to minimize the overall computational overhead. The proposed framework consists of two stages. In the first stage, four distinct base-level classifiers are utilized. The classification probabilities of the first stage are used in the modified meta-level classifier. The modified meta-level classifier is trained on the class probabilities of the base-level classifiers combined using a novel proposed probability function. The performance of the proposed NIDS framework is evaluated on a

	proprietary testbed dataset and two benchmark datasets namely CICIDS-2017 and UNSW-NB15. The results reveal that the proposed NIDS framework provides better performance than the existing NIDS frameworks in terms of false positive rate, despite using a significantly lower number of input features for its analysis. © World Scientific Publishing Company.
4.	[A robust and privacy-aware federated learning framework for non-intrusive load monitoring](#) **V Agarwal**, O Ardakanian, **S Pal** - IEEE Transactions on Sustainable Computing, 2024 **Abstract:** With the rollout of smart meters, a vast amount of energy time-series became available from homes, enabling applications such as non-intrusive load monitoring (NILM). The inconspicuous collection of this data, however, poses a risk to the privacy of customers. Federated Learning (FL) eliminates the problem of sharing raw data with a cloud service provider by allowing machine learning models to be trained in a collaborative fashion on decentralized data. Although several NILM techniques that rely on FL to train a deep neural network for identifying the energy consumption of individual appliances have been proposed in recent years, the robustness of these techniques to malicious users and their ability to fully protect the user privacy remain unexplored. In this paper, we present a robust and privacy-preserving FL-based framework to train a bidirectional transformer architecture for NILM. This framework takes advantage of a meta-learning algorithm to handle the data heterogeneity prevalent in real-world settings. The efficacy of the proposed framework is corroborated through comparative experiments using two real-world NILM datasets. The results show that this framework can attain an accuracy that is on par with a centrally-trained energy disaggregation model, while preserving user privacy. IEEE
5.	[A solar series grid following harmonic compensator with enhanced grid current shaping and active power injection capability](#) **PM Reddy, AI Gedam, KR Sekhar** - IEEE Transactions on Power Delivery, 2024 **Abstract:** This work proposes a solar-based series inverter configuration to demonstrate the superior power quality shaping with the active power injection capability in grid-interfaced nonlinear load applications. The proposed configuration realizes the AC network in series. It ensures the reduced AC filter size and DC voltage compared to the conventional inverter topologies. The series inverter configuration mimics the double switching frequency across the load, making the system's overall bandwidth higher than the conventional inverter. The improved bandwidth ensures reduced attenuation towards lower-order load-demanded harmonics. In addition, as the filter size plays a role in harmonic processing capability, in this work, an optimum filter size is derived by analyzing the nonlinear load current rise time signatures at different load resistances and filter inductances. With the appropriate filter sizing, the dynamic solar power and harmonic injection are accomplished by developing a dedicated closed-loop control mechanism for series inverters. The developed control methodology instantaneously derives combined references to individual inverters through instantaneous AC load harmonic segregation and DC solar power computation. With the derived control mechanism, the superiority of the proposed series inverter over a parallel isolated inverter in terms of enhanced harmonic compensation and dynamic solar power injection is demonstrated through experimental results.
6.	[Advances and challenges in organ-on-chip technology: toward mimicking human physiology and disease in vitro](#) **D Kumar, R Nadda, R Repaka** - Medical & Biological Engineering & Computing, 2024 **Abstract:** Organs-on-chips have been tissues or three-dimensional (3D) mini-organs that comprise numerous cell types and have been produced on microfluidic chips to imitate the complicated structures and interactions of diverse cell types and organs under controlled circumstances. Several morphological and physiological distinctions exist between traditional 2D

cultures, animal models, and the growing popular 3D cultures. On the other hand, animal models might not accurately simulate human toxicity because of physiological variations and interspecies metabolic capability. The on-chip technique allows for observing and understanding the process and alterations occurring in metastases. The present study aimed to briefly overview single and multi-organ-on-chip techniques. The current study addresses each platform's essential benefits and characteristics and highlights recent developments in developing and utilizing technologies for single and multi-organs-on-chips. The study also discusses the drawbacks and constraints associated with these models, which include the requirement for standardized procedures and the difficulties of adding immune cells and other intricate biological elements. Finally, a comprehensive review demonstrated that the organs-on-chips approach has a potential way of investigating organ function and disease. The advancements in single and multi-organ-on-chip structures can potentially increase drug discovery and minimize dependency on animal models, resulting in improved therapies for human diseases. Graphical Abstract: (Figure presented.).

7.	[An input current based method for fault diagnosis of high resistance connection in BLDC motors](#) **A Gupta,** RS Reddy**, K Jayaraman** - IEEE Sensors Journal, 2024 **Abstract:** High resistance connection (HRC) is a common problem in electric drives. It distorts the stator currents by producing asymmetry across the motor phases. To overcome this, fault diagnosis approaches remain a widely followed practice for early detection of HRC. Though the existing literature suggests various fault diagnosis techniques, the approaches that use the neutral point voltage are only applicable to star-connected motors. Moreover, the requirement for additional sensors increases the overall cost and the computational complexity of fault diagnosis. Against this backdrop, this article proposes a reliable yet cost-effective approach for detecting HRC faults in brushless direct current (BLDC) motor drives. The proposed approach is based on the moving window of the input current, for which the two statistical indices, variance and range, are continuously monitored to detect the fault. Further, without the additional sensors, the motor's built-in hall sensors have been utilized to localize the faulty phase by tracking the polarity of the input current slope in each switching interval. The reliability of the proposed approach has been investigated for the range of operating conditions of a 36 V, 400 W BLDC motor. The outcome of the experimental trials supports the claim for the effectiveness of the proposed cost-effective, easy-to-implement, and reliable fault diagnosis technique.
8.	[An overview of techniques for monitoring and compensating tool wear in micro-electrical discharge machining](#) **R Nadda, CK Nirala**, PK Singh, D Lee, R Kumar, T Singh - Heliyon, 2024 **Abstract:** Micro-electrical discharge machining (µEDM) is severely affected by tool wear and its process variants, which can lead to compromised precision and dimensional disruptions in micro-part production. Several attempts have been made to address this problem by suggesting offline and online (real-time) tool wear compensation strategies. Research efforts in this area have intensified over the last 20 years. However, most methods proposed were applicable only for a few work-tool combinations and in limited input process parametric settings. Instead of tool wear compensation, several research articles have focused on strategies to reduce the negative

	impact of tool wear on the quality of fabricated parts. The present study systematically reviews various investigations conducted in this area and aims to add cutting-edge compensation for tool wear to future inquiries. The articles reviewed here are explored in detail. Critical findings/innovations are classified into four categories: tool wear in μEDM, tool wear compensation techniques, and offline and online compensation methods. © 2024 The Authors
9.	**Analytical framework for data reception latency modelling in BLE 5.x based clustered architecture** **LK Baghel**, G Shan, **S Kumar** - IEEE Communications Letters, 2024 **Abstract:** Industrial Internet of Things (IIoT) networks often require minimal data reception latency, which primarily depends on advertising interval in BLE-based networks. Thus, selecting an optimal advertising interval is crucial to get minimal data reception latency. The existing solutions are limited to homogeneous networks (networks using the same set of BLE parameters). However, an IIoT scenario may have numerous devices incorporated with various sensors of different kinds, generating data of different sizes at different periods, which are likely to form a heterogeneous network, thus raising the need to evaluate the heterogeneous networks. To address these issues, we first analytically derived the optimal advertising interval expression that gives minimal latency for a heterogeneous network consisting of n clusters. Based on the analytical expressions, the algorithms are proposed that autonomously optimize the latency for heterogeneous networks. Moreover, an average energy consumption model is also proposed, which will help the service provider to select the suitable parameters, and further help in calculating the expected battery life of the device in the network. Further, the analytical results are verified by a commercial simulator whose simulation results show a good correlation with analytical results thus validates the proposed model.
10.	**Biomedical applications of biogenic carbon-based fluorescent nanoparticles** **K Kaur, G Singh**, R Badru, N Kaur, **N Singh** - Biogenic Nanomaterial for Health and Environment: Book Chapter, 2023 **Abstract:** The wide-ranging applications of carbon dots (CDs), which can be developed using either green or chemical precursors, have been made possible due to their reported properties and the various precursors that have been identified. This has opened up new opportunities for the development of high-quality CDs and their use in optoelectronic devices, bioimaging, and other applications. Green precursors can be derived from fruits, vegetables, flowers, leaves, seeds, stems, crop residues, fungi/bacteria species, and waste products, while chemical precursors can be categorized as either acid reagents or non-acid reagents. It provides a brief review of the past ten years of CD synthesis using both green and chemical precursors, as well as the use of CDs as sensing materials in biomedical applications. This comprehensive review will be a valuable resource for researchers who are interested in synthesizing high-quality CDs for a variety of applications.
11.	**Comparative assessment of machine learning (ML) techniques for false data injection attack (FDIA) classification** **N Kumar, S De, R Sodhi** - 2023 IEEE 3rd International Conference on Smart Technologies for Power, Energy and Control (STPEC), 2023 **Abstract:** With the advancement in communication technologies, the cyber physical systems have become vulnerable to various cyber threats. In this paper, one such significant cyber threat in the microgrids, viz., False Data Injection Attack (FDIA), is modeled in various forms, and three popular machine learning methods have been employed to detect and classify them. The FDIA classification strategy thus developed is tested on the IEEE 13-bus Islanded AC Microgrid test system, constituted of four DGs of similar rating supplying multiple loads in the network, and is modelled in Real Time Digital Simulation (RTDS) platform.

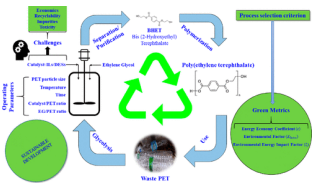|	
12.	[Comparative evaluation of exploratory data analysis techniques for power theft detection in residential distribution grids](#) **S Agarwal, A Srivastava, R Sodhi**, T Soni - IEEE 3rd International Conference on Smart Technologies for Power, Energy and Control (STPEC), 2023 **Abstract:** This paper presents a comparative evaluation of the performance of various Exploratory Data Analysis (EDA) techniques for detecting power theft in residential distribution networks. The techniques include Pearson Correlation Coefficient (PCC), Fuzzy C-Means Clustering (FCM) and Density-Based Spatial Clustering of Applications with Noise (DBSCAN). They are assessed using well-known classification assessment measures such as Accuracy, Geometric Truth Rate, Youden's Index and Area under Receiver operating characteristics curve. In the present work, power theft scenarios are divided into four different categories. Suspicious consumers are then identified using the concepts of feature extraction, correlation, and clustering. The information needed to detect the corrupt customers comes from a monitoring system at the distribution transformer for a block and electricity load data from smart meters installed at customer homes in the same block. The analysis is tested on actual dataset from UK power networks and it is found that FCM outperforms the other techniques. Sensitivity analysis is further performed to determine how the technique performs significantly w.r.t. various parameters.
13.	[Comparative study of the code-prescribed design interventions for open ground storey buildings in India](#) **PL Kurmi, P Haldar** - Innovative Infrastructure Solutions, 2024 **Abstract:** Reinforced Concrete (RC) frame buildings with Open Ground Storey (OGS) have undergone severe to heavy damage, mainly in open storey columns resulting collapse of the entire building. Several national standards have recommended the design of open storey members with higher forces using some multiplication factors or stiffening elements like bracings to compensate open storey stiffness and strength irregularity. Aim of the manuscript is to assess the efficacy and ease of practice of several available design interventions prescribed by various national design standards to remove strength/stiffness irregularity in OGS buildings. An exhaustive comparative study has been carried out on the effect of design provisions recommended by various national seismic design standards on sets of mid-rise and high-rise infilled RC frame buildings with open ground storey designed as per relevant Indian standards, in deterministic, as well as probabilistic terms. The effect of relevant OGS design provisions on the seismic performance and consequent seismic fragility has been evaluated using pushover analysis in conjunction with HAZUS methodology. Design of OGS through higher forces using a multiplication factor ranging from 2.5 to 3 is found effective and more feasible solution in terms of seismic performance as well as ease of OGS building design for all practical purposes.
14.	[Competition for resources in an exclusion model with biased lane-changing mechanism](#) **A Gupta, AK Gupta -** Physical Review E, 2024 **Abstract:** The motivation for the proposed work is drawn from the attachment-detachment observed in biological and physical transport processes that entail finite resources. We investigate the influence of limited particle availability on particle dynamics within two parallel totally asymmetric simple exclusion lanes, with one lane incorporating only particle detachment and the other considering particle attachment. We establish a theoretical framework by employing vertical mean-field theory in conjunction with singular perturbation technique. The analytical findings are supported by numerical and stochastic validation using a finite-difference scheme and the Gillespie algorithm. By utilizing these approaches, we scrutinize various stationary properties, including particle densities, phase boundaries, and particle currents for both lanes. Our analysis reveals that the complexity of the phase diagram exhibits a nonmonotonic trend in the number of stationary phases as the particle count increases. Each phase diagram is

	constructed with respect to the intrinsic boundary parameters, illustrating both bulk and surface transitions occurring within the lanes. The interplay between finite resources and coupling mechanisms gives rise to two phases involving upward shock in one of the lanes, while two phases exhibit synchronized downward shock in both lanes. Finally, we delve into shock dynamics to comprehend critical phase transitions occurring in the system.
15.	Control of five leg inverter based two motor drive under current sensor failure A Azeem, AVR Teja, S Payami - 2023 IEEE International Conference on Power Electronics, Smart Grid, and Renewable Energy (PESGRE), 2024 **Abstract:** This paper proposes a current sensor fault tolerant (CSFTC) control of the five-leg inverter (FLI) that drives the two induction motors independently. The simulation test validation is carried out when all current sensors or power supplies used for current sensor undergo failure. The proposed solution suggests employing generalized equations that leverage the PWM-generated voltage and the angular speed of the rotor. These equations enable the reconstruction of the stator phase current in the stationary reference frame (α-β).This scheme minimizing the system dependency on sensors in noisy environment. The proposed scheme is verified at different operating states of the drive system through the MATLAB/Simulink platform. The simulation result validate the effectiveness and feasibility of proposed scheme.
16.	Copper-catalyzed chemoselective o-arylation of oxindoles: access to cyclic aryl carboxyimidates PR Singh, M Lamba, A Goswami - The Journal of Organic Chemistry, 2024 **Abstract:** We have developed a highly efficient base- and additive-free chemoselective CuO-catalyzed strategy for the O-arylation of 2-oxindoles to synthesize 2-phenoxy-3H-indole and 2-phenoxy-1H-indole derivatives in the presence of diaryl iodonium salts. This method offers a variety of O-arylated oxindoles in good to excellent yields under relatively milder reaction conditions. Furthermore, this methodology was extended for the O-arylation of 2-pyridinone and isoindoline-1-one derivatives as well.
17.	Cultivating a greener tomorrow: Sustainable agriculture strategies for minimizing agricultural Waste D Bharti, A Sharma, M Sharma, R Singh, **A Kumar**, R Saxena - Valorization of Biomass Wastes for Environmental Sustainability: Book Chapter, 2024 **Abstract:** Agriculture that is truly sustainable must incorporate social, economic, and environmental sustainability. Increased awareness of the need for enhanced agricultural productivity stems from the requirement to feed a growing population. It is interesting that virtually all agricultural activities generate waste, and many nations produce substantial volumes of waste. Recent observations from our study reveal that globally, agricultural activities generate approximately five billion tons of waste each year. However, the improper disposal of these wastes can lead to staggering financial losses, estimated at around $300 billion annually, and severe environmental contamination, posing significant threats to human health. Every state and nation, on average, produces a substantial amount of waste every year, estimated at 200 million tons, or every 6 months. Hence, it is imperative that this waste is disposed of properly, recycled, or utilized to create value for the environment and agriculture. We find that "reducing," "reusing," and "recycling" field waste can significantly reduce the environmental footprint of agricultural practices, potentially reducing greenhouse gas emissions by up to 25% and

	conserving water resources by 15%. This chapter focuses on effective strategies for managing these wastes, including building a more sustainable agricultural supply chain, developing long-lasting markets, and enhancing rural infrastructures such as roads, storage, and power.
18.	Current understanding, motivations, and barriers towards implementing sustainable initiatives in the hospitality industry in the age of automation and artificial intelligence A Bihari Singh, G Gaurav, **P Sarkar**… - Recent Patents on Engineering, 2024 **Abstract:** Background: Sustainability concerns are rapidly being acknowledged as a key concern for hospitality sectors worldwide. Sustainable initiatives immediately contribute to improved organizational performance in terms of utility consumption, waste management, and regulatory compliance, resulting in cost-effectiveness and competitive advantage through distinctiveness. Objective: The purpose of the patent study is to analyze and summarize the motivations, indicators, and barriers towards applications of sustainable initiatives and modern technologies in the hospitality industry using the existing literature to develop a current understanding of the subject and know the way the current industry is thinking about it. Method: This study is a combination of systematic and bibliometric review, where the systematic review was based on selected articles from reputed journal databases, and the bibliometric review was conducted using VOS viewer and web of science database for a period of 20 years (2002- 2022) Seven research questions were framed and answered for the systematic review. Result: By describing the motivations, barriers, and impacts of implementing sustainability initiatives and cutting-edge technologies like AI and machine learning in the hospitality sector, the study helps practitioners and academics understand its present state for robust research. The current condition of such implantations in the hospitality sector is also discussed. Conclusion: This study adds value by shedding light on the perspective of sustainability in the hospitality industry by considering the recommendations and practical advice for hotel management suggested in the existing literature about the application of current sustainability innovations and effective sustainability initiatives in hotel management.
19.	Data-driven and artificial intelligence approaches for system-wide prediction of the drugable proteome to drug discovery in farm animals AS Ben Geoffrey, **JS Virk**, D Mittal, G Kau, SA Ali - Sustainable Agriculture Reviews: Animal Biotechnology for Livestock Production 4: Book Chapter, 2024 **Abstract:** A druggable proteome is of global interest for the drug development process. Growing livestock for food relies strongly on pharmacologically active chemicals, or medicines, in modern agricultural practice. The use of medications in food animals is critical for the welfare and well-being of the animals and the industry's economics. Drug consumption, on the other hand, is linked to adverse impacts on public well-being. Therefore it is crucial to test the drug comprehensively before its use in agricultural practice. The identification of druggable proteome requires a non-trivial amount of resources and time, therefore, artificial intelligence and machine learning have emerged as invaluable tools for drawing meaningful perspectives and improving decision making in drug research. In this respect, the overall drug discovery process necessitates a long-term transition and lowers production costs. Artificial intelligence is a promising alternative for dysfunctional drug discovery and development. This chapter outlines the applications of artificial intelligence and machine learning innovations to many other techniques in drug development, such as target recognition, compound screening, lead generation and optimization, drug reaction and synergy prediction, de novo drug design, and drug repurposing.
20.	Demographic transition and inflation **K Rai, B Garg** - Economic Systems, 2024 **Abstract:** We propose a few testable hypotheses to examine the impact of demographic transition on inflation. We contribute to the existing literature by refining the formulation of

hypotheses and treatment of slope heterogeneity and cross-sectional dependence by implementing the cross-sectionally augmented autoregressive distributed lag (CS-ARDL) procedure that adopts dynamic common correlated predictors. To this end, we consider two panels consisting of eight advanced economies (AEs) and sixteen emerging market economies (EMEs) to gain insights into the current asymmetric global demographic transition. Our comprehensive analysis reveals that the share of the working-age population is inflationary in AEs and disinflationary in EMEs. This analysis suggests that an asymmetry in demographic transition between AEs and EMEs influences inflation differently. Our findings offer clues to policymakers regarding the influence of the cohort size of the prime and young working-age population on inflation. Specifically, policymakers in emerging markets should incorporate information about the changing structure of demographic variables as the asymmetry in transition can lead to varying impacts on inflation compared to the impacts in advanced nations. © 2024 Elsevier B.V.

21.

[Direct numerical simulation of a single contaminated droplet microextraction in a yield-stress fluid](#)
S Garg, A Sharma, J Mahajan, N Nirmalkar - International Journal of Heat and Mass Transfer, 2024

Abstract: The present work investigates the extraction of solute from the contaminated micro-droplet suspended in non-Newtonain viscoplastic fluids (Herschel Bulkley). The fluid flow dynamics and interfacial mass transfer phenomena near a contaminated micro-droplet have been investigated prior to the estimation of extraction efficiency. The stagnant-cap model is employed to depict the droplet that has been contaminated. Dispersed droplet systems are commonly observed in diverse facets of our everyday encounters. These systems are found in various industries, encompassing flotation, energy storage, biofuels, printing, airlift reactors, and foam manufacture, among others. The study has focused on a linear thermodynamic equilibrium relationship that exists at the interface between two fluid phases. The momentum and species transport have been solved for a range of dimensionless parameters. These parameters include θcap, which varies between $120°$ and $150°$, the Reynolds number ($1 \leq Re \leq 100$), the Bingham number ($0 \leq Bn \leq 5$), the dispersed to continuous fluid viscosity ratio ($0.5 \leq \mu ratio \leq 4$), and the shear-thinning index ($0.4 \leq n \leq 1$). The results have been conveyed in the form of streamlines, contours, and by delineating the regions of deformation and non-deformation. The size of the zone that undergoes yielding tends to diminish as a result of the impact of the yield stress, while the presence of inertia promotes the enlargement of the zone that remains unyielded. The extraction efficiency and Sherwood number were estimated to be a function of θcap, Bingham number, Reynolds number, and shear-thinning index. © 2024 Elsevier Ltd

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22.

[Divergent temporal glacier responses in the Chandra-Bhaga and Suru-Zanskar basins of the Indian Western Himalaya](#)
S Guha, RK Tiwari, A Pratap - Remote Sensing Applications: Society and Environment, 2024

Abstract: Assessment of temporal fluctuation of glaciers due to climate change is essential for several aspects of glaciology research, including future prediction and various modelling. Therefore, the present study aims to calculate the temporal changes in glacier areas and retreats in the Suru-Zanskar Basin (SZB) and Chandra-Bhaga Basin (CBB). At first, 45 sample glaciers were manually digitized for 2000, 2007, 2016, and 2022 for the SZB. Likewise, 51 sample glaciers were taken for the CBB. After that, the Friedman and Dunn tests were conducted to compare the area changes and retreat rates in the SZB and CBB from sample glaciers. The Mann-Kendell test and Sen slope indicate the temperature was increased at a rate of $0.0091 \pm 0.00014°Cyr-1$ between 1901 and 2021 in the CBB. The total sample glacier area has changed from $608.95 km2$ to $584.54 km2$ between 2000 and 22 in the CBB. The temporal assessment shows glacier area changes, and retreat shows a heterogeneous trend. The average area changes lie between -0.187 to -0.285, -0.303 to -0.483, -0.165 to -0.313, and -0.237 to -0.324 %yr-1 in

	2000-09, 2009-16, 2016-22, and 2000-22 respectively. Also, the average retreat lies between 8.03 to 13.2 myr-1, 12 to 18.5 myr-1, 16.7 myr-1 to 31.3 myr-1 and 12.7 to 18.8 myr-1 in 2000-07, 2007-16, 2016-22 and 2000-22 respectively. On the other hand, the sample glacier area changed from 913.77 km2 to 894.69 km2 through the study period in the SZB. The temporal assessment shows a uniform areal shrinkage and retreat of glaciers in all timeframes in the SZB. The Guha et al. (2023) dataset is accessible at https://doi.org/10.5281/zenodo.8242507.
23.	Effect of laser energy density on bead characteristics in wire-DED S Rathor, R Kant, E Singla - Sadhana: Academy Proceedings in Engineering Sciences, 2024 **Abstract:** Achieving repeatability in part production remains a challenge in laser-wire feed directed energy deposition (LW-DED). It is necessary to understand the laser-wire deposition and bead aspect ratio varying the process conditions to achieve repeatability. Laser energy density is one of the key process parameters that affect the dimensions of the deposit. So, this study discusses the fundamentals of depositing the copper-coated ER70S-6 low carbon steel wire. The laser energy density effects on aspect ratio, overall porosity, microstructure, and microhardness are presented. The bead morphology changes with the change in laser energy density. Single track deposited sample results helped in understanding the melt transition for material deposition and dimensional resolution of the deposited track.
24.	Effect of salinity on crop growth and soil moisture dynamics: A study with root water uptake model G Goet, **I Sonkar**, S Kumar, KS Hari Prasad, CSP Ojha - Journal of Hazardous, Toxic, and Radioactive Waste, 2024 **Abstract:** This study investigates the hazardous effect of salinity on plant growth and soil moisture dynamics in the root zone. Field irrigation experiments on paddy (Oryza sativa L.—basmati variety) with varying levels of salinity of irrigation water (0.5, 5, 10, 15, 20, and 25 dS/m) were performed for studying the effect of salt water stress on crop growth. Throughout the crop's growth period, measurements of leaf area index (LAI), root depth (RD), and soil moisture status in the root zone were recorded. For the analysis, a numerical model was developed to simulate root water uptake (RWU) and soil moisture movement in the root zone, accounting for osmotic pressure developed as a result of the salinity. Nonlinear parameters for the RWU model were estimated based on these observations for each salinity level. By incorporating meteorological data and soil–crop parameters, the model simulated RWU and root zone soil moisture. The results of the irrigation experiments revealed that increased salinity levels in the irrigation water significantly hindered crop development, leading to a decrease in LAI and root depth. The maximum LAI in the growth period decreased markedly, from 5.19 m2m−2 at 0.5 dS/m to 2.01 m2m−2 at 25 dS/m, a decline of approximately 61%. Root depth also exhibited a substantial reduction, declining by up to 36%, from 69.5 cm at 0.5 dS/m to 44.5 cm at 25 dS/m. The simulation outcomes further demonstrated that higher salt concentrations in the irrigation water resulted in reduced root water uptake and decreased soil moisture content in the root zone, ultimately affecting crop yield. The reduction in root water uptake becomes notably pronounced, exhibiting an approximate decrease of 81% when salinity level increases from 0.5 to 25 dS/m. These findings shed light on the hazards posed by salinity in agricultural practices and emphasize the importance of effective management strategies to ensure sustainable crop production in the presence of salinity-induced hazards.
25.	Effects of material properties uncertainty on seismic fragility of reinforced-concrete frames using machine learning approach I Latif, **M Surana**, A Banerjee - Journal of Building Engineering, 2024 **Abstract:** Material properties play a crucial role in governing the seismic response of reinforced-concrete buildings. Investigating the effects of material properties uncertainty using

	nonlinear dynamic analysis can be computationally expensive to obtain the seismic fragility curve parameters. Machine learning models are used to address this challenge, which takes material properties, the fundamental period, and the number of stories in the building as input and predicts their seismic fragility curve parameters. Reinforced-concrete buildings with 4, 8, and 12 storeys are investigated considering the uncertainty in material properties associated with concrete and steel rebars. Latin hypercube sampling is used to obtain 200 sets of variations of the material properties, and hence a total of 600 buildings are analyzed using nonlinear dynamic analyses, considering three different intensity measures, namely, PGA, Sa(T1), and Saavg. The seismic fragility curve parameters are obtained corresponding to three limit states, i.e., 'Immediate Occupancy', 'Life Safety', and 'Collapse Prevention', for all the investigated buildings, and intensity measures. It is found that the material properties uncertainty significantly affects both the median and standard deviation parameters of seismic fragility curves, for both Sa(T1) and Saavg, as compared to PGA. The predictions of trained machine learning models are explained using SHAP analysis, which is then used to identify the effects of input material and building-specific features on seismic fragility curve parameters and the subsequent changes in their rankings due to change in the buildings' limit states. The SHAP analysis revealed that the fundamental period of the building, and the unconfined concrete material properties are the important input features that govern the seismic fragility curve parameters. An interactive dashboard is developed as a part of this work that can be used to predict both the fundamental period and seismic fragility curve parameters for reinforced-concrete buildings at the intensity measures and limit states of interest.
26.	Electrochemical oxidative CC bond cleavage of methylenecyclopropanes with alcohols R Kumar, S Dutt, P Banerjee - Chemical Communications, 2024 **Abstract:** Herein, an electrochemical approach toward the ring opening functionalization of methylenecyclopropanes (MCPs) *via* C–C bond cleavage in the presence of alcohols is reported. The methodology avoids the usage of external oxidants and shows good functional group tolerance. The mechanistic studies suggest that the reaction proceeds *via* direct single electron oxidation of the C–C bond of MCPs followed by ring opening to form the desired product.
27.	Electrochemical valorization of HCl for the production of chlorine via a proton-filter functional covalent organic framework S Kaur, KC Ranjeesh, K Garg… **TC Nagaiah**…- Journal of Materials Chemistry A, 2024 **Abstract:** Chlorine (Cl2) is one of the prime building blocks for several industrially important chemicals and engineering materials. HCl electrolysis is a well established technology for the production of Cl2 at the anode. However, combining it with the hydrogen evolution reaction (HER) at the cathode results in both high energy consumption and safety risks during unexpected shutdowns. Herein, we demonstrated the feasibility of integrating the chlorine evolution reaction (CER) together with the oxygen-depolarized cathode (ODC) by utilizing a nitrogen-rich two-dimensional in situ proton filter functional covalent organic framework (COF, Tta-Dfp) to suppress the HER. The as-synthesized Tta-Dfp COF was explored as a bifunctional catalyst towards the ODC and Cl2 evolution and exhibited outstanding activity towards Cl2 evolution with a faradaic efficiency of 92% and demonstrated excellent stability in a corrosive environment even under multiple shut-downs under mimicked industrial conditions. Furthermore, the visualization of the local electrocatalytic activity of the designed COF was analysed by redox competition mode of scanning electrochemical microscopy (RC-SECM) using a Pt ultra-microelectrode and extended to state-of-the-art electrocatalyst, Pt/C (20%). The 3D SECM images demonstrate the excellent stability of the Tta-Dfp catalyst in chlorine rich electrolyte. Therefore, metal-free catalysis for Cl2 production by integrating the two electrochemical processes with the added advantage of energy saving is a promising cost-effective approach.
28.	Electrochemically reactive colloidal nanobubbles by water splitting

N Nirmalkar, G Yadav - Journal of Colloid and Interface Science, 2024

Abstract: Hypothesis: The existing literature reports have conflicting views on reactive oxygen species (ROS) generation by bulk nanobubbles. Consequently, we propose the hypothesis that (i) ROS may be generated during the process of nanobubble generation through water splitting, and (ii) bulk nanobubbles possess electrochemical reactivity, which could potentially lead to continuous ROS generation even after the cessation of nanobubble production. Experiments: A comprehensive set of experiments was conducted to generate nanobubbles in pure water using the water-splitting method. The primary aims of this study are as follows: (i) nanobubble generation by electrolysis and its characterization; (ii) to provide conclusive evidence that the nano-entities are indeed nanobubbles; (iii) to quantify the production of reactive oxygen species during the process of nanobubble generation and (iv) to establish evidence for the presence of electrochemically reactive nanobubbles. The findings of our experiment suggest that bulk nanobubbles possess the ability to generate reactive oxygen species (ROS) during the process of nanobubble nucleation. Additionally, our results indicate that bulk nanobubbles are electrochemically reactive after the cessation of nanobubble production. The electron spin spectroscopy (ESR) response and degradation of the dye compound over time confirm the electrochemical reactivity of bulk nanobubbles. © 2024 Elsevier Inc.

29.

Energy and environmental metrics-based comparison of ionic liquids/deep eutectic solvents-assisted chemical recycling of waste poly (ethylene terephthalate)

G Kumar, K Kumar, A Bharti - Industrial & Engineering Chemistry Research, 2024

Abstract: Because of excellent thermal, mechanical, and chemical properties, poly(ethylene terephthalate) (PET) is widely used in food and beverage packaging, automotive parts, and healthcare applications. However, due to inefficient waste plastic management, these materials end up in landfills, remain in the environment for thousands of years, and threaten the ecological system. This environmental crisis has prompted the development of new upcycling processes. It is believed that chemical recycling is the way forward. In chemical recycling, PET is depolymerized into monomers using solvents. Glycolysis is the solvolytic depolymerization of PET using glycols, mainly ethylene glycol. But PET glycolysis in the absence of a catalyst is extremely slow. Several catalysts, such as metal salts and oxides, have been developed, but severe reaction conditions, low monomer yield, problems in catalyst recovery and reusability, and product purification have limited their use. Therefore, developing efficient catalysts for PET glycolysis under mild reaction conditions is the trend in PET depolymerization. In recent years, ionic liquids (ILs) and deep eutectic solvents (DESs) have emerged as new-generation materials and have shown excellent catalytic activity. Therefore, this Review focuses on the glycolysis of PET in the presence of ILs/DESs as catalysts, as studied by researchers. The effect of reaction conditions such as temperature, time, catalyst/PET ratio, and solvent/PET ratio are discussed. The processes are compared using three green metrics, energy economy coefficient (ϵ), environmental factor, and environmental energy impact factor (ξ), to find the best IL/DES. In the end, a perspective has been presented for future research in PET depolymerization.

30.

Energy policy: Formulation, monitoring, and adaptation for moving towards a low carbon economy

AR Patel, P Sarkar, H Singh, H Tyagi - The Costs of Climate Change Mitigation Innovations: Book Chapter, 2024

	Abstract: It is essential to understand the connection between energy production, greenhouse gas emissions, and global warming. A worldwide sustainability plan has unified several nations under one roof. The paper offers a comprehensive methodology and factors to be taken into account when developing a sustainable energy policy for a country. When assessing the effectiveness of various nations' efforts to adapt to the production, usage, and consequences of energy sources, the energy trilemma index is frequently used. Nations have varied policies and strategies for reaching sustainable energy goals due to variances in their resources, liabilities, geographic position, stage of development, fuel resources, energy demand, populations, economic growth, and other considerations. There are more and more signs that countries are starting to converge towards a common policy strategy, but there are still a lot of areas that may need improvement. The paper also highlights some important grey areas, including how nuclear and hydro energy are handled, how energy and emissions are accounted for in policy, how emissions are controlled in the transportation sector, how legal provisions for renewable energy are proposed, social responsibilities, energy certificates, embodied energy and emission data, etc. These elements demand that researchers and decision-makers examine this issue from a comprehensive angle. Given this, it is crucial to develop an international, cross-border energy plan that takes into account how the economy and environment affect energy production.
31.	[Enhancing the performance of reinforced hydroxyapatite coatings through post coating treatment](#) G Singh…**D Pal, B Kumari** - Results in Surfaces and Interfaces, 2024 **Abstract:** To enhance the metallurgical, mechanical, and biological properties of medical implants in bodily fluid environments, biocompatible coatings are applied to biomaterials. These biocompatible coatings have a porous structure that promotes effective osseointegration and the ability to prevent harmful ions from metal from seeping into the surrounding bodily environment. In the present study, the impact of the addition of Tantlum carbide (TaC) with 5 and 10 wt% as reinforcement in hydroxyapatite (HA) on the morphology, mechanical and cell viability of plasma-sprayed coatings were investigated. The post-coating treatments are carried on pure HA, HA-R5(HA+5%TaC) & HA-R10 (HA+10%TaC) coatings at 900 °C and at low-temperature treatment at −196 °C. The results showed that heat treatment affects the crystallinity, surface roughness, and bond strength under different high-temperature and low-temperature treatments. Further, in-vitro results show that post-treated samples have more survival of cells as compared to as-sprayed samples. Also, heat-treated and reinforced HA coatings showed no toxicity.
32.	[Evaluation of dynamic properties of sand treated with natural rubber latex for seismic isolation](#) U Vena, **N James** - Geotechnical Special Publication, 2024 **Abstract:** Natural rubber is a frequently utilized material for vibration isolation due to its remarkable energy absorption properties. A few recent studies reported the use of natural rubber, in the form of rubber tyre crumbs, for preparing geotechnical seismic isolation (GSI) layers. In this technique, the soil beneath the foundation is replaced with a layer of sand and rubber chips. However, it can only be used for newly planned constructions. The present study explores the feasibility of transforming a naturally occurring sand layer into a GSI layer by permeating it with natural rubber latex (NRL). The advantage of this treatment is that it is possible even beneath already-existing structures. For this purpose, a preliminary assessment of dynamic properties such as cyclic shear modulus and damping ratio of loose uniform fine sand permeated with NRL was conducted over a range of shear strains by performing cyclic triaxial tests and resonant column
33.	[Expanding a peptide-covalent probe hybrid for PET imaging of S. aureus driven focal infections](#) J B Mitra…S Rakshit, **A Bandyopadhyay**… - EJNMMI Radiopharmacy and Chemistry, 2024

Abstract: Background: The urgent demand for innovative theranostic strategies to combat bacterial resistance to antibiotics is evident, with substantial implications for global health. Rapid diagnosis of life-threatening infections can expedite treatment, improving patient outcomes. Leveraging diagnostic modalities i.e., positron emission tomography (PET) and single photon emission computed tomography (SPECT) for detecting focal infections has yielded promising results. Augmenting the sensitivity of current PET and SPECT tracers could enable effective imaging of pathogenic bacteria, including drug-resistant strains. UBI (29–41), an antimicrobial peptide (AMP) fragment recognizes the S. aureus membrane through electrostatic binding. Radiolabeled UBI (29–41) is a promising SPECT and PET-based tracer for detecting focal infections. 2-APBA (2-acetyl-phenyl-boronic acid), a non-natural amino acid, specifically targets lysyl-phosphatidyl-glycerol (lysyl-PG) on the S. aureus membranes, particularly in AMP-resistant strains. We propose that combining UBI with 2-APBA could enhance the diagnostic potential of radiolabeled UBI. Results: Present work aimed to compare the diagnostic potential of two radiolabeled peptides, namely UBI (29–41) and 2-APBA modified UBI (29–41), referred to as UBI and UBI-APBA. APBA modification imparted antibacterial activity to the initially non-bactericidal UBI against *S. aureus* by inducing a loss of membrane potential. The antibacterial activity demonstrated by UBI-APBA can be ascribed to the synergistic interaction of both UBI and UBI-APBA on the bacterial membrane. To enable PET imaging, we attached the chelator 1,4,7-triazacyclononane 1-glutaric acid 4,7-acetic acid (NODAGA) to the peptides for complexation with the positron emitter Gallium-68 (^{68}Ga). Both NODAGA conjugates were radiolabeled with ^{68}Ga with high radiochemical purity. The resultant ^{68}Ga complexes were stable in phosphate-buffered saline and human serum. Uptake of these complexes was observed in *S. aureus* but not in mice splenocytes, indicating the selective nature of their interaction. Additionally, the APBA conjugate exhibited superior uptake in *S. aureus* while preserving the selectivity of the parent peptide. Furthermore, [^{68}Ga]Ga-UBI-APBA demonstrated accumulation at the site of infection in rats, with an improved target-to-non-target ratio, as evidenced by ex-vivo biodistribution and PET imaging. Conclusions: Our findings suggest that linking UBI, as well as AMPs in general, with APBA shows promise as a strategy to augment the theranostic potential of these molecules.

34.

Gas-sensitive properties of β-ga$_2$o$_3$ thin films deposited and annealed at high temperature
N Yakovlev, A Almaev, A Korchemagin, **M Kumar, D Kaur** - Engineering Proceedings, 2023

Abstract: The gas-sensitive properties of thin films of β-Ga$_2$O$_3$ deposited via RF magnetron sputtering while heating the substrate to 650 °C were studied. Some of the samples were subjected to additional high-temperature annealing at a temperature of 900 °C. As a result, for samples subjected to additional annealing, the response when exposed to 1% H$_2$ increased by five once sensitivity to hydrogen-containing gases appeared. These samples are also characterized by good long-term stability compared to samples without high-temperature annealing. The improvement in gas-sensitive characteristics is explained by a decrease in oxygen vacancies and a decrease in current density by four orders of magnitude.

35.

Group-based voltage control for distribution system with high penetration of PVs
D Kumar, BP Padhy - IEEE 3rd International Conference on Smart Technologies for Power, Energy and Control (STPEC), 2023

Abstract: In the Distribution System (DS), increasing the ratio of solar photovoltaic distributed generators (PV-DGs) results in overvoltage issues. For the reliable and stable operation of DS, this issue must be addressed. In this paper, the Group-Based Voltage Control (GBVC) technique has been proposed. In order to implement GBVC, novel differential entropy-based spectral-clustring clustering is used. It separates the DS in such a way that existing PV-DGs in the group can manage the voltage profile of the group. The optimal operating power of PV-DGs

	has been determined by implementing the Optimal Power Flow (OPF) within the group by satisfying multiple objectives, such as minimizing the active power curtailment and reactive power absorption by available PV-DGs within the group and system losses. The effectiveness of GBVC has been validated on IEEE 33 distribution system by comparing it with the Centralized Voltage Control (CVC) method regarding voltage profile, cumulative active power curtailment and reactive power absorption by PV-DGs, distribution system losses and computation time.
36.	Harnessing sustainable N-doped activated carbon from walnut shells for advanced all-solid-state supercapacitors and targeted Rhodamine B dye adsorption A Husain, K Ansari, DK Mahajan… - Journal of Science: Advanced Materials and Devices, 2024 **Abstract:** This research introduces a novel approach to repurposing walnut shells, an abundant agricultural waste, to synthesize sustainable nitrogen-doped activated carbon (N@AC). The resulting material exhibits remarkable properties suitable for dual applications in high-performance all-solid-state supercapacitors and efficient Rhodamine B dye (RhB) adsorption. In a three-electrode setup, the N@AC electrode exhibits an impressive specific capacitance of 484.6 Fg^{-1} at 1 Ag^{-1} and remarkable long-term stability, maintaining 97.4% of its initial performance even after 5000 charge-discharge cycles. Simultaneously, the all-solid-state symmetric supercapacitor configuration (N@AC//N@AC) demonstrates outstanding specific capacitance, registering at 168.8 Fg^{-1} at 1 Ag^{-1}, accompanied by a favourable rate capability of 67.3% at 10 Ag^{-1}. Notably, the N@AC//N@AC configuration attains a high energy density of 39.8 $WhKg^{-1}$ at 1 Ag^{-1}. Furthermore, N@AC//N@AC exhibits favourable cyclic stability, retaining 83.91% of its initial capacitance even after 10,000 charge-discharge cycles. Moreover, the adsorption efficiency of N@AC toward RhB is scrutinized, highlighting its efficacy in addressing environmental remediation challenges. The porous architecture and nitrogen functionalities of N@AC play a crucial role in expeditiously eliminating organic pollutants from aqueous solutions, offering a sustainable approach to treating wastewater. Optimal conditions for the highest RhB adsorption are identified: pH 7.2, a contact duration of 180 min, and an initial dye concentration of 20 mgL^{-1}. Thermodynamic evaluations, encompassing the determination of $\Delta H\circ$, $\Delta H\circ$, and $\Delta S\circ$, signify the endothermic and spontaneous nature of the adsorption process. In desorption investigations, it is noted that H_2O, employed as an eluting agent, proficiently releases 87.35% of the adsorbed RhB dye.
37.	Improved approach to magnetorheological finishing of blind-hole cavities TS Bedi, SK Pawan, R Kant, AS Rana - Materials and Manufacturing Processes, 2024 **Abstract:** Nanofinishing of blind-hole cavities is important to produce high quality products without any surface irregularities. The commonly used methods such as grinding or honing are not efficient because of the uncontrolled forces and direct contact of the solid abrasive tool with the workpiece. Magnetorheological (MR) polishing process using smart fluid has proved its effectiveness in achieving the nano-finished surface. The existing tool design uses two different operations for nano-scale finishing of a blind-hole cavity, resulting into a higher production cost. In this present work, a novel tool that can vary its dimensions during finishing operation was developed for enhancing the surface finishing of blind-hole cavities. Distribution of magnetic fields within the entire tool and blind-hole cavity surface was found appropriate and also revealed that the tool surface has maximum magnetic field for stiffening the MR polishing fluid over its surface. After 90 minutes of finishing, it was concluded that the roughness (Ra) change on the blind-hole cavity were reduced by 75.12% (on inner vertical) and 74.21% (on inner bottom).
38.	Influence of exhaust aftertreatment system on powertrain vibration behavior AK Sarna, J Singh, N Kumar, V Sharma - SAE International Journal of Commercial Vehicles, 2024

Abstract: NVH refinement of commercial vehicles is the key attribute for customer acceptance. Engine and road irregularities are the two major factors responsible for the same. During powertrain isolators' design alone, the mass and inertia of the powertrain are usually considered, but in practical scenarios, a directly coupled subsystem also disturbs the boundary conditions for design. Due to the upgradation in emission norms, the exhaust aftertreatment system of modern automotive vehicles becomes heavier and more complex. This system is further coupled to the powertrain through a flexible joint or fixed joint, which results in the disturbance of the performance of the isolators. Therefore, to address this, the isolators design study is done by considering a multi-body dynamics model of vehicles with 16 DOF and 22 DOF problems, which is capable to simulate static and dynamic real-life events of vehicles. Design indicators are thoroughly analyzed and validated through the rigid body modes and real field events of the vehicle. As most of the research is done for four-point mounting powertrain systems by considering 6 DOF or 12 DOF in commercial vehicles but a novel approach with a 22 DOF model is proposed in this study to predict the impact of the inclusion of the exhaust aftertreatment system on torque roll axis and rigid body modes decoupling. The results of the proposed system show that the rigid body mode decoupling of the powertrain system improved and consequently the overall NVH performance of the vehicle in real life is further improved. Therefore, it is suggested from the study that ignoring the inclusion of the exhaust aftertreatment system in the powertrain mounting system design reduces the NVH performance of the vehicle, hence it is recommended to include it in the early phase of design.

39.

Interview with Padma Shri S. R. D. Prasad: On the martial art form of Kalarippayattu
A Nandha, AV Suresh - Theatre, Dance and Performance Training, 2024

Absract: *Padma Shri* S. R. D. Prasad (b. 1945, Kerala, India) is an established Kalarippayattu expert recognized by the Government of India with the fourth highest civilian award of 'Padma Shri' for his outstanding contribution to the field of Kalarippayattu. He is the son of Kalarippayattu veteran Chirakkal T. Sreedharan Nair. Groomed as a Kalarippayattu exponent in Sree Bharath Kalari, situated in Valapattanam, Kerala, he now heads the same and has trained numerous students in martial art. He is also a published author. Passionate about championing the cause of Kalarippayattu, he has travelled to various countries and given several talks popularising Kalarippayattu. He is not only a Kalarippayattu master but also a lecture-demonstrator of Kalarippayattu and a former visiting faculty of martial arts at Mumbai University and, most recently, at Kannur University, Kerala. He has several books to his credit on the legacy of Kalarippayattu and has received numerous awards for his contributions to the field, including the prestigious Sangeet Natak Akademi Award in 2015. In 2023, the Government of India bestowed him with 'Padma Shri' in the sports category for his distinguished contribution to the Indian martial art 'Kalarippayattu.' His exceptional accomplishments testify to his passion, dedication, and commitment to the martial art form of Kalarippayattu. This online interview was conducted on the 5th of April 2023 by Aparna Nandha and Aneesh V. Suresh as part of the Indian National Science Academy-funded project titled 'History of Kalarippayattu and its Links with Indigenous Medical Practices.

40.

Investigating the role of amino acids in short peptides for hydroxyapatite binding and osteogenic differentiation of mesenchymal stem cells to aid bone regeneration
M Halder, A Singh, D Negi, Y Singh - Biomacromolecules, 2024

Abstract: Bone defects show a slow rate of osteoconduction and imperfect reconstruction, and the current treatment strategies to treat bone defects suffer from limitations like immunogenicity, lack of cell adhesion, and the absence of osteogenic activity. In this context, bioactive supramolecular peptides and peptide gels offer unique opportunities to develop biomaterials that can play a dominant role in the biomineralization of bone tissues and promote bone formation. In
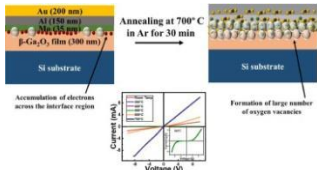
this article, we have demonstrated the potential of six tetrapeptides for specific binding to hydroxyapatite (HAp), a major inorganic component of the bone, and their effect on the growth and osteogenic differentiation of mesenchymal stem cells (MSCs). We adopted a simplistic approach of rationally designing amphiphilic peptides by incorporating amino acids, Ser, pSer, Pro, Hyp, Asp, and Glu, which are present in either collagenous or noncollagenous proteins and render properties like antioxidant, calcification, and mineralization. A total of six tetrapeptides, Trp–Trp–His–Ser (WWHS), Trp–Trp–His–pSer (WWHJ), Trp–Trp–His–Pro (WWHP), Trp–Trp–His–Hyp (WWHO), Trp–Trp–His–Asp (WWHD), and Trp–Trp–His–Glu (WWHE), were synthesized. Four peptides were found to self-assemble into nanofibrillar gels resembling the extracellular matrix (ECM), and the remaining two peptides (WWHJ, WWHP) self-assembled into nanorods. The peptides showed excellent cell adhesion, encapsulation, proliferation, and migration and induced the differentiation of mesenchymal stem cells (MSCs), as evident from the enhanced mineralization, resulting from the upregulation of osteogenic markers, RUNX 2, COL I, OPN, and OCN, alkaline phosphatase (ALP) production, and calcium deposition. The peptides also induced the downregulation of inflammatory markers, TNF-α and iNOS, and the upregulation of the anti-inflammatory marker, IL-10, resulting in M2 macrophage polarization. RANKL and TRAP genes were downregulated in a coculture system of MC3T3-E1 and RAW 264.7 cells, implying that peptides promote osteogenesis and inhibit osteoclastogenesis. The peptide-based biomaterials developed in this work can enhance bone regeneration capacity and show strong potential as scaffolds for bone tissue engineering.

41.
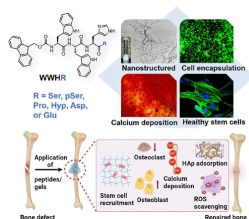
[Lithium-grafted Si-doped γ-graphyne as a reversible hydrogen storage host material](#)
N Duhan, TJD Kumar - Physical Chemistry Chemical Physics, 2024

Abstract: In recent years, hydrogen (H2) has become the most sought-after sustainable energy carrier by virtue of its high energy content and carbon-free emission. The practical implementation of hydrogen as an alternative fuel calls for an efficient and secure storage medium. Within this framework, we have investigated Li-grafted Si-doped γ-graphyne for H2 storage applications by implementing the cutting-edge density functional theory (DFT). A dynamically and thermally stable Si-doped γ-graphyne (SiG) monolayer is functionalized with Li metal atoms that augmented the hydrogen binding strength of the nanolayer by almost three times, owing to the polarization effect of the Li atoms. The Li metal atoms get adsorbed over the monolayer, allowing a binding energy of −2.73 eV that is greater than the Li cohesive energy (−1.63 eV), which eliminates the metal–metal clustering probability. The reliability of the Li-functionalized SiG monolayer (Li8SiG) at elevated temperature has been further substantiated by performing and analyzing ab initio molecular dynamics (AIMD) simulations at 400 K. It is noteworthy that a total of four H2 molecules are held up by each Li atom with an average adsorption energy of −0.32 eV and a maximum gravimetric capacity of 8.48 wt%, which remarkably follows the US-DOE parameters. Partial density of states and Hirshfeld charge analysis are utilized to recognize the interaction channel which reveals the Kubas and Niu–Rao–Jena-like bonding among the metal atoms and loaded hydrogen molecules. The hydrogen occupancy calculated at different temperatures and pressures indicates that hydrogen molecules can be reversibly stored over the Li8SiG system, and it is noted that adsorbed H2 begins to desorb at 280 K, with complete desorption at 400 K and 20 atm (or lower). AIMD simulations are further performed to authenticate the H2 desorption at various temperatures,
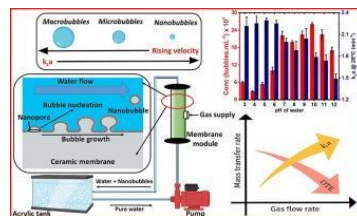
	which agrees well with the occupation number analysis. All the outcomes advocate for efficient reversible hydrogen storage over the proposed host material.
42.	Low resistance ohmic contact of multi-metallic Mo/Al/Au stack with ultra-wide bandgap Ga2O3 thin film with post-annealing and its in-depth interface studies for next-generation high-power devices **Shivani**, N Sharma, M Kumar, **M Kumar -** Surfaces and Interfaces, 2024 **Abstract:** Ultra-wide band gap materials like β-Ga2O3 is considered as a potential candidate for power devices owing to their high breakdown voltage in contrast to the conventional semiconductors. The performance and the figure-of-merit for power devices critically depend on resistance offered by ohmic contact of metal with ultra-wide gap materials. However, high-quality ohmic contacts with Ga2O3 presents a significant challenge due to Fermi-level pinning and formation of Schottky barriers for the majority of metal contacts. Here, we investigated the electrical characteristics and interfacial reactions of Au/Al/Mo metal stack with β-Ga2O3 thin film at various annealing temperatures to demonstrate the ohmic contact formation mechanism. In-depth surface-sensitive XPS and UPS are employed to study the interface of metallic stack/Ga2O3 thin film. Our results indicate that post-annealing at high temperatures led to the intermixing of the metallic stack and results in the formation of binary intermetallic compounds of Al and Au. The intermetallic compound diffuses into the Ga2O3 layer and resulting in the creation of an oxygen-deficiency near the interface and helping to achieve contact resistance of $7.15 \times 10^{-6}\ \Omega\ cm^2$. This study establishes a robust foundation for the expanded utilization of Ga2O3 in power electronics and optoelectronics devices, emphasizing the vital role of interface engineering.
43.	Mechanical stimulation alters the collagen protein structure in skin tissue KK Dwivedi, R Jhorar, S Kumar, **N Kumar -** Microbiology-2.0 Update for a Sustainable Future: Book Chapter, 2024 **Abstract:** Soft tissue remodelling is the response of mechanical signal sensed by the molecular structure. However, the response of soft tissue molecular structure against the external mechanical stimulation is not well known. Some studies illustrated that the tissue remodelling depends on the rate of mechanical stimulation, however its cause is not well known. Understanding the response of molecular structure against the mechanical stimulation is crucial for the development of physiotherapeutic criteria to improve tissue health and wound healing. In this study, we investigated the effect of rate of mechanical stimulation on the alteration of nano and molecular structure of skin. For mechanical stimulation, pig skin was cyclically stretched at three different frequencies 0.1, 2.0 and 5.0 Hz. Whereas, nano and molecular structure of virgin and mechanical tested skin was assessed under atomic force microscope (AFM) and attenuated total reflectance Fourier transform infrared spectroscopy (FTIR–ATR), respectively. The alteration in nano and molecular structure was found sensitive to rate of mechanical stimulation as change in collagen fibril d-periodicity and collagen molecular (tropocollagen, protein structure) was found significantly larger corresponding to 0.1 Hz than 2.0 Hz and 5.0 Hz. A significant negative correlation ($r = 0.74$, $p = 0.041$) was found between stretching frequency and alteration in collagen protein structure. These results indicate that slow mechanical stimulation during physiotherapy may improve the tissue remodelling.
44.	Modified variational iteration method and its convergence analysis for solving nonlinear aggregation population balance equation

S Yadav, M Singh…**J Kumar** - Computers & Fluids, 2024

Abstract: This study proposes a novel approach based on the variational iteration method to solve the nonlinear aggregation population balance equation. The approach provides great flexibility by allowing the selection of appropriate linear operators and efficiently determining the Lagrange multiplier in the nonlinear aggregation population balance equation. The mathematical derivation is supported by conducting a detailed convergence analysis using the contraction mapping principle in the Banach space. Furthermore, error estimates for the approximate solutions are derived, thereby improving our understanding of the accuracy and reliability of the proposed method. To validate the new approach, the obtained solutions are compared with the exact solutions for analytically tractable kernels. However, for more complex physically relevant kernels including polymerization, Ruckenstein/Pulvermacher, and bilinear kernels, due to lack exact solutions, the obtained series solutions corresponding to different initial conditions are verified against the finite volume scheme (kumar et al., 2016). The outcomes illustrate that the proposed approach offers superior approximations of number density functions with fewer terms and demonstrates higher accuracy over extended time domains than the traditional variational iterative method. The new approach also has the tendency to capture the zeroth and first order moments of the number density function with high precision.

45.

[Morphine acts via TLR4 resulting in neuroinflammation and immunosuppression](#)
JA Malik, JN Agrewala - Medical Hypotheses, 2024

Abstract: Millions of people suffer globally from disorders caused by narcotic substances. Drug addiction leads to the destruction of an individual's life and risk to public safety. Morphine is the prime alkaloid well-known as the mother opiate and has many implications for the human body, specifically for the immune system. It down-regulates all the arms of the immune system and reduces its efficiency in combating different pathogenic molecules. It also implicates human physiology and deviates from homeostasis. The morphine-like drugs alter the immune system by binding to the mu receptor. This binding results in impaired clearance of pathogens from the body. Morphine produces organ-specific effects; in the brain, it mediates neuroinflammation that is responsible for morphine tolerance and morphine addiction and causes anti-inflammatory effects in the peripheral organs that are responsible for immunosuppression, leading to opportunistic infections. There is huge complexity in understanding the effects of morphine in the biological system. Therefore, in this paper, we will discuss the dual roles of morphine in the brain and peripheral organs and the mechanisms associated.

46.

[Multivariate population balance modeling and simulation of ultrasound-assisted crystallization of a plate-type pharmaceutical: Nucleation, growth, and breakage](#)
A Maharana, A Das, **J Kumar**, D Sarkar - Computers & Chemical Engineering, 2024

Abstract: The application of ultrasound is recently gaining significant interest in crystallization because of its significant impact on nucleation and growth rates, particle breakage, crystal habit, polymorphism, and crystal size distribution. Pyrazinamide, an essential drug for the treatment of mycobacterium tuberculosis, has four different polymorphic forms. The metastable δ-polymorph exhibit plate-type habit which is desirable for downstream operations compared to commercially available needle-type α-polymorph. This contribution presents a detail experimental and computational study on the effect of ultrasound and its amplitude on nucleation, growth, and breakage of crystals for unseeded batch cooling sonocrystallization of δ-polymorph of pyrazinamide from its 1,4-dioxane solution. A series of sonocrystallization experiments are conducted with different cooling rates and ultrasonic amplitudes and a bivariate population balance model involving crystal nucleation, growth, and breakage is developed and fully validated. The model simulations give important insights on time evolution of mean crystal size and aspect ratio of plate-type crystals.

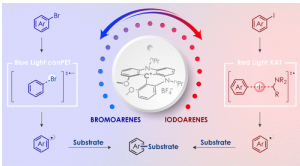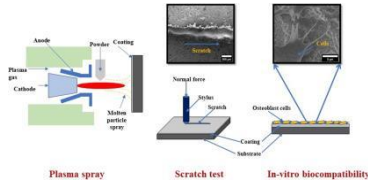|	
47.	[Nanobubbles produced by nanopores to probe gas-liquid mass transfer characteristics](#) **H Sharma, N Nirmalkar**, W Zhang -Journal of Colloid and Interface Science, 2024 **Abstract:** Hypothesis: This study tested the hypothesis of how the nanopore size of membranes and how the surface charge of nanobubbles responds to its pinch-off from the nanopore. This study also tested the hypothesis that nanobubbles that remain in solution after production may increase the dissolved oxygen content in water. Experiments: The effect of membrane pore size, hydrodynamic conditions (gas and liquid flow rates), and physicochemical parameters (pH and temperature) on volumetric mass transfer coefficient ( ) for oxygen nanobubbles formed by the nanopore diffusion technique was investigated. This study experimentally determined the by carefully removing the dissolved oxygen by nitrogen purging from nanobubble suspension to examine the sole contribution of nanobubble dissolution in water to the reaeration. Results: Scaling estimates indicate that the nanobubble pinch-off radius and nanopore radius have a power-law correlation and that nanobubble size declines with the nanopore size. This is in line with our experimental results. The surface charge of nanobubbles delays its pinch-off at the gas-liquid interface. Nanobubbles offered 3-4 times higher than microbubbles. Standard oxygen transfer efficiency in water was found to be 78%, significantly higher than that in microbubbles. However, dissolving stable nanobubbles in water does not considerably increase dissolved oxygen levels.
48.	[Nanoscale Ni/Mo/MoO₃/Ni memristor for synaptic applications](#) M Praveen, AK Nishad, **VK Nishad** - Electronics Letters, 2024 **Abstract:** For the first time, a physics-based modelling of a nanoscale $Ni/Mo/MoO_3/Ni$ memristor is presented in this letter by inserting a 'Mo:Capping layer' between the top electrode (Ni) and the insulating layer (MoO_3). The proposed memristor has stable hysteresis I–V characteristics as well as a significant reduction in 'Forming voltage' (V_{FORM}) to 0.75 V. The simulated resistive switching responses using the COMSOL Multiphysics package demonstrate consistently low values of coefficient of variability (C_V) with 14.31% and 14.85% for the SET and RESET modules, respectively, during cycle-to-cycle variations along with a low compliance current (I_{CC}) of 193 µA. In addition to observing synaptic plasticity behaviour, it also examines how ramp-rates impact 'Potentiation' and 'Depression' as memristor conductance (G) is closely related to synaptic weights.
49.	[Oil spill risk analysis for the NEOM shoreline](#) **HVR Mittal**, MA Hammoud, AK Carrasco… - Scientific Reports, 2024 Abstract: A risk analysis is conducted considering an array of release sources located around the NEOM shoreline. The sources are selected close to the coast and in neighboring regions of high marine traffic. The evolution of oil spills released by these sources is simulated using the MOHID model, driven by validated, high-resolution met-ocean fields of the Red Sea. For each source, simulations are conducted over a 4-week period, starting from first, tenth and twentieth days of each month, covering five consecutive years. A total of 180 simulations are thus conducted for each source location, adequately reflecting the variability of met-ocean conditions in the region. The risk associated with each source is described in terms of amount of oil beached, and by the time required for the spilled oil to reach the NEOM coast, extending from the Gulf of Aqaba in the North to Duba in the South. To further characterize the impact of individual sources, a finer analysis is performed by segmenting the NEOM shoreline, based on

	important coastal development and installation sites. For each subregion, source and release event considered, a histogram of the amount of volume beached is generated, also classifying individual events in terms of the corresponding arrival times. In addition, for each subregion considered, an inverse analysis is conducted to identify regions of dependence of the cumulative risk, estimated using the collection of all sources and events considered. The transport of oil around the NEOM shorelines is promoted by chaotic circulations and northwest winds in summer, and a dominant cyclonic eddy in winter. Hence, spills originating from release sources located close to the NEOM shorelines are characterized by large monthly variations in arrival times, ranging from less than a week to more than 2 weeks. Similarly, large variations in the volume fraction of beached oil, ranging from less then 50% to more than 80% are reported. The results of this study provide key information regarding the location of dominant oil spill risk sources, the severity of the potential release events, as well as the time frames within which mitigation actions may need to deployed.
50.	On arithmetic nature of a Q-Euler-double zeta values **T Chatterjee**, **S Garg** - Proceedings of the American Mathematical Society, 2024 **Abstract:** Chatterjee and Garg [Proc. Amer. Math. Soc. 151 (2023), pp. 2011–2022] established closed form for a q-analogue of the Euler-Stieltjes constants. In this article, we aim to build upon their work by extending it to a q-analogue of the double zeta function. Specifically, we derive a closed form expression for $\gamma_{0,0}(q)$ which is a q-analogue of Euler's constant of height 2 and appear as the constant term in the Laurent series expansion of a q-analogue of the double zeta function around $s_1 = 1$ and $s_2 = 1$. Moreover, we examine the linear independence of a set of numbers involving the constant [Formula presented], where $1 \leq i \leq r$ for any integer $r \geq 1$, that appears in the Laurent series expansion of a q-double zeta function. Finally, we discuss the irrationality of certain numbers involving a 2-double Euler-Stieltjes constant ($\gamma_{0,0}(2)$). © 2024 by Tapas Chatterjee; Sonam Garg.
51.	On the dynamics of coalescence between droplets and partially filled microgrooves **R Kumar, CS Sharma** - Physics of Fluids, 2024 **Abstract:** When water vapor condenses on a hydrophobic surface equipped with microgrooves, a unique phenomenon of coalescence between droplets growing on the ridges and the microgrooves partially imbibed with a condensate is manifested. Such coalescence is distinctly different from droplet–droplet coalescence and can trigger rapid removal of the condensate from the surface, a critical requirement for high thermodynamic efficiency of condensation. In this work, we investigate the dynamics of this coalescence process. We develop an experimentally validated, three-dimensional, volume of fluid method-based numerical modeling framework that accounts for dynamic contact angle variation during contact line motion. The condensate wetting the microgroove forms a liquid column with a meniscus pinned to the microgroove edges. We show that ridge droplet coalescence with this pinned meniscus triggers capillary ripples that traverse the microgroove in transverse and longitudinal directions and can trigger the depinning of the contact line from the opposing edge depending on the size of the coalescing droplet. The contact line depins when the local contact angle at the opposing edge reaches ~180° and, simultaneously, the kinetic energy converted from the excess surface energy available reaches a maximum. Additionally, we show that the overall coalescence process is significantly affected by the microgroove aspect ratio. For the same liquid volume, relatively shallower microgrooves cause the condensate to overflow, thus attaining a morphology akin to large droplets in the Wenzel state. As a result, the coalescence dynamics on such microgrooved surfaces are similar to that on a planar surface.
52.	Performance evaluation of linear antenna array using quasi opposition modified particle swarm algorithm

H Singh, **S Singh**, J Kaur, A Sharma, A Gupta, H Singh - Journal of Computational Science, 2024

Abstract: Linear antenna arrays find extensive application in the communication systems of the future, including IoT, 5 G, and beamforming technologies. However, sustaining subsidiary lobes while keeping a tight beamwidth remains a challenge. In this paper, an enhanced version of Artificial Hummingbird Algorithm (AHOA) is presented. AHOA is a kind of particle swarm algorithm based on the unique flying abilities and clever foraging techniques of hummingbirds seen in nature. In this research, a hybridization of AHOA and quasi opposition based learning is presented for linear antenna array applications. The quasi opposition learning based artificial hummingbird method has been developed to produce more accurate outcomes for further complicated tasks and is named as Quasi Opposition Based Artificial Hummingbird Algorithm. The approach is evaluated across various communication needs of the linear array, and the results are compared with those obtained from other conventional methods. In comparison to the other approach, the proposed strategy delivers the lowest subsidiary lobes along with the narrow beamwidth without any grating lobes. Thus, the proposed approach is capable of managing diverse linear array applications without sacrificing beamwidth or subsidiary lobes levels.

53.

PhishDetect: A BiLSTM based phishing URL detection framework using FastText embeddings

K Mangalam, B Subba - 16th International Conference on COMmunication Systems and NETworkS (COMSNETS)*, 2024.*

Abstract: As per the Anti-Phishing Working Group's (APWG) report, there were approximately 4.7 million phishing attacks in the year 2022. A significant portion of these phishing attacks were carried out by alluring unsuspecting users into visiting counterfeit web-pages, which are hosted using malicious uniform resource locators (URLs). This paper proposes a lightweight Bidirectional Long Short Term Memory (BiLSTM) based phishing URL detection framework for mitigating the threats posed by phishing attacks. The proposed framework initially splits the URLs into four distinct components namely, Protocol type, domain, sub-domain and top level domain(TLD) using a set of special characters as delimiters. Different feature values corresponding to these four components are then used to build a vocabulary database of the URL corpus. Thereafter, a customized FastText word embedding technique is used to learn numeric feature vector representations of the tokens(URL features) present in the vocabulary database. These learned feature vectors, along with the pre-processed instances of the URL corpus are then provided as input to train a BiLSTM based classifier model for detection of malicious phishing URLs. Experimental results on a proprietary URL corpus comprising 200,000 normal and phishing URL instances show that the proposed framework achieves high accuracy in detecting malicious phishing URLs with minimal computational overhead.

54.

Power theft detection in residential distribution grids using dirichlet process mixture modelling

S Agarwal, A Srivastava, R Sodhi - 10th IEEE International Conference on Power Systems (ICPS), 2023

Abstract: In developing nations like India, distribution companies annually face a loss of billions of dollars due to electricity theft. Conventional manual inspection of power theft can be very time-consuming and ineffective. Hence, advanced methods need to be developed to accurately detect electricity theft. The technique proposed in this work is based upon irregular-scenario classification, feature extraction and clustering to identify suspicious customers. The proposed methodology makes use of Bayesian Non-Parametric Dirichlet Process Mixture Modelling (BNP-DPMM) which is an advanced clustering algorithm and eliminates the problem of having a fixed number of clusters. A rigorous analysis is carried out and the proposed technique successfully group irregular and regular customers in very distinct clusters. For verification, another analysis on actual Smart meter data is also carried out and the technique is able to again successfully categorize different types of customers in distinct clusters.
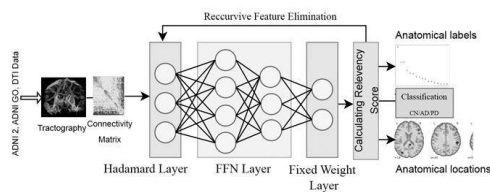
55.	[Quantum chemistry-based approach for density prediction of non-ionic hydrophobic eutectic solvents](#) G Kumar, **K Kumar**, A Bharti - Journal of Solution Chemistry, 2024 **Abstract:** Non-ionic hydrophobic eutectic solvents have emerged as a new class of eutectic solvents. They are prepared by mixing two non-ionic components. They have gained significant interest compared to their counterpart ionic hydrophobic eutectic solvents and hydrophobic ionic liquids due to the availability of a wide array of non-ionic substances that can be used to prepare these solvents. Understanding the distinct physical characteristics of these solvents is crucial to their practical application within process industries and associated fields. The present work reports the development of a density model for these solvents based on the conductor-like screening model (COSMO), a dielectric continuum solvation model. For this purpose, a comprehensive literature search was carried out, and 485 density points of 37 different hydrophobic non-ionic eutectic solvents were collected. COSMO volume, one of the outputs of the COSMO calculations, was correlated with the experimental molar volume for the model development. Two different models were developed, one at 298.15 K and another a general model that can predict the density over a wide temperature range at atmospheric pressure. The developed model only requires the molar ratio and COSMO volumes of the components forming the eutectic solvents to predict the density. The proposed general model performed better than most other models and was comparable with the best one reported in the literature, with an average relative deviation percent (ARD%) of 1.34%.
56.	[Radar-based human activity recognition using multidomain multilevel fused patch-based learning](#) **A Dey**, S Rajan, G Xiao, J Lu - IEEE Transactions on Instrumentation and Measurement, 2024 **Abstract:** Recently, several deep-learning (DL) techniques using different types of 2-D representations of radar returns, have been developed for radar-based human activity recognition (HAR). Most of these DL techniques involve a fusion approach (either at the feature level (intermediate) or at the decision level (late)) as the information obtained from one 2-D radar representation supplements the information obtained from another 2-D radar representation for enhanced HAR. The inputs to these fusion-based DL techniques are red, green, and blue (RGB) images of 2-D representations of radar returns. The information contained in the 2-D representations is completely mapped to color (RGB) domains. However, none of the DL techniques exploit this color information explicitly for HAR. This work proposes a novel lightweight multidomain multilevel fused patch-based learning model that exploits individual color domain information of RGB images of 2-D representations, namely, range-time, range-Doppler, and spectrograms for enhanced HAR using radars. This work proposes a novel domain-level (early) fusion of 2-D representations of radar returns based on the color domain information. Individual color planes (R, G, B) of 2-D representations are fused together to form consolidated three-channel images that serve as input to an isotropic patch-based learning model called convolutional mixer (convMixer). The early (domain) fused three-channel images are used as inputs to an attentional feature level (intermediate) fusion-based convMixer models. The performance of the proposed model is evaluated using a publicly available radar signatures dataset of human activities. The proposed model outperforms the state-of-the-art significantly using a location-wise testing strategy, which eliminates the possibility of data leakage.
57.	[Randomized singular value decomposition based real-time wide area voltage stability (WAVS) assessment](#) **M Pandit, R Sodhi** - Electric Power Systems Research, 2024 **Abstract**: Phasor Measurement Units (PMUs) are the advanced measuring devices which provide time-stamped measurements of voltage magnitudes as well as phase angles in Wide Area Monitoring Systems. These synchrophasors are exploited in this paper to develop a model-free voltage stability assessment method using randomized singular value decomposition (rSVD).

	Stage-1 of the proposal carries out an off-line study to (a) identify voltage weak buses to equip them with PMUs and (b) estimate the voltage stability monitor's threshold based on the largest singular value (LSV). Stage-2 proposes a temporal change detection technique to identify and isolate the disturbance samples from steady state measurement window to maintain linearity of PMU data matrix. Finally, Stage-3 proposes the use of rSVD technique in an online environment to assess the WAVS. This technique performs SVD of low dimensional PMU data matrix to make the approach computationally lighter. The performance of the proposed scheme is demonstrated on the IEEE 14-bus system and the IEEE 118-bus system. The viability of the real-time implementation of the proposed scheme is also verified by way of its Real-Time Digital Simulation on the IEEE 14-bus system.
58.	Rapid self-healing and superior toughness in ionically crosslinked polymer ionogels and strain sensing applications **AK Padhan, D Sharma, TS Thomas, AP Sinha, AN Mallick, D Mandal** - Journal of Materials Chemistry A, 2024 **Abstract:** Self-healing polymeric ionogel/hydrogel materials are mostly viscoelastic and lack high mechanical toughness; however, simultaneous rapid self-healing and robust mechanical properties are essential for various applications. Herein, an ionically crosslinked polymer ionogel comprising poly(vinylimidazol) [PVIM] and polyphosphoric acid [PPA] having a dual interpenetrating network of ionic and hydrogen bonding interactions is reported. The designed ionogel PVIM-PPA shows rapid and repeatable self-healing within a few seconds without any external stimulus, realizes exceptional mechanical properties such as high tensile strength (30 ± 1 MPa), superior toughness (43.3 ± 0.5 MJ m−3), and fracture energy (4100 J m−2) with ~90% of healing efficiency and possesses intrinsic flexibility, transparency, and fire-resistant properties. In addition, the mechanical and self-healing properties of the polymer were also investigated by incorporating Ca-ions into the PVIM-PPA ionogels. The PVIM-PPA-Ca ionogel shows an enhancement of the tensile strength to 39 ± 1 MPa and fracture energy of 4700 J m−2 with ≥87% self-healing efficiency. The ionic conductivity of the PVIM-PPA-Ca polymer membrane increases almost five times (5.93×10^{-5} S cm−1) w.r.t PVIM-PPA (1.25×10^{-5} S cm−1) and it can retain ~90% of the conductivity after self-healing. The recovery efficiency remains almost constant from the second cycle up to the sixth subsequent failure-recovery cycle for these ionogels. Furthermore, a wearable strain sensor was designed using the designed ionogels to detect various human motions accurately and reliably.
59.	Realizing the label-free sensitive detection of carcinoembryogenic antigen (CEA) in blood serum via a MNC-decorated flexible immunosensor **D Mehta, S Kaur, TC Nagaiah** - Analytical Methods, 2024 **Abstract:** A label-free electrochemical immunosensor utilising nitrogen-rich mesoporous carbon (MNC) as the substrate material was developed for the sensitive quantification of carcinoembryonic antigen (CEA). The synergic interactions between MNC and AbCEA also eliminated the need for coupling agents such as EDC/NHS. The novel immunosensor demonstrated a wide detection range from 500 fM (9.04 pg mL−1) to 50 nM (1 μg mL−1) and a low detection limit (LOD) of 500 fM. Moreover, the immunosensor showed sensitivities of 12.27 mA nM−1 cm−2 and 0.066 mA nM−1 cm−2 for detecting CEA in the linear ranges 10 pM to 1 nM and 2 nM to 50 nM, respectively, while maintaining long-term storage stability of 6 weeks. Analysis of real serum sample analysis yielded highly accurate results with recovery rates ranging from 99.3% to 103.7%. Furthermore, the developed paper-based screen-printed electrode exhibited a similar detection range, suggesting its potential for use in point-of-care detection devices in future applications.
60.	Red light-blue light chromoselective C(sp2)-X bond activation by organic helicenium-based photocatalysis

MM Hossain, **AC Shaikh**, R Kaur, TL Gianetti - Journal of the American Chemical Society, 2024

Abstract: Chromoselective bond activation has been achieved in organic helicenium (nPr-DMQA+)-based photoredox catalysis. Consequently, control over chromoselective C(sp2)–X bond activation in multihalogenated aromatics has been demonstrated. nPr-DMQA+ can only initiate the halogen atom transfer (XAT) pathway under red light irradiation to activate low-energy-accessible C(sp2)–I bonds. In contrast, blue light irradiation initiates consecutive photoinduced electron transfer (conPET) to activate more challenging C(sp2)–Br bonds. Comparative reaction outcomes have been demonstrated in the α-arylation of cyclic ketones with red and blue lights. Furthermore, red-light-mediated selective C(sp2)–I bonds have been activated in iodobromoarenes to keep the bromo functional handle untouched. Finally, the strength of the chromoselective catalysis has been highlighted with two-fold functionalization using both photo-to-transition metal and photo-to-photocatalyzed transformations.

61.

Retinal vascular pathology in a mouse model of Lafora progressive myoclonus epilepsy
RP Patil, N Kumar, A Kaur, **RK Munian**… - Neuroscience Research, 2024

Abstact: Neurodegenerative diseases (ND) affect distinct populations of neurons and manifest various clinical and pathological symptoms. A subset of ND prognoses has been linked to vascular risk factors. Consequently, the current study investigated retinal vascular abnormalities in a murine model of Lafora neurodegenerative disease (LD), a fatal and genetic form of progressive myoclonus epilepsy that affects children. Here, arterial rigidity was evaluated by measuring pulse wave velocity and vasculature deformations in the retina. Our findings in the LD mouse model indicate altered pulse wave velocity, retinal vascular thinning, and convoluted retinal arteries.

62.

Role of tungsten disulfide quantum dots in specific protein-protein interactions at air-water interface
H Kaur, M Garg, **D Tomar, KC Jena**... - Journal of Chemical Physics, 2024

Abstract: The intriguing network of antibody-antigen (Ab-Ag) interactions is highly governed by environmental perturbations and the nature of biomolecular interaction. Protein-protein interactions (PPIs) have potential applications in developing protein-adsorption-based sensors and nano-scale materials. Therefore, characterizing PPIs in the presence of a nanomaterial at the molecular level becomes imperative. The present work involves the investigation of antiferritin-ferritin (Ab-Ag) protein interactions under the influence of tungsten disulfide quantum dots (WS2 QDs). Isothermal calorimetry and contact angle measurements validated the strong influence of WS2 QDs on Ab-Ag interactions. The interfacial signatures of nano-bio-interactions were evaluated using sum frequency generation vibration spectroscopy (SFG-VS) at the air-water interface. Our SFG results reveal a variation in the tilt angle of methyl groups by $\sim12° \pm 2°$ for the Ab-Ag system in the presence of WS2 QDs. The results illustrated an enhanced ordering of water molecules in the presence of QDs, which underpins the active role of interfacial water molecules during nano-bio-interactions. We have also witnessed a differential impact of QDs on Ab-Ag by raising the concentration of the Ab-Ag combination, which showcased an increased inter-molecular interaction among the Ab and Ag molecules and a minimal influence on the methyl tilt angle. These findings suggest the formation of stronger and
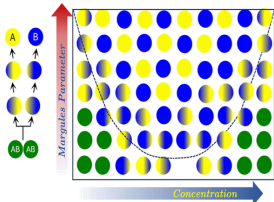
ordered Ab-Ag complexes upon introducing WS2 QDs in the aqueous medium and signify the potentiality of WS2 QDs relevant to protein-based sensing assays.

63.	Scratch resistance and in-vitro biocompatibility of plasma-sprayed baghdadite coatings reinforced with carbon nanotubes **S Singh, A Kumar, M Kamboj, B Das, H Singh, K Rakha** - Surface and Coatings Technology, 2024 **Abstract:** Hydroxyapatite (HA, Ca10(PO4)6(OH)2) coatings, commonly used for metallic implants, have limitations such as excessive brittleness, low fracture toughness, inadequate wear resistance, and slow osseointegration properties. In contrast, baghdadite (BAG, Ca3ZrSi2O9), a calcium zirconium silicate-based bioceramic, exhibits outstanding biological properties, to promote cell proliferation and differentiation of human osteoblasts along with adequate mechanical strength. In this study, plasma-sprayed HA, BAG, and carbon nanotubes (CNT, 1 wt%, and 2 wt%) reinforced BAG coatings are deposited on titanium (Ti) substrate to enhance its mechanical as well as biological properties. The microhardness values of CNT-reinforced BAG coatings increase due to a decrease in porosity and the retention of CNT inside the BAG matrix. Progressive loading scratch tests are performed, revealing a reduction in wear volume loss from 15.051 mm3 to 12.574 mm3 and scratch rate from 43.262 mm3N−1 m−1 to 36.172 mm3N−1 m−1 with the addition of 2 wt% CNT in BAG coatings. The scratch hardness test results demonstrated that introducing CNT into BAG coating significantly enhances its performance, showing a remarkable 38.7 % improvement. In-vitro cell culture studies indicate excellent cell adhesion, growth, and proliferation of MC3T3-E1 osteoblast cells on the surfaces of the CNT-reinforced BAG coatings.
64.	SecAP: Security analysis of the artificial pancreas M Walenda, A Lektorov, S Saxena, S Bhatia, **N Kumar** - International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), 2023 **Abstract:** The artificial pancreas system is a recent development to assist patients with type 1 diabetes controlling their blood glucose levels. It involves several medical devices that use wireless protocols for communication and thus are vulnerable to cyber attacks. This paper focuses on replay and denial-of-service attacks because of their commonality and potentially significant impact on the patient's health. These attacks were modeled and implemented on the GlucoSym Simulator, a program used to develop safer and more accurate AP control algorithms. The effects of each attack on the patient's glucose and insulin dose levels were observed and recorded. Observations of events of hyperglycemia and hypoglycemia over the course of the simulation were used to identify the ideal time for an attacker to cause the most harm to the patient. Finally, a detection method for these attacks is proposed to alert the AP user that corrective actions need to be taken in the event of an attack.
65.	Seismic response of rocking shallow foundation in RC framed structure: A parametric study **RM Kannan, N James, P Haldar** - Journal of Vibration Engineering & Technologies, 2024 **Abstract:** Purpose: This article concentrates on rocking foundation which is one of the most effective design alternatives to safeguard the super structure from excessive damage due to higher lateral forces during severe earthquakes. Methods; The present study aims to illustrate the beneficial effects of rocking foundations on the overall seismic performance of high-rise Reinforced Concrete (RC) frame structures by comparing with its conventionally designed

foundation and fixed base counterparts. Within the OpenSees framework the rocking foundation and conventionally designed foundations are modelled as Beam on Nonlinear Winkler Foundation (BNWF) and super structure elements are modelled using fiber section approach with distributed plastic hinges. Results: Nonlinear static pushover analyses revealed that allowing rocking at the footing level increases yield and peak displacement by about 9% to 34% without significant reduction in the strength of the structures. Further, plastic displacement capacity is enhanced with increasing rocking effect, indicating the beneficial effect of foundation rocking on the overall seismic performance of the structure. Based on the results obtained from nonlinear dynamic time history analyses, it is ascertained that the moment transferred from column to foundation, owing to seismic action, decreases by 20% to 50% with a reduced peak roof acceleration and increasing settlement at the base of the foundation with increasing foundation rocking. However, the maximum settlement did not exceed permissible limits mentioned in Indian standards. From the fragility assessment, it is noticed that the increasing foundation rocking substantially reduces the collapse probability by a maximum of 10% than the fixed base counterparts for the 8-storey and 10-storey structures resting on dense and very dense sand. Conclusions: The findings from this study shows that it is desirable to under-proportion the size of footings with reduced earthquake loads by up to 50%, in order to improve the overall seismic behaviour of RC-framed structures during severe earthquake events.

66.	[Solvated electrons: dynamic reductant in visible light photoredox catalysis](#) P Singh, N Lal, **AC Shaikh** - Advanced Synthesis & Catalysis, 2024 **Abstract**: Open shell species are alluring significant attention owing to their unique physiochemical properties in redox chemistry for activating remarkably stable bonds. Solvated electrons are one of them that have been extensively investigated due to their high reduction potential (Ered = -2.9 V vs SHE in CH3CN), diverse substrate activation, and promising applications. If the activating species have a larger redox potential with a longer lifetime, then the broader range of substrates will be activated. Hence, the solvated electron qualifies as a super-reductant with these qualities. However, due to safety issues, generating solvated electrons by dissolving alkali metals in an ammoniated solvent limits its use towards complicated organic transformations. Instead photochemically generated solvated electron overcome this limitation and is identified as a user-friendly, sustainable, and much safer alternative approach for producing solvated electrons. In this minireview, we have comprehensively highlighted the recent key methods to generate the solvated electron photochemically, characterization techniques, and its application in organic transformations with selected examples. The minireview provides new opportunities for chemists to understand the conceptual, physical, and mechanistic chemistry principle of this super reductant for exploiting a new photochemical route for the transformations that are difficult to achieve by other means.
67.	[Solvent-free chemical upcycling of poly(bisphenol A carbonate) and poly(lactic acid) plastic waste using SBA-15-functionalized basic ionic liquids](#) **AK Manal, G Saini, R Srivastava** - Green Chemistry, 2024 **Abstract:** Chemical upcycling of plastic waste has garnered global attention due to its sustainable approach to addressing the growing plastic waste accumulation problem and facilitating the establishment of a circular plastic economy. Methanolysis is a chemical upcycling process for the depolymerization of post-consumer polycarbonates and polyesters into their monomeric feedstock, which generally requires an excess amount of co-solvents and homogeneous inorganic salts. Herein, a solvent-free heterogeneous catalytic chemical upcycling of poly(bisphenol A carbonate) (BPA-PC) and poly(lactic Acid) (PLA) is proposed for the production of bisphenol A (BPA) and methyl lactate (ML) with a high yield using SBA-15 functionalized basic ionic liquid catalysts. Among all the synthesized catalysts, SBA-15-Pr-MIM-OH exhibited the highest basicity and demonstrated the best performance for depolymerization of PC and PLA at 120 °C, completing the reaction in 1 h and 4 h, respectively,

with a complete conversion and a monomer yield of >98%. The reaction condition was optimized to get the best catalytic performance and product selectivity. Furthermore, the "one-pot" depolymerization strategy was applied for the chemical upcycling of mixed plastic waste (BPA-PC/and PLA) to their monomers. A detailed depolymerization pathway is provided, supported by FT-IR spectroscopy, 1H NMR spectroscopy, and TGA. The parameters for green chemistry metrics were evaluated to show the efficiency and sustainability of the proposed system, opening doors for the industrial upscaling of plastic depolymerization.

68.

Sparse deep neural network for encoding and decoding the structural connectome
SP Singh, **S Gupta**, JC Rajapakse - IEEE Journal of Translational Engineering in Health and Medicine, 2024

Abstract: Brain state classification by applying deep learning techniques on neuroimaging data has become a recent topic of research. However, unlike domains where the data is low dimensional or there are large number of available training samples, neuroimaging data is high dimensional and has few training samples. To tackle these issues, we present a sparse feedforward deep neural architecture for encoding and decoding the structural connectome of the human brain. We use a sparsely connected element-wise multiplication as the first hidden layer and a fixed transform layer as the output layer. The number of trainable parameters and the training time is significantly reduced compared to feedforward networks. We demonstrate superior performance of this architecture in encoding the structural connectome implicated in Alzheimer's disease (AD) and Parkinson's disease (PD) from DTI brain scans. For decoding, we propose recursive feature elimination (RFE) algorithm based on DeepLIFT, layer-wise relevance propagation (LRP), and Integrated Gradients (IG) algorithms to remove irrelevant features and thereby identify key biomarkers associated with AD and PD. We show that the proposed architecture reduces 45.1% and 47.1% of the trainable parameters compared to a feedforward DNN with an increase in accuracy by 2.6 % and 3.1% for cognitively normal (CN) vs AD and CN vs PD classification, respectively. We also show that the proposed RFE method leads to a further increase in accuracy by 2.1% and 4% for CN vs AD and CN vs PD classification, while removing approximately 90% to 95% irrelevant features. Furthermore, we argue that the biomarkers (i.e., key brain regions and connections) identified are consistent with previous literature. We show that relevancy score-based methods can yield high discriminative power and are suitable for brain decoding. We also show that the proposed approach led to a reduction in the number of trainable network parameters, an increase in classification accuracy, and a detection of brain connections and regions that were consistent with earlier studies.

69.

Studying the impact of biaxial strain on the electronic and optical properties of and double perovskites for optoelectronic applications: ab initio calculations
S Dani, H Sharma, **R Kumar**, R Pandit - The European Physical Journal Plus, 2024

Abstract: We report the electronic, vibrational, and optical properties of specific double perovskites, i.e., (BYBO) and (BSBO) using first-principle calculations based on density functional theory. The stability of both the compounds has been confirmed by their elastic and thermodynamic properties. The effects of strain on the electronic and optical properties of BYBO and BSBO; with an external range of to . Electronic properties show semiconducting behavior with bandgap ( ) values of; and , for BYBO and BSBO, respectively with indirect bandgap alignment. On application on external tensile strain , the bandgap of BYBO and BSBO

undergoes a transition from indirect alignment to direct alignment, whereas the electronic bandgap alignment does not change with compressive strain. Interestingly, the magnitude of the bandgap shows contrasting behavior, i.e., the bandgap increases (up to 0.9–1 eV) with compressive strain and decreases (up to 0.7–0.8 eV) with tensile strain. The wavelength values calculated in the absorption spectra of the pristine samples are 373 nm for BYBO and 434 nm for BSBO; suggesting their potential suitability as alternatives for "solar cell" applications, photodetectors, superlenses, photovoltaic devices, etc.

70.	**Superhydrophobic coatings: Insights and real-world applications** S Keshri, S Sudha, S Roychowdhury, **K Kumar** - Functional Coatings: Innovations and Challenges: Book Chapter, 2024 **Summary**: Mother Earth inspires scientists and researchers worldwide every day to unveil its mysteries. We can imitate biology to create nanomaterials, nanodevices, and processes that have desirable qualities thanks to the recently developed discipline of biomimetics. Applications in both research and industry have shown a unique interest in biomimetic surfaces with specific wettability and adaptability. Thanks to nanotechnology, surface chemistry, and architecture, improvements have made superhydrophobicity a practical goal. Superhydrophobic surfaces are distinctive due to several notable developments, and they are predicted to continue to advance for many years. This chapter will focus on the most up-to-date developments in the physical characterization of numerical modeling, experimental methods, and practical uses of superhydrophobic surfaces. Superhydrophobic coatings, which are mechanically stable, thermally inert, and chemically inert, have vast promise in every area of human life. The biological, culinary, and aerospace industries could all benefit significantly from using superhydrophobic materials.
71.	**Sustainable energy deployment in developing countries: The role of composition of energy aid** **P Jain, S Bardhan** - Economic Systems, 2024 **Abstract:** Climate mitigation in developing nations calls for a shift to renewable technologies from fossil fuels. However, such transformative change requires enormous concessional funding in the energy sector. This paper examines the impact of energy aid and its composition on the transition to clean energy infrastructure in the power sector in 67 developing countries during the period 2002–2017. The analysis is also conducted by segregating aggregate renewable technologies into hydro and non-hydro sources. Applying system GMM and panel quantile regression techniques, we find that the effectiveness of energy aid depends upon its composition and the maturity of renewable technology in the recipient countries. Renewable and distribution energy aid benefits the transition only with hydro sources and has a counter-productive effect on non-hydro renewable technologies, such as solar and wind. In contrast, findings reveal that energy aid for non-renewable energy generation and policy hinder the transition process with both hydro and non-hydro renewable technologies. These findings warrant a shift in the composition and technology target of energy aid by the donors in order to foster climate mitigation and mobilize private investments in relatively less developed non-hydro renewable technologies.
72.	**Syntheses and properties of hole-transporting biindenofluorenes** **H Sharma**, Ankita, **V Mittal**, UK Pandey, **S Das** - Organic Letters, 2024 **Abstract:** Described herein is a straightforward approach to synthesizing three biindenofluorene (BIF) derivatives, composed of antiaromatic indenofluorene units, which are the first non-alternant congeners of known bipentacene. Dimerization of indeno[1,2-b]fluorene and indeno[2,1-c]fluorene units by connecting carbons 3 and 3′ and carbons 2 and 2′, respectively, is shown to influence the highest occupied and lowest unoccupied molecular orbital energy levels of the resulting BIFs, affording band gaps (1.5-1.6 eV) that are smaller than that of a known

	indenofluorene polymer (2.3 eV). The hole mobilities of BIFs were determined to be ~10-2 cm2 V-1 s-1.
73.	Synthesis of trifluoroethoxy/aryloxy cinnolines, cinnolinones and indazoles from o-alkynylanilines via metal-free diazotization reagent M Kumar, A Goswami - Organic and Biomolecular Chemistry, 2024 **Abstract:** A facile and user-friendly protocol for the synthesis of trifluoroethoxy/aryloxy cinnolines, cinnolinones and indazoles from o-alkynylaniline in good-to-excellent yields has been developed using a metal-free diazotization reagent (a combination of BF3·OEt2 and TBN). The methodology has been further extended to construct bis-cinnolinones and for the chemoselective synthesis of N-propargylated cinnolinones.
74.	The influence of microwave ablation parameters on the positioning of trocar in different cancerous tissues: a numerical study V Satish, R Repaka - Electromagnetic Biology and Medicine, 2024 **Abstract:** The present study analyzed the microwave ablation of cancerous tumors located in six major cancer-prone organs and estimated the significance of input power and treatment time parameters in the apt positioning of the trocar into the tissue during microwave ablation. The present study has considered a three-dimensional two-compartment tumour-embedded tissue model. FEA based COMSOL Multiphysics software with inbuilt bioheat transfer, electromagnetic waves, heat transfer in solids and fluids, and laminar flow physics has been used to obtain the numerical results. Based on the mortality rates caused by cancer, the present study has considered six major organs affected by cancer, viz. lung, breast, stomach/gastric, liver, liver (with colon metastasis), and kidney for MWA analysis. The input power (100 W) and ablation times (4 minutes) with apt and inapt positioning of the trocar have been considered to compare the ablation volume of various cancerous tissues. The present study addresses one of the major problems clinicians face, i.e. the proper placement of the trocar due to poor imaging techniques and human error, resulting in incomplete tumor ablation and increased surgical procedures. The highest values of the ablation region have been observed for the liver, colon metastatic liver and breast cancerous tissues compared with other organs at the same operating conditions.
75.	Three-dimensional printed silk fibroin and fenugreek based bio-composites scaffolds AI Ansari, NA Sheikh, **N Kumar**, J Nath - Proceedings of the Institution of Mechanical Engineers, Part L: The Journal of Materials: Design and Applications, 2024 **Abstract:** When treating orthopaedic damage or illness and accidental fracture, bone grafting remains the gold standard of treatment. In cases where this approach doesn't seem achievable, bone tissue engineering can offer scaffolding as a substitute. Defective and fractured bone tissue is extracted and substituted with porous scaffold structures to aid in the process of tissue regeneration. Three-dimensional bioprinting has demonstrated enormous promise in recent years for producing scaffold structures with the necessary capabilities. In order to create composite biomaterial inks for three-dimensional bioprinting, four different materials were combined such as silk fibroin, bone particles (B), synthetic biopolymer poly (ε-caprolactone), and Fenugreek (F). These biomaterials were mixed together in certain proportion to develop a silk fibroin + bovine bone + polycaprolactone + fenugreek powder composites biomaterial which was later three-dimensional bioprinted to fabricated composite bio-scaffold. The biomechanical, structural, and biological elements of the manufactured composite scaffolds were characterized in order to determine their suitability as a possible biomaterial for the production of bone tissue. The in vitro bioactivity of the composite scaffolds was assessed in the simulated body fluids, and the swelling and degradation characteristics of the two developed scaffolds were analyzed separately over time. The results showed that the mechanical durability of the composite scaffolds was enhanced by the bovine bone particles, up to a specific concentration in the silk

	fibroin matrix. Furthermore, the incorporation of bone particles improved the bioactive composite scaffolds' capacity to generate hydroxyapatite in vitro. The combined findings show that the three-dimensional printed bio-composites scaffolds have the required mechanical strength and may be applied to regeneration of bone tissue and restoration, since they resemble the characteristics of native bone.
76.	Trade off between hydrodynamic and thermodynamic forces at the liquid–liquid interface **L Palodhi**, MC Kim, **M Mishra** - Langmuir, 2024 **Abstract:** Viscous fingering (VF) instability has been investigated in the case of a partially miscible binary system by nonlinear numerical simulations. Partially miscible fluid systems offer the possibility of phase separation coupled with VF instability. The thermodynamics of such systems are governed by the Margules parameter (interaction parameter) as well as the fluid concentrations. Kinetics of the decomposition is also influenced by dynamical parameters such as the viscosity of the fluid, which incidentally also affects the hydrodynamic forces. Here, we explore the effects of concentration and Margules parameter in order to ascertain the trade-offs incurred between hydrodynamic and thermodynamic effects at the interface as well as the thermodynamics of the bulk. Based on the Gibb's free energy versus concentration curve, we select concentrations (i) outside spinodal and binodal regions, (ii) within binodal but outside the spinodal, and (iii) within the spinodal curve. We solve the modified Cahn–Hilliard-Hele-Shaw equation employing the COMSOL Multiphysics software. Applying high-resolution numerical simulations, we show a strong dependence of the thermodynamic forces on the concentration of the mixtures. Rapid phase separation and hence a faster rate of droplet formation have been found when the concentration lies inside the spinodal region. Further, we have investigated the correlation between the fractal dimension and dynamics of the system. The spatiotemporal studies presented in this work clearly illustrate the competition between hydrodynamic and thermodynamic forces and provide insights on the kinetics of decomposition and growth of interfacial instabilities.
77.	Tribological study of nano copper-hydroxyapatite polyoxymethylene (nCuHAp_POM) for biomedical applications A Banerjee, TA Rohit, R Bandyopadhyay, **P Uniyal** - Microbiology-2.0 Update for a Sustainable Future: Book Chapter, 2024 Hydroxyapatite (HAp) is commonly used to improve biomedical temporomandibular joint (TMJ) implant bioactivity. In this research, a new biomaterial is developed suitable for biomedical TMJ implants. In this study, we investigated the tribological properties of polyoxymethylene (POM) composites with antibacterial copper-hydroxyapatite (CuHAp) as reinforcement. To confirm its usage in orthopedic biomechanics, tribology test was conducted on a 316L stainless steel plate with nano copper-hydroxyapatite (nCuHAp) added in various weight percentages (1, 2, 3, 4, and 5%). Further, mechanical properties of samples were assessed using hardness test, microporosity, and roughness tests. Also, the cell proliferation test was conducted on the polymer samples to discuss the bioactivity of the polymer. The best result was shown at 2%, preferred for biomedical applications in the total implant replacement like temporomandibular joint.
78.	XPS insights for optimization of laser-remelting as a post-processing technique for coatings **G Vinay**, NK Singh, **SW Khan, R Kant, H Singh** - Surfaces and Interfaces, 2024

Abstract: Coatings frequently exhibit inherent imperfections such as porosity and defects, prompting the need for post-processing to enhance properties. Laser remelting is one of the frequently considered post-processing techniques, which employ precisely controlled energy to address these imperfections through induced heat treatment. Despite its advantages, variations in laser energy distribution in the beam create distinct regions, such as the Beam Concentrated Area (BCA) and Heat Affected Zone (HAZ). This study focuses on laser remelting of HVOF-deposited WC-15NiCr coatings and employs X-ray Photoelectron Spectroscopy (XPS) to analyze chemical states of the remelted coating. Owing to the variation of energy with in the laser beam, the analysis reveals distinct material behaviors in different regions of the coatings, particularly in the BCA and HAZ. The study highlights the importance of tailored optimization strategies for these regions, advancing laser remelting as a potent post-processing technique for thermal spray coatings.