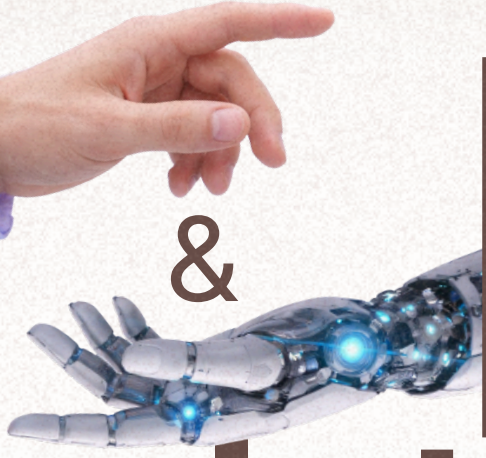
R & D newsletter



April 2026 | Volume 22 www.iitr.ac.in

DIRECTOR'S MESSAGE

I am delighted to connect with the IIT Roorkee community through the Volume 22 Issue of this newsletter, as we reflect on our collective progress and the impact of our endeavors. As we move forward in the academic year, I am pleased to note the continued momentum across our teaching, research, and innovation ecosystems. Our faculty, researchers, and students have demonstrated exemplary commitment toward advancing knowledge, addressing real-world challenges, and upholding the institute's legacy of excellence.

In recent months, the institute has made significant strides in fostering interdisciplinary research and strengthening collaborations with industry and global academic partners. These engagements are essential in ensuring that our work remains relevant, impactful, and aligned with emerging technological and societal needs. I encourage all members of the institute to continue pursuing innovative ideas that contribute to sustainable development and national priorities.
Equally important is our focus on nurturing a holistic academic environment—one that promotes inclusivity, ethical practices, and intellectual curiosity. The achievements highlighted in this issue reflect not only academic excellence but also the spirit of collaboration and resilience that defines IIT Roorkee.

I extend my sincere appreciation to our faculty, staff, students, and alumni for their unwavering dedication and contributions. Let us continue to work together with renewed enthusiasm to strengthen our institution's position as a leader in education, research, and innovation.

I hope this newsletter serves as a valuable platform to showcase our collective accomplishments and inspire further progress.

With best wishes,
Prof. K K Pant
Director, Indian Institute of Technology Roorkee

DEAN SRIC MESSAGE

The Sponsored Research and Industrial Consultancy (SRIC) continues to serve as a vital catalyst in transforming ideas into impactful outcomes. Our collective efforts have significantly strengthened the institute's research portfolio, with a growing number of high-value sponsored projects, strategic industry collaborations, and translational research initiatives. These achievements underscore not only the technical excellence of our faculty and researchers but also the increasing confidence of industry and funding agencies in IIT Roorkee's capabilities.

I am particularly pleased to note that IIT Roorkee has emerged as one of the leading recipients of funding from the Anusandhan National Research Foundation (ANRF), securing the among the leading recipients of ANRF funding in the country. This remarkable achievement reflects the strength of our research ecosystem, the quality of our scientific contributions, and the dedication of our faculty in addressing national priorities through cutting-edge research and innovation.

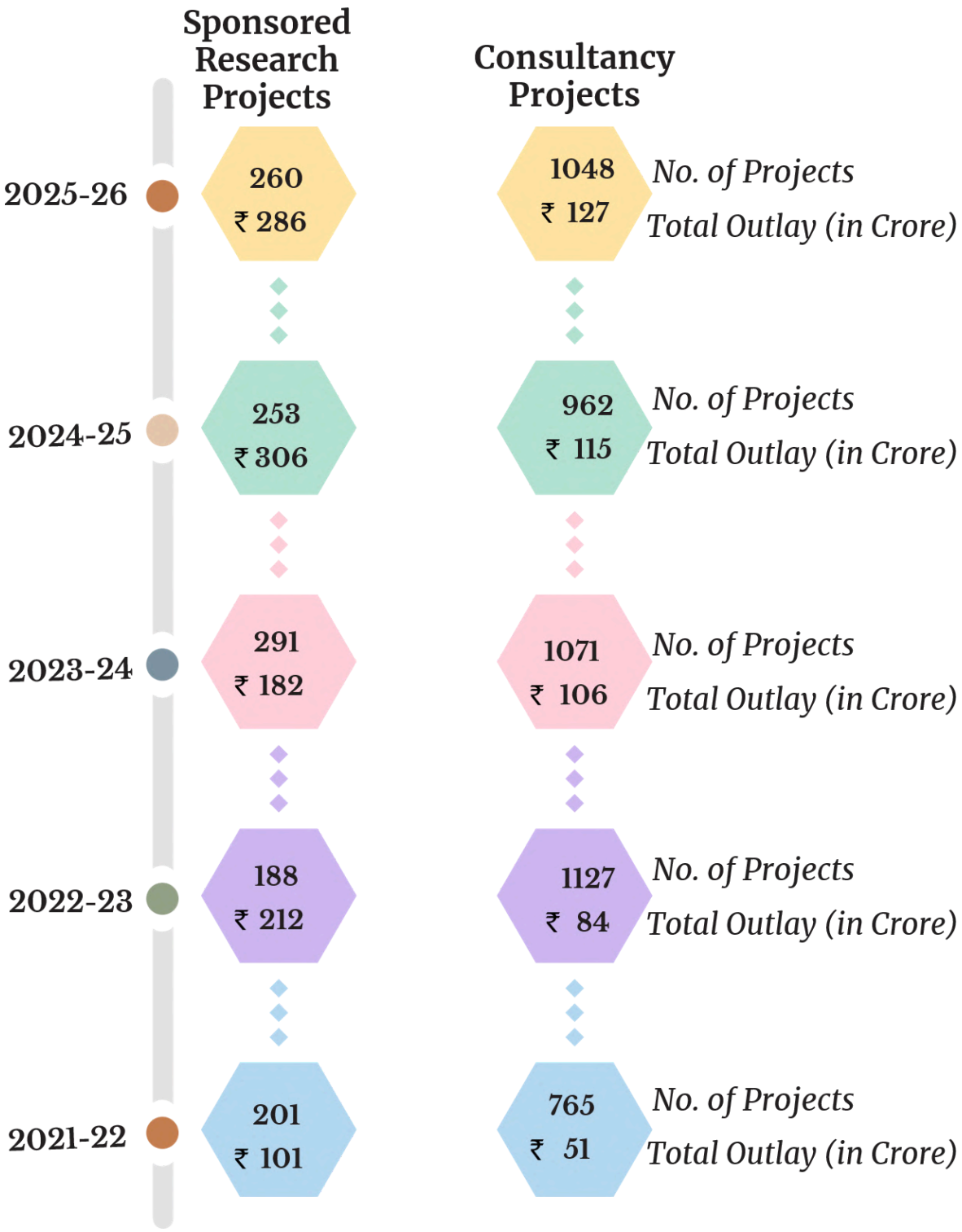
In today's rapidly evolving technological landscape, the true measure of research lies in its relevance and its ability to create tangible societal and industrial impact. At SRIC, we remain committed to fostering an ecosystem that encourages interdisciplinary collaboration, accelerates innovation, and bridges the gap between academia and application. Our focus is on enabling seamless project execution, enhancing research facilitation, and supporting the conversion of knowledge into scalable technologies, startups, and policy contributions.

I am particularly encouraged by the active involvement of our young researchers and students, whose energy and ideas are driving the next wave of innovation. Equally, the sustained engagement of our faculty in addressing complex, real-world challenges continues to elevate the institute's research standing at both national and international levels. As we move forward, it is imperative that we further strengthen our partnerships with industry, government, and global institutions, while also embracing emerging areas of research that hold transformative potential. Together, we must strive not only for academic excellence but also for meaningful impact that contributes to sustainable development and societal well-being.

I extend my sincere appreciation to the entire IIT Roorkee fraternity for their unwavering commitment and contributions. Let us continue to build on this momentum and position IIT Roorkee at the forefront of research, innovation, and industrial engagement.

With best wishes,
Prof. Vivek Kumar Malik
Dean SRIC, Indian Institute of Technology Roorkee

CONSULTANCY & SPONSORED RESEARCH PROJECTS



IP PORTFOLIO

YEAR: 2021–2026 (UP TO MARCH 2026)

	2021	2022	2023	2024	2025	2026	Total
Patent filed	47	83	121	150	102	23	746
Patent Granted	12	34	156	60	76	30	392
Patent Published	94	75	116	137	106	26	708
Technology Transfer	04	07	04	22	17	03	60

35 / 25 Industrial Design Filed/Accepted

09 PCT

11 International Patent (Filed)

36 / 31 Copyright Filed/Accepted

150 / 8 Trademark Filed/Accepted

LIST OF PROJECTS

Sponsored Research Projects			
Sr. No.	**Title of the Project**	**Sponsor Agency**	**PI**
1	Short Carbon Fiber-Reinforced High-Entropy High-Temperature Ceramic Composites	Aeronautics Research and Development Board, Defence Research and Development Organisation, New Delhi	Prof. Ankit Bansal
2	Developing a scalable high resolution methane emission assessment framework using UAV sensing, satellite measurements and modelling approaches for MSW landfills	Anusandhan National Research Foundation, Advanced Research Grant	Prof. Prakhar Misra
3	Tailoring π-Frameworks of Carbonyl/Nitrogen MR-TADF Emitters by Smart Embedding of Carbazole and Pyrene for Advanced Optoelectronics	Anusandhan National Research Foundation, New Delhi	Prof. K R Justin Thomas
4	Direct solvolysis of waste Tetra Pak to generate Al2O3 nanocomposites and Fuel additives	Anusandhan National Research Foundation, Advance Research Grant	Prof. Siva Mohan Reddy
5	Mechanistic and Receptor Insights into E Protein–Driven Innate Immune Dysfunction in Orthoflavivirus (Zika and KFDV)	Anusandhan National Research Foundation	Prof. Shailly Tomar
6	Advanced Additive Manufacturing of Hetero-structured Scintillators Using Bridgman-Grown Single Crystals and 3D-Printed Plastic & Ceramic Scintillators for TOF-PET and Related Applications	Anusandhan National Research Foundation	Prof. Anil Kumar Gourishetty

LIST OF PROJECTS

Sponsored Research Projects			
Sr. No.	**Title of the Project**	**Sponsor Agency**	**PI**
7	Small RNA drivers of pathophysiological fitness of Acinetobacter baumannii: studies on post-transcriptional and riboregulatory networks. (SPARTN)	Anusandhan National Research Foundation	Prof. Ranjana Pathania
8	Affordable Metal Matrix Composite Fabrication via Wire Arc Additive Manufacturing	Anusandhan National Research Foundation	Prof. Amit Choudhary
9	Hybrid Halide Perovskite-Based Dual-Gated Electrochemical Transistors for switchable optoelectronics and neuromorphic computing	Anusandhan National Research Foundation, Applied Research Grant	Prof. Monojit Bag
10	Exploring Mitigation Pathways for Holistic Sustainable Development in Indian States (EMPHASIS)	CICERO (Centre for International Climate Research, Research Council of Norway)	Prof. Tarun Sharma
11	Effect of Hygroscopic Ageing on Mechanical and Fracture-Fatigue Behaviour of Sandwich Composites for Armament Applications	Armament Research Board, Defence Research and Development Organisation, New Delhi	Prof. I V Singh
12	Azole Based Fused ring and methylene-bridged energetic compounds	Sponsor: Defence Research and Development Organisation	Prof. Dheeraj Kumar

LIST OF PROJECTS

Sponsored Research Projects			
Sr. No.	**Title of the Project**	**Sponsor Agency**	**PI**
13	Design and Development of Digital Band-Pass Filter from 30 to 520 MHz	Defence Research and Development Organisation, Industry Academia Centre of Excellence, IIT Roorkee (DIA-CoE, IITR)	Prof. Gowrish Basavarajappa
14	Optimized Thermal Management of BESS with BMS and Design Development of Smart Inverter for defence microgrid application	Defence Research and Development Organisation	Prof. Premalata Jena
15	Shark and camelid nanobodies targeting the FAT1 protein as an antitumour agent.	Department of Biotechnology.	Prof. Rajesh Kumar
16	Commercial Scale-Up of a Portable Potentiostat Platform for Non-invasive Multiplexed Salivary Diagnosis and Prognosis of Oral and Lung Cancer	Sponsor : Indian Council of Medical Research, New Delhi	Prof. P. Gopinath
17	Development Of A Novel Mitochondria targeted Luteolin-Copper Nanomedicine For Treating Non-Small Cell Lung Cancer By Cuproptosis Induced Cell Death	Sponsor : Indian Council of Medical Research, New Delhi	Prof. Partha Roy
18	Development of a photonic diagnostic system for Gastro-Intestinal Infections through detection of viruses in stool using Machine-learning enabled Plasmon Enhanced Raman Sensing (GIMPERS)	Sponsor : Indian Council of Medical Research, India	Prof. Sachin Kumar Srivastava

LIST OF PROJECTS

Sponsored Research Projects			
Sr. No.	**Title of the Project**	**Sponsor Agency**	**PI**
19	Design and Development of Chimeric Vaccine Candidates for Flavivirus infections using CHIKV-based Platforms	Sponsor : Indian Council of Medical Research	Prof. Shailly Tomar
20	Handling Problem of Data Quality in Artificial Intelligence and its Application to Software Quality, Fairness and explainable AI (DAQUA)	Sponsor : Ministry of Education, Govt. of India	Prof. Sandeep Kumar
21	Development of a Real Time Digital Simulator for Pumped Storage Plants (PSPs)	Sponsor: National Hydroelectric Power Corporation Limited.	Prof. Himanshu Jain
22	Decentralized Rainwater Harvesting and Greywater Treatment Using Electrocoagulation-Ceramic Membrane Systems in the Indian Himalayan Region	Sponsor : National Mission on Himalayan Studies (NMHS)	Prof. Abhijit Maiti
23	Tapping GaN potential: Heterogeneously integrated packaging of GaN devices for low voltage high current electric vehicle drives.	Sponsor : SPARC, Ministry of Education	Prof. Prashant Surana

RECENTLY REGISTERED PROJECTS

Title

Short Carbon Fiber-Reinforced High-Entropy High-Temperature Ceramic Composites

PI : Prof. Ankit Bansal
Department of Mechanical and Industrial Engineering, Chemical Engineering

Email ID : ankit.bansal@me.iitr.ac.in

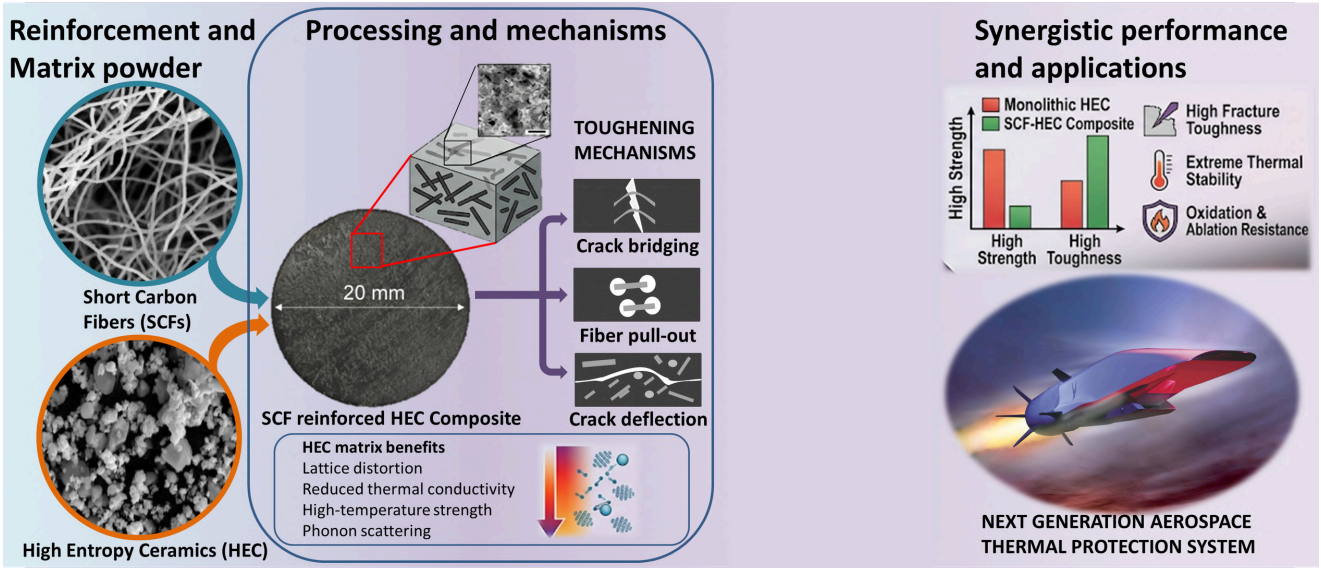
Co-PI: :
Prof. Vimal Kumar
Prof. Vidit Gaur

Link : https://iitr.ac.in/~ME/Ankit_Bansal

Sponsor: ARDB, DRDO, New Delhi INDIA

Abstract

High-entropy ceramic (HEC) composites have emerged as a new class of ultra-high temperature materials owing to their configurational disorder, which imparts superior thermal stability, oxidation resistance, and mechanical strength compared to conventional ceramics . However, their intrinsic brittleness remains a critical limitation for structural applications under extreme thermo-mechanical loading. In this study, short carbon fiber (SCF) reinforcement is employed to engineer damage-tolerant high-entropy carbide-based ceramic composites for high-temperature applications. The incorporation of SCFs introduces multi-scale toughening mechanisms, including crack bridging, fiber pull-out, and crack deflection, significantly enhancing fracture resistance. Simultaneously, the high-entropy matrix, composed of multi-principal carbides (e.g., Ta–Zr–Si–Nb–Ta)C, provides solid-solution strengthening, lattice distortion, and reduced thermal conductivity due to phonon scattering arising from chemical disorder.The synergistic interaction between the SCFs and the HEC matrix leads to the development of a heterogeneous microstructure with optimized fiber–matrix interfaces, enabling efficient load transfer while maintaining controlled debonding for energy dissipation. Additionally, the presence of carbon fibers enhances thermal shock resistance and mitigates catastrophic brittle failure, which is a typical limitation of monolithic HECs. The resulting composites exhibit a unique combination of high-temperature strength, improved fracture toughness, and enhanced ablation resistance, making them promising candidates for next-generation aerospace thermal protection systems, hypersonic vehicles, and energy applications. This work highlights the critical role of microstructural design and fiber-matrix interfacial engineering in tailoring the performance of high-entropy ceramic composites, providing a pathway toward robust, damage-tolerant ultra-high temperature materials.



Title

Developing a scalable high resolution methane emission assessment framework using UAV sensing, satellite measurements and modelling approaches for MSW landfills

PI : Prof. Prakhar Misra
Department of Civil Engineering

Co-PI: :
Prof. Absar Ahmed Kazmi

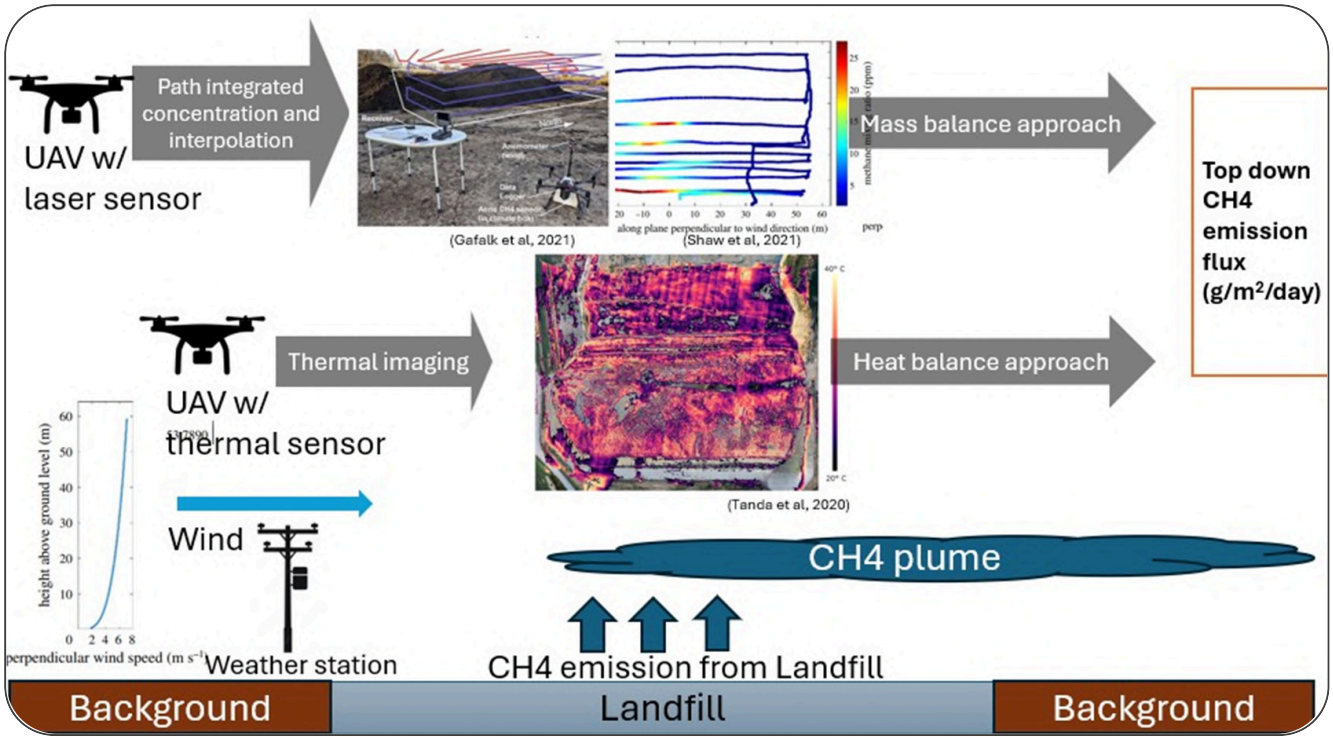
Email ID : prakhar.misra@ce.iitr.ac.in

Link : https://civil.iitr.ac.in/CE?Uid=prakhar.misra

Sponsor: ANRF Advanced Research Grant (ARG)

Abstract

Municipal solid waste landfills and open dumps are major yet poorly quantified methane sources in India, contributing to climate change, ozone formation, and landfill fire risks. This project proposes a scalable high-resolution methane monitoring framework using UAV-mounted TDLAS methane sensors, thermal imaging, satellite observations, and IPCC/FOD modeling. Emphasis will be placed on hotspots, active waste cells, seasonal and climatic variability, and diverse landfill typologies. The study will generate India's first validated landfill methane emission maps, reduce uncertainty in current inventories, and assess methane mitigation through landfill gas-to-energy (LFGTE), supporting national climate targets, regulatory compliance, and improved waste governance.



Title

Tailoring π-Frameworks of Carbonyl/Nitrogen MR-TADF Emitters by Smart Embedding of Carbazole and Pyrene for Advanced Optoelectronics

PI : Prof. K R Justin Thomas
Department of Chemistry

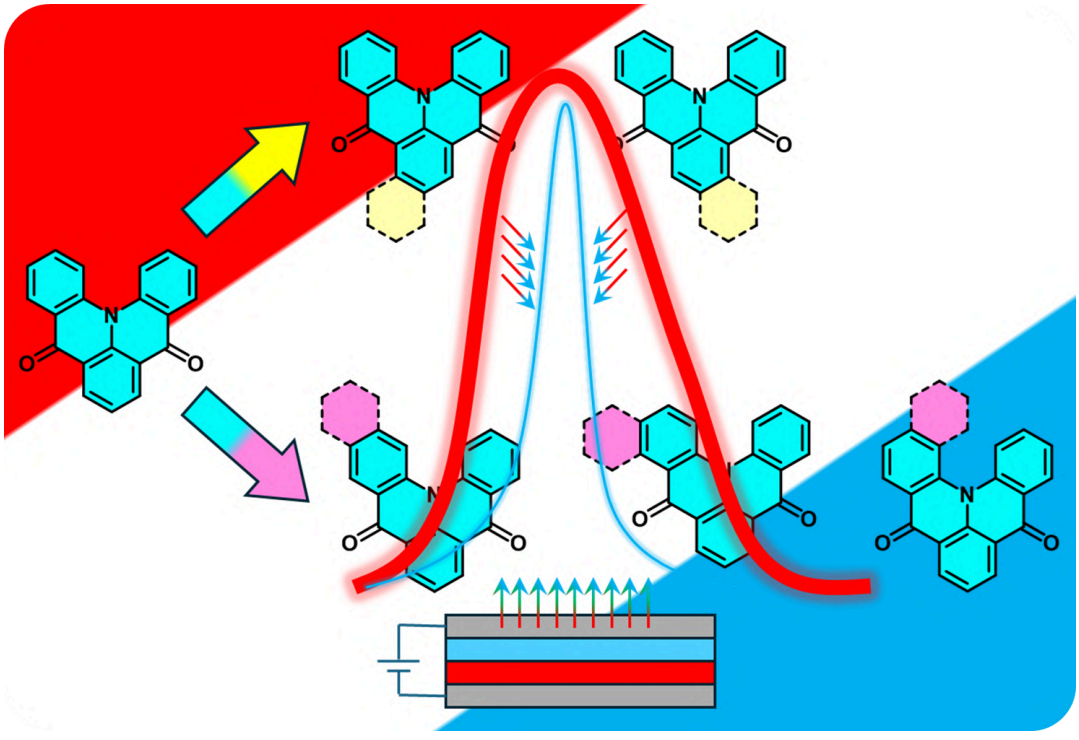
Email ID : krjt@cy.iitr.ac.in

Link : https://faculty.iitr.ac.in/~krjt8fcy/

Sponsor : ANRF, New Delhi

Abstract

The advent of multi-resonant thermally activated delayed fluorescence (MR-TADF) has revolutionized the design of organic light-emitting diode (OLED) materials by enabling narrowband emission with high efficiency. Among these, carbonyl–nitrogen (C=O/N)-based MR-TADF systems have emerged as promising candidates owing to their intrinsic resonance character, rigid scaffolds, and synthetic accessibility. However, the current design paradigms often rely on limited π-systems and lack diversity in core architecture, restricting the scope for emission tunability and further performance enhancement. In this project, we propose a systematic design and development of C=O/N-based MR-TADF emitters by integrating carbazole and polyaromatic fragments such as fluorene, phenanthrene, pyrene, naphthalimide, coumarin, fluorenone, etc. into the MR core. This strategy aims to extend conjugation, modulate short-range charge transfer (SRCT) characteristics, and fine-tune the donor–acceptor interactions, leading to better control over excited-state dynamics, ΔEST reduction, and enhanced RISC rates. By engineering both the core and periphery through fusion, substitution, and locking strategies, we seek to develop color-pure, high-efficiency emitters with emissions ranging from deep blue to red.



Title

Direct solvolysis of waste Tetra Pak to generate Al2O3 nanocomposites and Fuel additives

PI : Prof. Siva Mohan Reddy
Department of Chemical Engineering

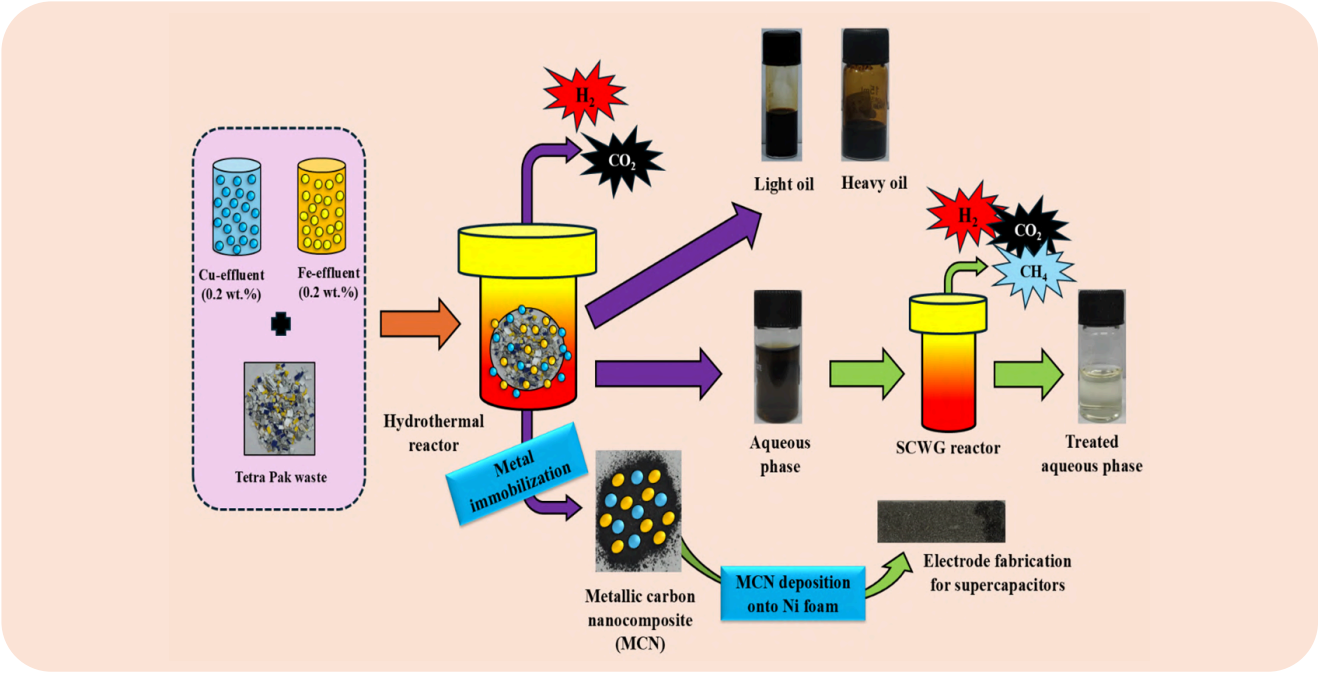
Email ID : n.reddy@ch.iitr.ac.in

Link : https://iitr.ac.in/Departments/Chemical%20Engineering%20Department/People/Faculty/100707.html

Sponsor : ANRF, Advance Research Grant

Abstract

Tetra Pak cartons are primarily made of paperboard, which accounts for 75% of the carton's weight and gives the packaging its mechanical stability and strength. While making up 20% of the total weight of the packaging, the LDPE serves as an adhesive between the different parts of the material and shields the contents from outside moisture. Aluminium, which makes up only 5% of the packaging, is extremely important for the thermal stabilization of the food product since it keeps light and oxygen out. In 2021 more than 192 billion packages were sold in more than 160 countries. However, the global recycling rate of tetra Pak packaging was only 26% in the year 2019. Environmental contamination can result from this buildup in landfills and incineration, but more crucially, the polyethylene polymer contained in the packaging material is thought to have harmful deleterious effects on both human and animal health. Concerning the large quantities of the tetrapack waste, we are proposing a novel single pot process to convert all the organic fraction to bio-oil with characteristics similar to bio-diesel and inorganic fraction as nanocomposite of Alumina. With solvlysis at supercritical conditions, the implemented ethanol can promote the degradation through two liquid products are attained where they can act as direct fuel additives to B20 (converted fraction) and E20 (recycled fraction).



Title

Mechanistic and Receptor Insights into E Protein–Driven Innate Immune Dysfunction in Orthoflavivirus (Zika and KFDV)

PI : Prof. Shailly Tomar
Department of Biosciences and Bioengineering

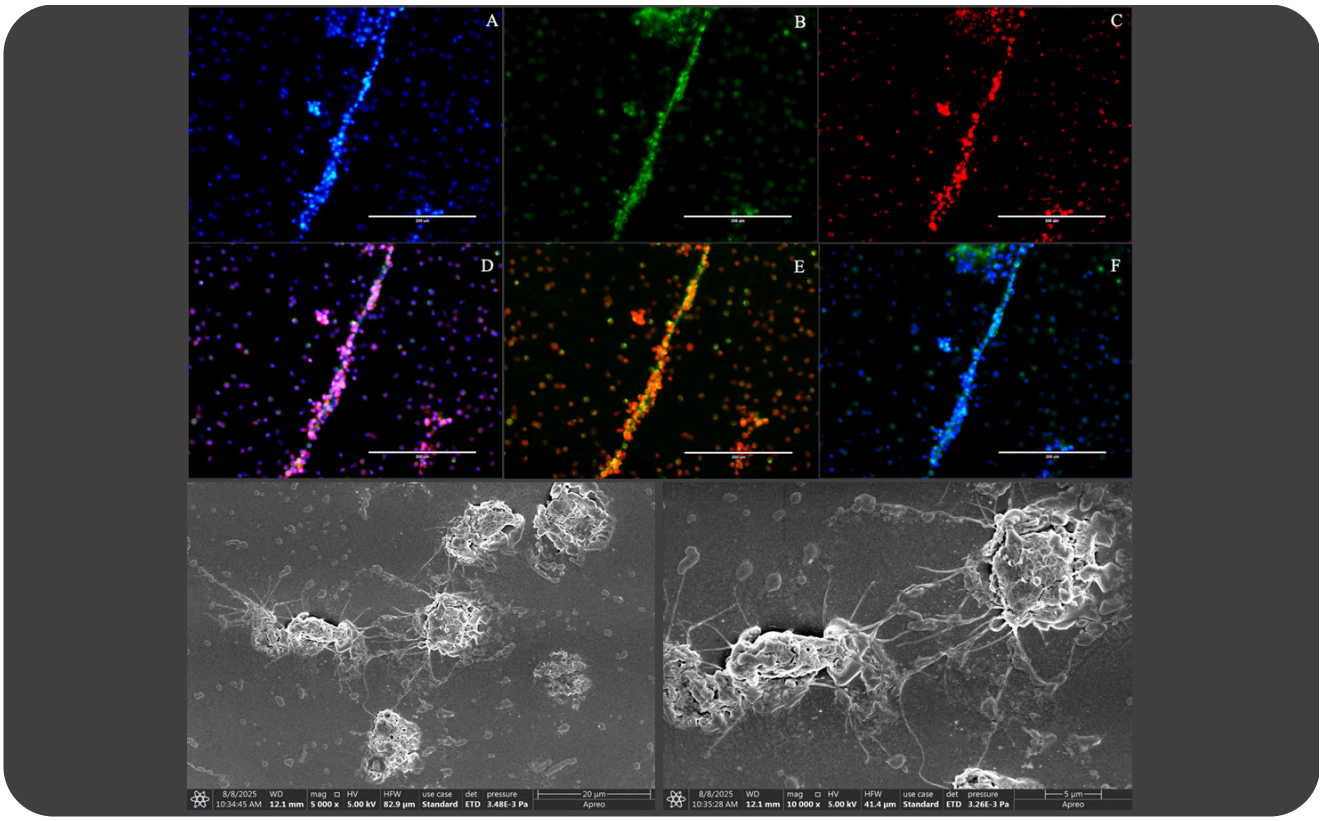
Email ID : shailly.tomar@bt.iitr.ac.in

Link : www.iitr.ac.in/mvl/

Sponsor : ANRF

Abstract

Investigating the pathological implications of the encephalitis viruses around the innate immune system dysfunction is significant to better understand viral pathogenesis. Currently, there are no FDA-approved vaccine and specific antiviral therapies available for ZIKV and KFDV, and both are associated with significant mortality. The seasonal outbreaks of KFDV and the ongoing endemic of ZIKV in western India marks them as pathogens that require immediate attention in terms of research. The study is novel in terms of studying E protein induced pathogenesis in the light of neutrophil-mediated inflammation and dysfunction. We aim to decipher key players involved in viral E protein induced pathogenesis across innate immune axis encompassing neutrophils and macrophages including the structural interactions of E protein with host receptors. The effect of E protein is being analyzed in context to symptoms like vascular leakage and neuroinflammation both in vitro and in vivo.



Title

Advanced Additive Manufacturing of Hetero-structured Scintillators Using Bridgman-Grown Single Crystals and 3D-Printed Plastic & Ceramic Scintillators for TOF-PET and Related Applications

PI : Prof. Anil Kumar Gourishetty
Department of Physics

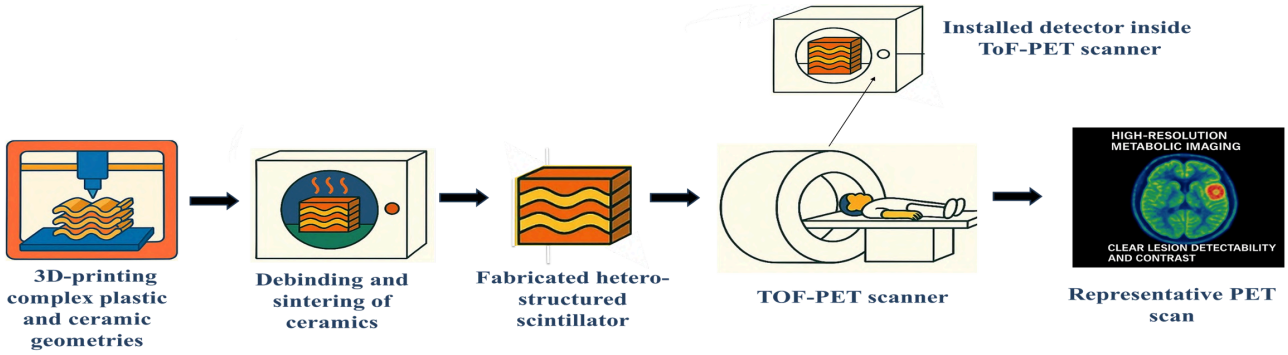
Email ID : anil.gourishetty@ph.iitr.ac.in

Link : https://ph.iitr.ac.in/~PH/anilgfph

Sponsor : ANRF

Abstract

This project proposes a new class of heterostructured scintillators for next-generation Time-of-Flight PET and related ToF detectors. The concept combines a thin ultrafast plastic scintillator with a high-density transparent ceramic to overcome the conventional trade-off between timing performance and gamma-ray stopping power. Using 3D printing and ceramic processing, the work will develop layered, embedded, and fiber-type detector architectures with greatly improved design flexibility over current planar modules. The main goal is to achieve Coincidence Time Resolution (CTR) of ≤100 ps while maintaining high detection efficiency. The project will involve fabrication of plastic and ceramic components, assembly of heterostructures, and optical and scintillation characterization using gamma sources, SiPMs, and fast digitizers. If successful, it will establish a scalable indigenous platform for advanced ToF-PET, particle identification, neutron–gamma spectroscopy, and related radiation-detection applications



Title

Small RNA drivers of pathophysiological fitness of Acinetobacter baumannii: studies on post-transcriptional and riboregulatory networks. (SPARTN)

PI : Prof. Ranjana Pathania
Department of Biosciences & Bioengineering

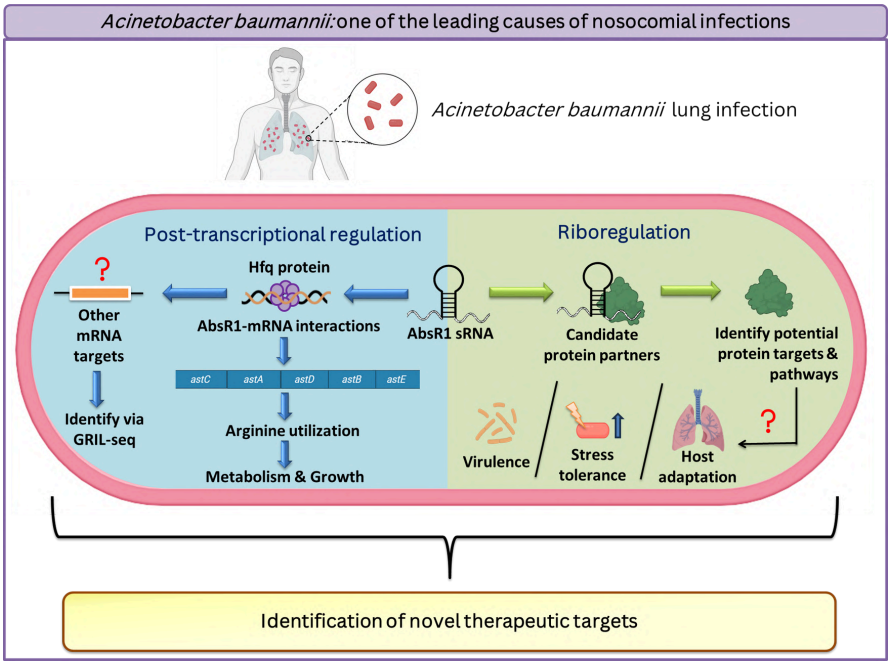
Email ID : ranjana.pathania@bt.iitr.ac.in

Link : https://bt.iitr.ac.in/~BT/rpathfbs

Sponsor : ANRF

Abstract

Acinetobacter baumannii is an opportunistic nosocomial pathogen associated with multidrug-resistant infections and is classified as a critical priority pathogen by the World Health Organization. Its remarkable ability to adapt to diverse host environments and develop resistance highlights an urgent need to identify novel therapeutic targets. Emerging evidence from literature suggests that post-transcriptional regulation mediated by small RNAs (sRNAs), along with RNA chaperones like Hfq, play a crucial role in bacterial physiology. However, this mechanism remains poorly understood in A. baumannii. In this project, we aim to decipher sRNA-mediated regulatory networks that govern metabolism and virulence in this pathogen. Our preliminary findings indicate that deletion of AbsR1, an Hfq-dependent small RNA, leads to downregulated expression of genes involved in arginine utilization. This results in an impaired growth in arginine, suggesting its importance in metabolic adaptation. Therefore, we aim to perform functional and structural characterization of AbsR1 to investigate its role in regulating arginine metabolism, a pathway critical for bacterial survival during host lung infection. In addition, since small RNAs are known to regulate multiple mRNA targets, AbsR1 too is likely to modulate additional transcripts beyond the arginine utilization operon. Therefore, we will investigate direct AbsR1–mRNA interactions by employing transcriptome-wide approaches such as GRIL-seq to identify global mRNA targets of AbsR1. Furthermore, building on our findings that establish Hfq chaperone-mediated AbsR1–mRNA regulation, this study aims to explore whether Absr1 sRNA interacts directly with other cellular proteins. Identification and validation of such novel sRNA–protein interactions will provide insights into non-canonical regulatory mechanisms in Acinetobacter baumannii. Overall, this project aims to uncover critical post-transcriptional and riboregulatory pathways that contribute to the physiological fitness and pathogenicity of this bacterium. With insights gained from this study, we aim to reveal potential molecular targets for the development of antimicrobials against this highly drug-resistant pathogen.



Title

Affordable Metal Matrix Composite Fabrication via Wire Arc Additive Manufacturing

PI : Prof. Amit Choudhary
Department of Mechanical and Industrial Engineering

Co-PI: :
Prof. Vidit Gaur

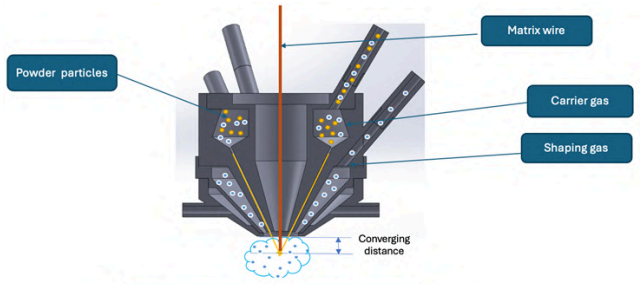
Email ID : amit.Choudhary@me.iitr.ac.in

Link : https://me.iitr.ac.in/~ME/Amit_Choudhary

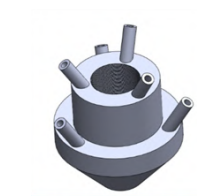
Sponsor : ANRF

Abstract

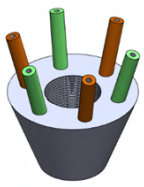
The project aims to design and develop a modular, customized nozzle for Wire Arc Additive Manufacturing (WAAM) to deliver matrix wire and ceramic reinforcement powder simultaneously into the melt pool. The customized nozzle system is designed to fabricate ceramic-reinforced metal matrix composites (MMCs) and functionally graded materials (FGMs) with uniform reinforcement distribution. Two nozzle variants are proposed: a continuous-feed coaxial nozzle for FGM deposition and a discrete-powder-feed nozzle for localized surface enhancement. Both nozzles are optimized through computational fluid dynamics (CFD) simulations to minimize carrier gas turbulence, mitigate reinforcement agglomeration, and improve catchment efficiency in the melt pool. The system couples an arc-based power source, a powder feeder, a multi-axis CNC controller, and a custom-designed nozzle for the fabrication of MMCs. Ferrous matrices (SS316L, ER70S-6) reinforced with ceramic powder (e.g., WC, B_4C, and SiC) will undergo microstructural and tribomechanical characterization. An oxygen-controlled inert chamber extends this study to fabricate reactive titanium and aluminum matrix systems, targeting scalable, affordable MMC fabrication.



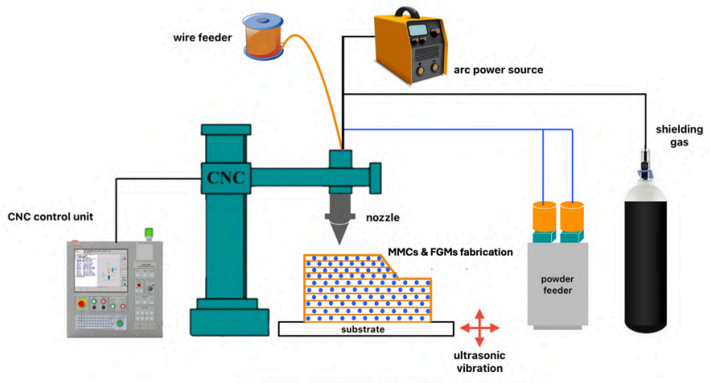
Customized co-axial nozzle



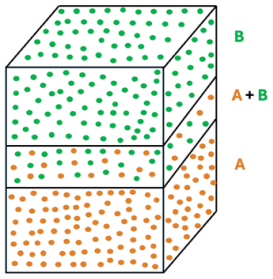
Nozzle Type-I



Nozzle Type-II



Integrated WAAM setup



Fabrication of MMCs and FGMs

Title

Hybrid Halide Perovskite-Based Dual-Gated Electrochemical Transistors for switchable optoelectronics and neuromorphic computing

PI : Prof. Monojit Bag
Department of Physics

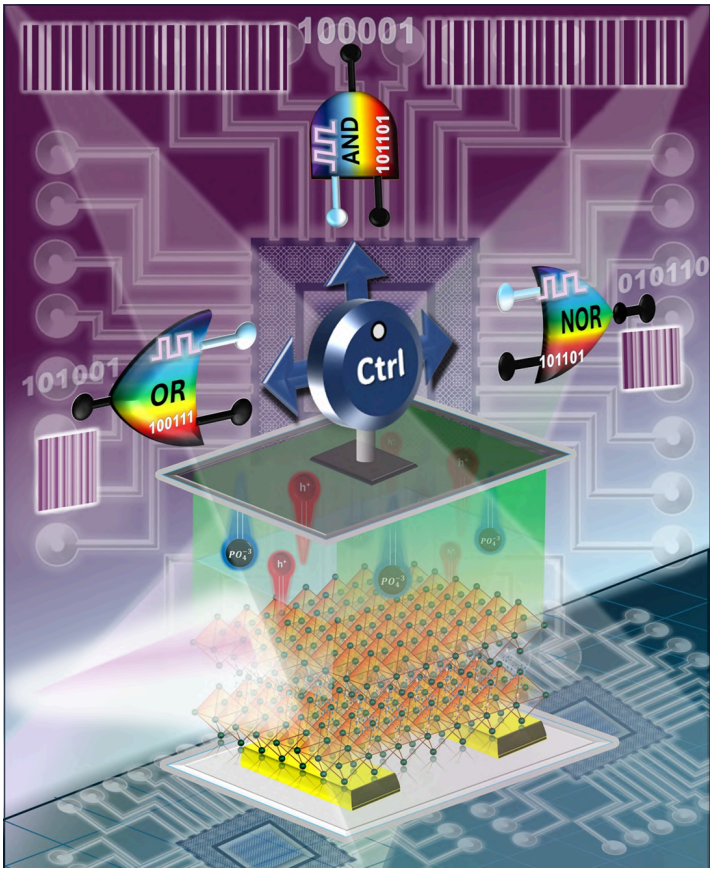
Email ID : monojit.bag@ph.iitr.ac.in

Link : https://www.iitr.ac.in/~PH/Monojit_Bag

Sponsor : ANRF-ARG grant

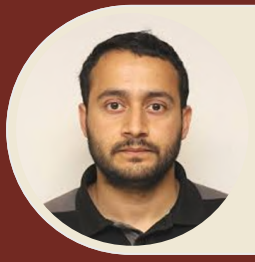
Abstract

In this project, we proposed to fabricate efficient and stable electrochemically gated field-effect transistors (FETs) using hybrid halide perovskites (HHPs) as the active materials. We also plan to fabricate a 4-terminal dual-gated device for mixed-input universal logic gates and synaptic functionalities. The key challenge in this project is to identify the degradation of halide perovskite in the electrochemical environment and to propose possible device configurations and interface engineering to mitigate this instability. Finally, we would fabricate an array of stable electrochemically doped memristors with desired synaptic properties for visual neuromorphic computing. Slow and fast ion kinetics can control the synaptic properties such as STDP, LTP, and LTD. Other properties, such as intensity- or pulse-duration-dependent plasticity, may be tested for better performance. In the end, software-hardware co-design with neural networks will be tested for accuracy.



Title

Exploring Mitigation Pathways for Holistic Sustainable Development in Indian States (EMPHASIS)



PI : Prof. Tarun Sharma
Department of Management Studies

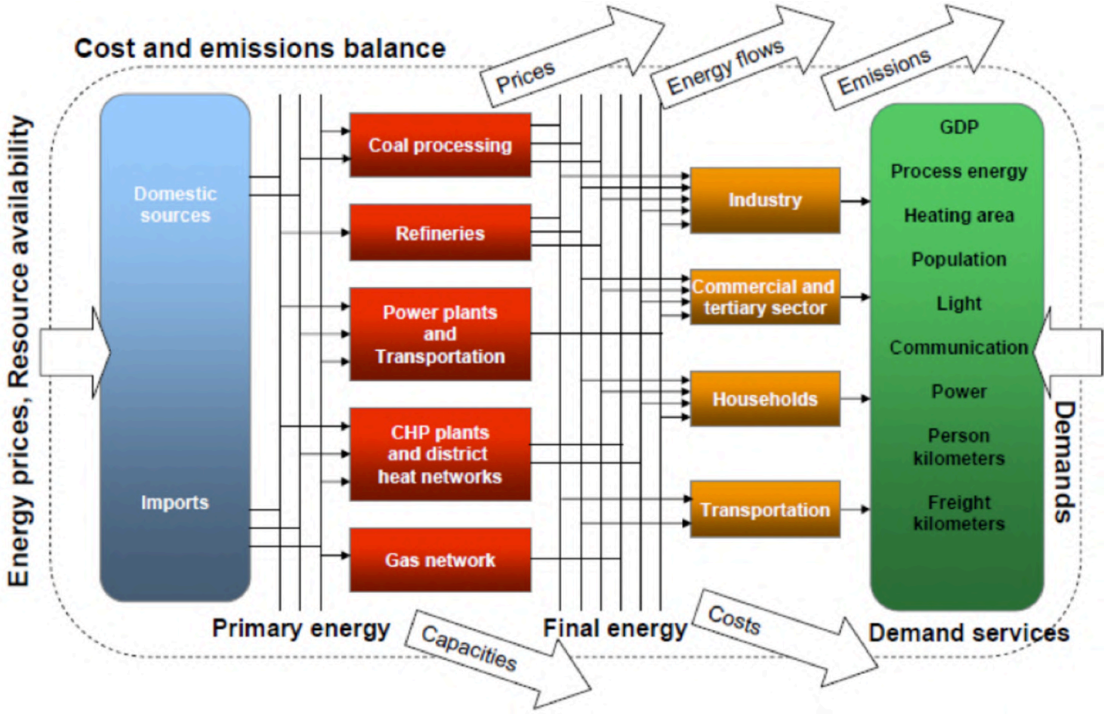
Email ID : tarunsharma@ms.iitr.ac.in

Link : https://www.iitr.ac.in/~DM/Tarun_Sharma

Sponsor : CICERO
(Centre for International Climate Research, Research Council of Norway)

Abstract

India's rapid economic growth is characterized by a booming service sector and a growing population, juxtaposed with significant greenhouse gas emissions. This presents a compelling case study that underscores the challenges of achieving sustainable development while addressing environmental concerns. The significant variations in resource availability, economic structures, and policy frameworks across different states add further complexity to India's energy transition. This diversity not only influences the implementation of energy solutions but also shapes the unique challenges and opportunities faced by each state. EMPHASIS will use an interdisciplinary, holistic and multilevel approach to assess climate mitigation pathways at Indian state and national levels and their potential synergies and trade-offs with sustainable development in terms of energy security and economic growth. The outcome of EMPHASIS will provide decision makers with the knowledge to design effective sectoral mitigation policies.



Title

Effect of Hygroscopic Ageing on Mechanical and Fracture-Fatigue Behaviour of Sandwich Composites for Armament Applications

PI : Prof. Indra Vir Singh
Department of Mechanical and Industrial Engineering,

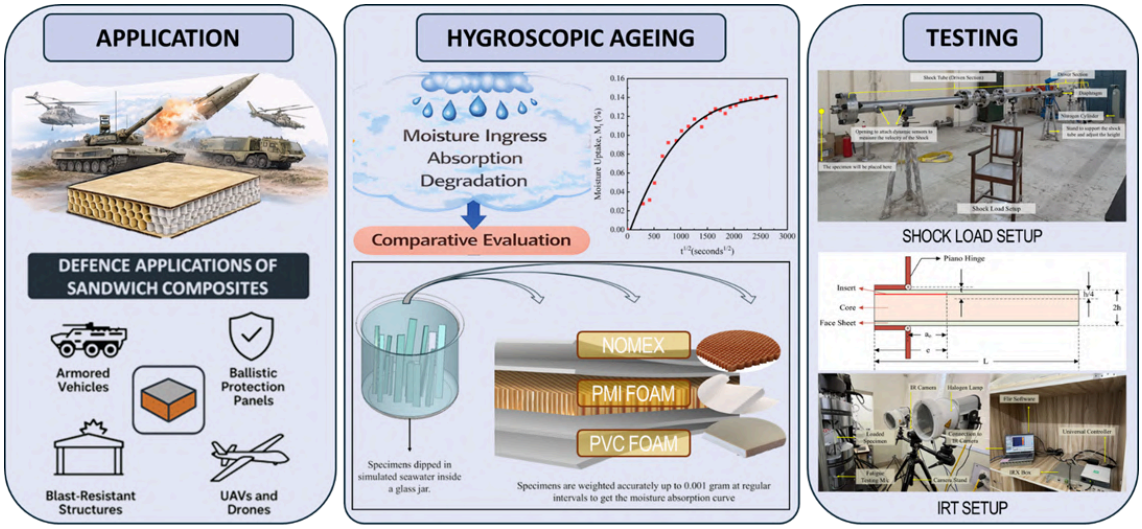
Email ID : ivsingh@me.iitr.ac.in

Co-PI: :
Prof. Ateeb Ahmad Khan
(Department of Mechanical Engineering, AMU, Aligarh)

Link : https://www.iitr.ac.in/~ME/Indra_Vir_Singh **Sponsor :** Armament Research Board, DRDO, New Delhi

Abstract

The proposed research project aims to examine the effect of hygroscopic ageing on the mechanical response and fracture-fatigue behaviour of sandwich composites for armament applications. These structures, consisting of fibre-reinforced face sheets and lightweight cores offer high specific stiffness and energy absorption but are susceptible to moisture-induced degradation. Hygroscopic exposure can cause matrix plasticization, fibre-matrix debonding, and interfacial weakening, leading to reduced structural integrity and accelerated delamination and fatigue crack growth. This study systematically compares pristine and aged samples through experimental evaluation of flexural, compression, and core shear properties, along with Mode-I and Mode-II interlaminar fracture toughness. Fatigue performance will be assessed by establishing S-N curve and damage evolution. Controlled ageing environments will be used to simulate service conditions. The study will provide mechanistic insights into moisture-driven degradation and will help in designing more durable and reliable sandwich composite systems for defence applications. Additionally, the study will employ advanced diagnostic techniques such as infrared thermography and fractographic analysis to monitor damage initiation and propagation. A comparative assessment across different core materials will provide insights into moisture sensitivity, damage mechanisms, and performance degradation patterns. The outcomes of this research are expected to bridge critical knowledge gaps related to environmental durability of sandwich composites in defence applications. By quantifying the impact of moisture-induced ageing on structural performance, the project will contribute to the development of more reliable, durable, and high-performance composite materials. The findings will support the design and optimization of next-generation armament systems, enhancing structural safety, operational efficiency, and service life under harsh environmental conditions



Title

Azole Based Fused ring and methylene-bridged energetic compounds

PI : Prof. Dheeraj Kumar
Department of Chemistry

Email ID : dheeraj.kumar@cy.iitr.ac.in

Link : https://www.dkresearchlab.in/home

Sponsor: DRDO

Abstract

In recent decades, the use of energetic materials has expanded significantly beyond military applications to include space exploration and various civilian sectors. These applications range from mineral mining and construction to metal processing, fire extinguishing, nanomaterial synthesis, and oil well drilling. With growing awareness of environmental protection, the development of greener energetic materials has become an important area of research in chemistry and materials science. Conventional explosives such as RDX and HMX are not only highly sensitive but are also carcinogenic. Likewise, commonly used lead-based primary explosives (e.g., lead azide and lead styphnate) and oxidizers such as ammonium perchlorate pose serious environmental hazards. In contrast, nitrogen- and oxygen-rich heterocyclic compounds such as azoles, oxadiazoles, and tetrazines have emerged as promising candidates for green energetic materials. These compounds exhibit high density and superior energetic performance due to the presence of multiple energetic bonds, including N–N, N=N, N–C, and N=C. Additionally, they are considered environmentally friendly because their detonation primarily produces non-toxic nitrogen gas (N_2). Although several azole- and oxadiazole-based compounds have demonstrated energetic properties surpassing those of CL-20, many of them face limitations such as poor thermal stability, high sensitivity, costly starting materials, and complex synthesis procedures. Therefore, a key challenge in energetic materials research is to develop green compounds that achieve an optimal balance between high performance and safe physical properties. In this project, we aim to synthesize environmentally friendly energetic compounds with performance exceeding that of RDX and HMX, while ensuring improved safety for both users and the environment.

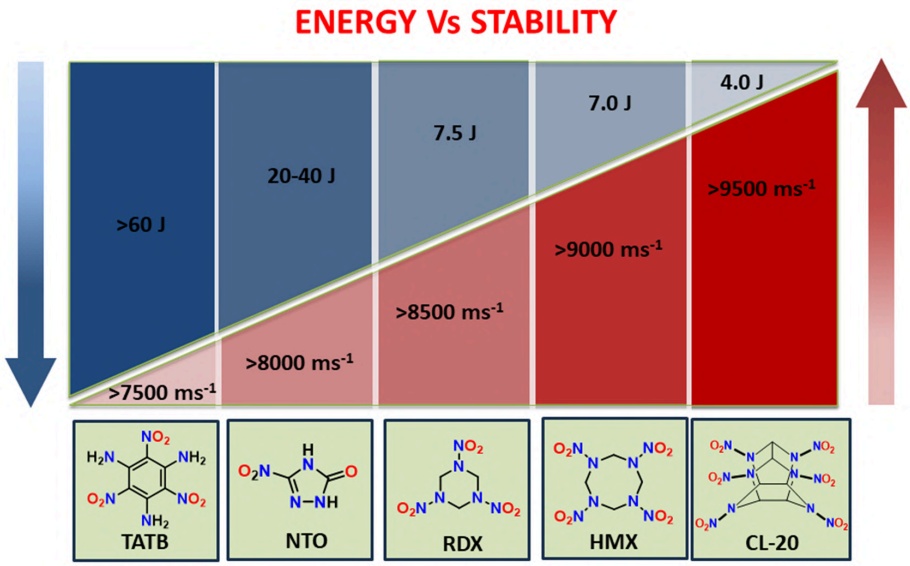


Figure : 2.1

Title

Design and Development of Digital Band-Pass Filter from 30 to 520 MHz

PI : Prof. Gowrish Basavarajappa
Department of Electronics and Communication Engineering

Email ID : gowrish.b@ece.iitr.ac.in

Co-PI: :
Prof. Karun Rawat

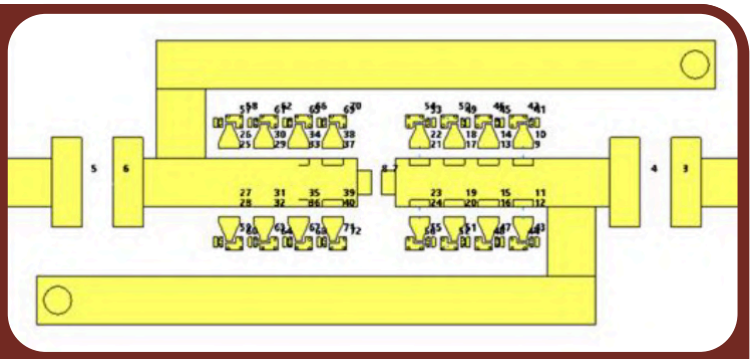
Link : www.gowrish.in

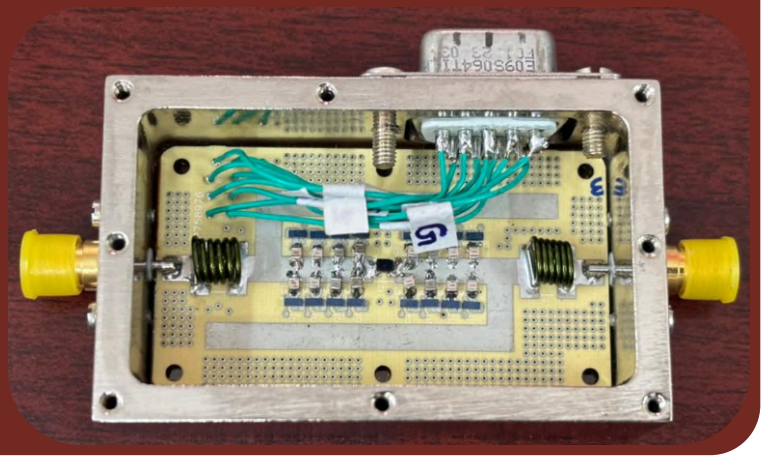
Sponsor : DRDO Industry Academia Centre of Excellence, IIT Roorkee (DIA-CoE, IITR)

Abstract

With the advent of SDR (Software Defined Radio) platforms, reconfigurable radio architectures have emerged as the a primary requirement in wireless communication applications. In such an SDR platform, except for the band-pass filter and local oscillator, all other components like LNA, PA, and mixers are wideband components. Thanks to the PLL architecture, local oscillator can be reconfigured over a wide tuning range. Hence, tunable band-pass filters are the bottleneck and thus play a vital role in selecting the band of interest and rejecting the interference signal for effective operation. This is even more evident in strategic applications where frequency hopping is employed for secure communication. In this research project we aim to design and develop a digital tunable band-pass filter from 30 to 520 MHz.

Proof of Concept : Preliminary Hardware Development





Title

Optimized Thermal Management of BESS with BMS and Design Development of Smart Inverter for defence microgrid application

PI : Prof. Premalata Jena
Department of Electrical Engineering

Co-PI: :
Prof. Siba Kumar Patro

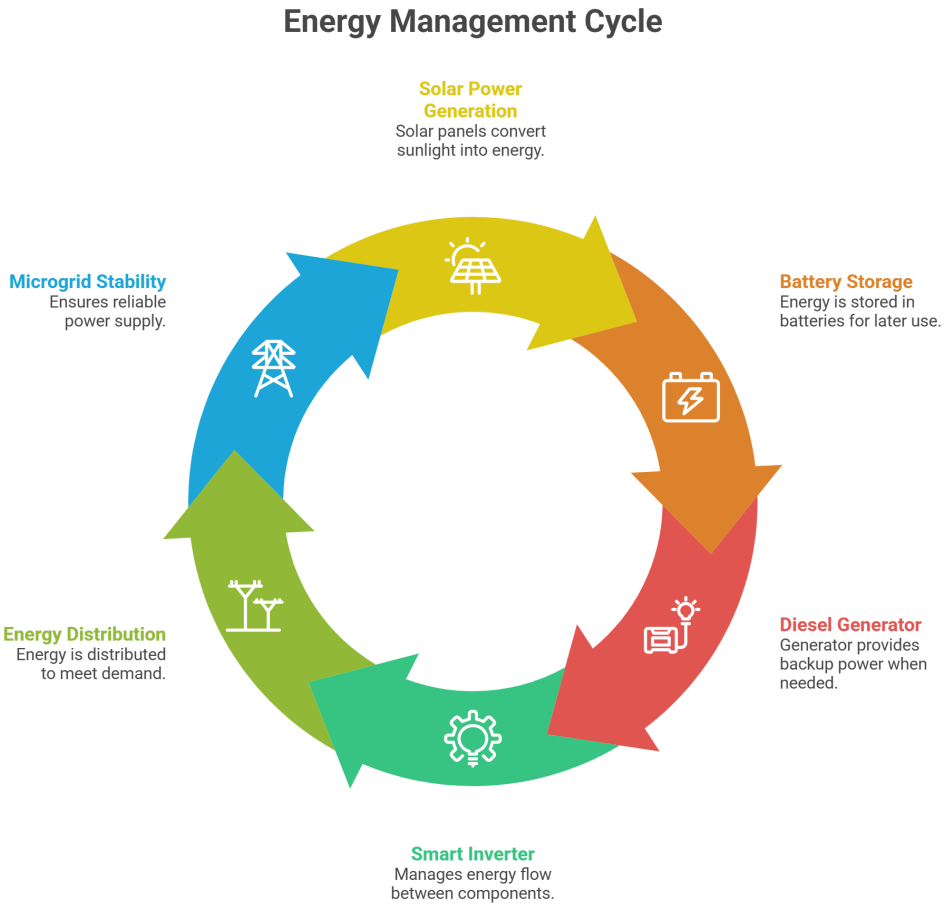
Email ID : premalata.jena@ee.iitr.ac.in

Link : https://ee.iitr.ac.in/~EE/ Premalata Jena

Sponsor : DRDO

Abstract

The project proposal aims to develop a smart inverter–based microgrid control framework capable of optimally coordinating solar PV generation, battery energy storage, and diesel generator (DG) sets. The focus will be on maximizing utilization of available solar power, managing limited solar windows, and ensuring a reliable power supply under extreme operating conditions. Furthermore, the project proposal aims to develop thermal management and control strategies for Battery Energy Storage Systems (BESS) operating at temperatures as low as -40°C, without altering the battery chemistry. This includes ensuring battery safety, performance stability, and reliable operation for high-altitude stations. Next, the work will focus on the design and implementation of advanced control algorithms for the smart inverter, enabling adaptive charging–discharging, stable microgrid operation, and efficient energy management under dynamic load and generation conditions.



Title

Shark and camelid nanobodies targeting the FAT1 protein as an antitumour agent.

PI : Prof. Rajesh Kumar
Department of Biosciences and Bioengineering

Co-PI: :
Prof. Pravinder Kumar

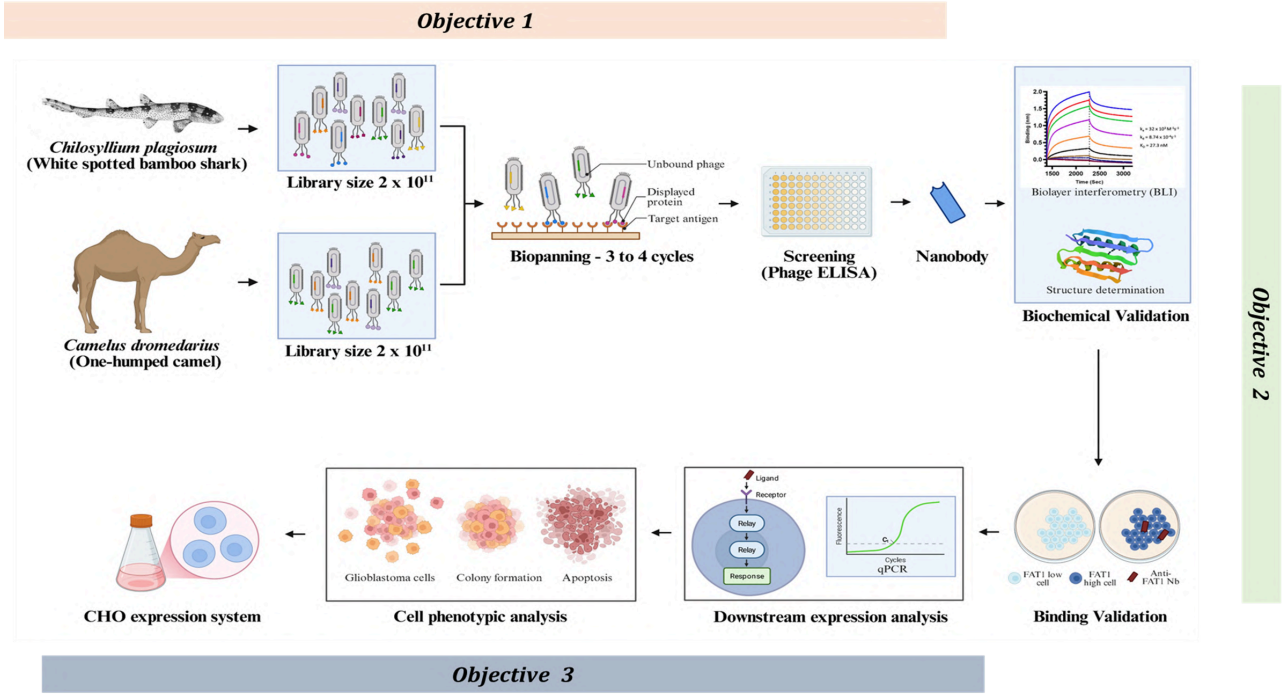
Email ID : rajesh.kumar@bt.iitr.ac.in

Link : https://iitr.ac.in/Departments/Biosciences%20and%20Bioengineering%20Department/People/Faculty/101008.html

Sponsor : DBT

Abstract

In this proposal we are exploring the potential of nanobodies and nanobody-drug conjugates (NDCs) as an innovative tool in cancer immunotherapy, specifically targeting FAT1 to enhance anti- tumor responses. This study aims to leverage the unique characteristics of nanobodies, including their small size, high specificity, and engineering flexibility, to develop advanced cancer treatment strategies. By modifying nanobodies with drugs for better tumor penetration and retention. Furthermore, the study aims to evaluate the preclinical and clinical potential of FAT1-targeted nanobody-based therapies in lung cancer, investigating their mechanisms of action and therapeutic outcomes. This research seeks to advance our understanding of nanobody-based cancer treatments, propose solutions to current challenges in immunotherapy, and pave the way for the clinical translation as targeted anti-tumor agents with enhanced therapeutic benefits.



Title

Commercial Scale-Up of a Portable Potentiostat Platform for Non-invasive Multiplexed Salivary Diagnosis and Prognosis of Oral and Lung Cancer

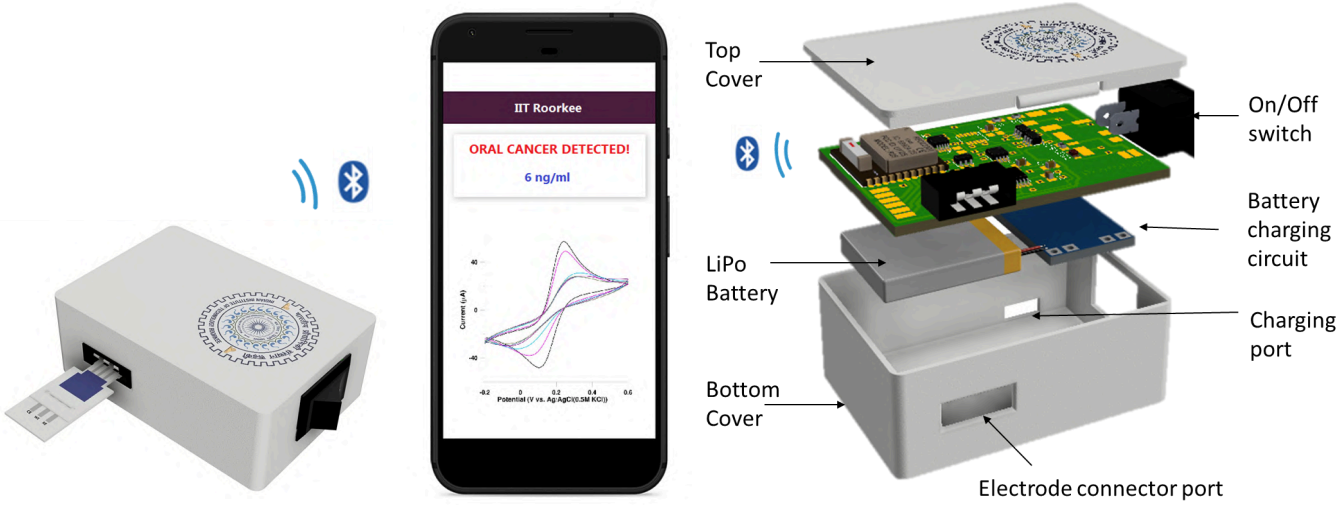
PI : Prof. Gopinath Packirisamy
Department of Biosciences and Bioengineering

Email ID : gopi@bt.iitr.ac.in

Link : https://bt.iitr.ac.in/~BT/P_Gopinath & https://www.supergoodnano.com/ **Sponsor :** ICMR, New Delhi

Abstract

This project focuses on the detection of saliva-based biomarkers for oral and lung cancer using an in-house developed wireless potentiostat. It includes clinical validation of the device through testing with real-world patient samples, along with regulatory compliance documentation in accordance with CDSCO guidelines. The study is designed as a multi-centre effort involving five sites across India, to be conducted over a period of three years.



Title

Development Of A Novel Mitochondria targeted Luteolin-Copper Nanomedicine For Treating Non-Small Cell Lung Cancer By Cuproptosis Induced Cell Death

PI : Prof. Partha Roy
Department of Biosciences and Bioengineering

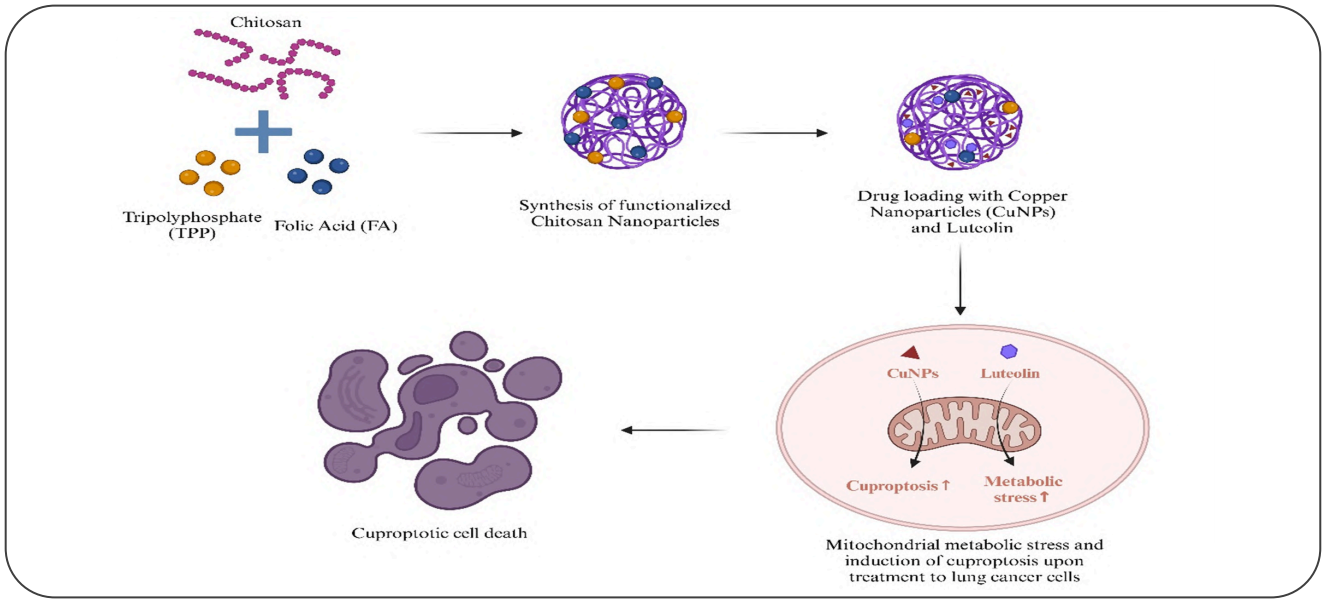
Email ID : partha.roy@bt.iitr.ac.in

Link : https://bt.iitr.ac.in/~BT/paroyfbs

Sponsor : ICMR, New Delhi

Abstract

Lung cancer remains one of the leading causes of cancer-related deaths globally, necessitating the development of innovative and targeted therapies. Copper is an essential trace element playing a crucial role in maintaining proper lung function and cellular metabolism. Recent studies have highlighted the potential of copper-mediated cell death, known as cuproptosis, as a promising therapeutic strategy against lung cancer. Cuproptosis is primarily induced by proteotoxic stress and reactive oxygen species (ROS) generation during copper's participation in intracellular redox reactions within mitochondrial metabolism. This study proposes to increase the effectiveness of copper nanoparticles (CuNPs) in targeting lung cancer cells because of their ability to trigger cuproptosis. To achieve this, our study focuses on developing a mitochondria-targeted chitosan based nanoparticle loaded with CuNPs for cuproptosis induction and luteolin that will disrupt cytoprotective redox signaling pathways, thereby increasing ROS production and making cancer cells more susceptible to cuproptosis. Furthermore, to enhance the specificity of this therapeutic approach, we will conjugate folic acid and triphenylphosphonium (TPP) to the complex. Folic acid is known for its high affinity for folate receptors, which are overexpressed on the surface of lung cancer cells and triphenylphosphonium will selectively target mitochondria for higher copper accumulation and ROS generation. This targeted delivery system is expected to induce cuproptosis selectively in lung tumor cells, minimizing cytotoxicity to normal healthy cells.



Title

Development of a photonic diagnostic system for Gastro-Intestinal Infections through detection of viruses in stool using Machine-learning enabled Plasmon Enhanced Raman Sensing (GIMPERS)

PI : Prof. Sachin Kumar Srivastava

Department of Physics, jointly at Centre of Photonics and Quantum Communication Technology

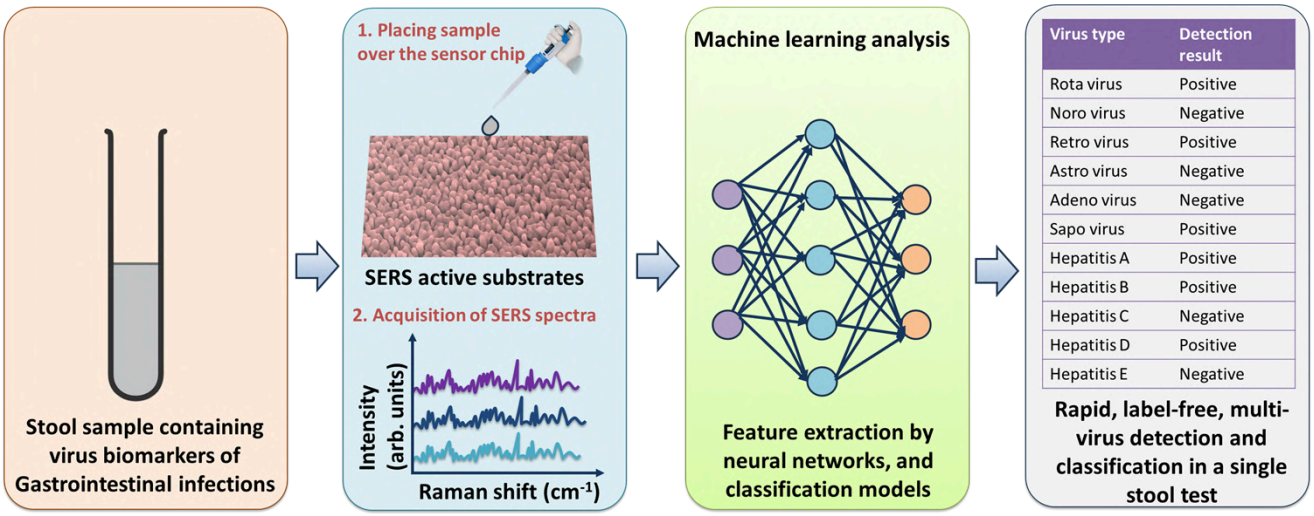
Email ID : sachin.srivastava@ph.iitr.ac.in

Link : https://www.iitr.ac.in/~PH/Sachin_Kumar_Srivastava

Sponsor : ICMR, India

Abstract

State of the art methods for the diagnosis of gastrointestinal infections (GI) are time-consuming and costly. Machine learning integrated surface-enhanced Raman spectroscopy (ML-SERS) provides a rapid, label-free, highly sensitive and indigenous point of diagnostic platform for the detection of viruses causing GI. ML-SERS would enable detection of viruses (rotavirus, norovirus, retrovirus, astrovirus, adenovirus, sapovirus, variants of hepatitis virus) causing GI from a single stool test. SERS enables rapid (< 10 minutes), cost-effective, sensitive, and label-free detection tool for point of diagnosis.



Title

Design and Development of Chimeric Vaccine Candidates for Flavivirus infections using CHIKV-based Platforms

PI : Prof. Shailly Tomar
Department of Biosciences and Bioengineering

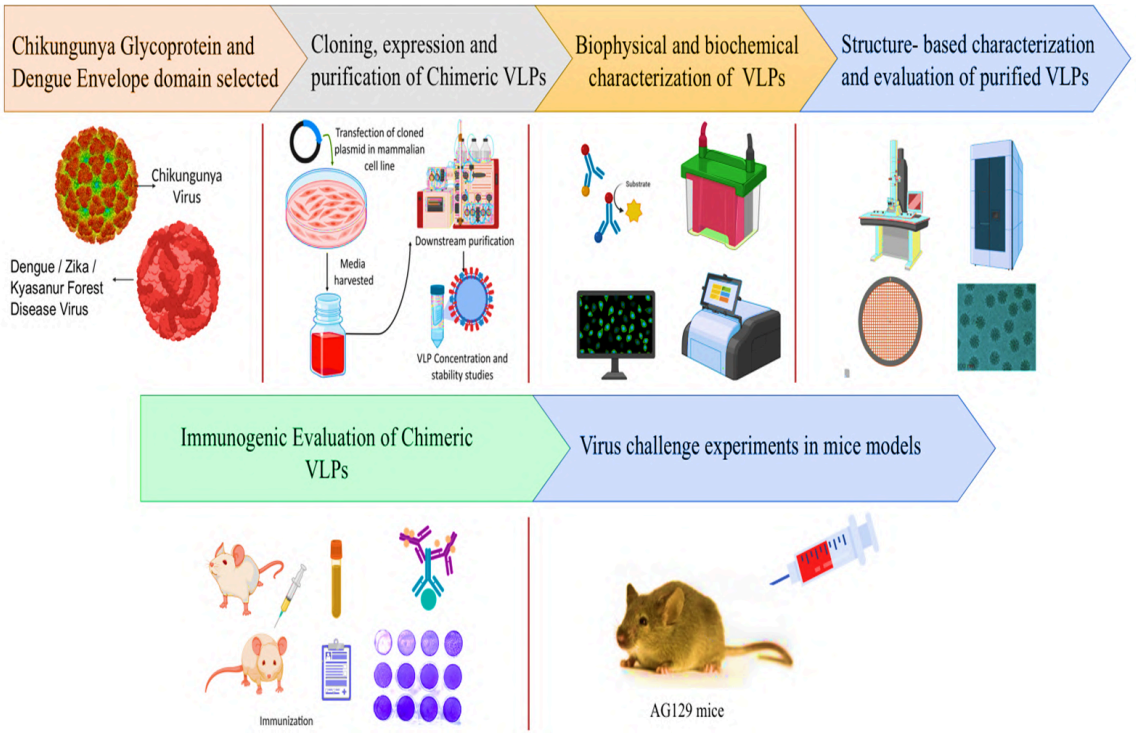
Email ID : shailly.tomar@bt.iitr.ac.in

Link : https://www.iitr.ac.in/~BT/shailfbt

Sponsor : Indian Council of Medical Research

Abstract

Arboviruses as re-emerging viral pathogens, including alphaviruses like Chikungunya virus (CHIKV), and flaviviruses like Dengue virus (DENV), Zika virus (ZIKV) and Kyasanur Forest disease virus (KFDV). India exhibits a high prevalence of DENV-CHIKV co- infections, with DENV serotypes (DENV-1 to 4) co-circulating. ZIKV co-infection with DENV and CHIKV further complicates the arboviral disease burden. In endemic regions, vaccination remains the primary control strategy, and chimeric vaccines offer a promising approach to enhance immunogenicity and overcome current limitations in infection control. The novelty of this study stems from the lack of approved chimeric vaccine formulations designed to target these arboviruses. This study aims to design and develop unique chimeric enveloped VLP vaccines to elicit immunity against DENV (1-4) and ZIKV leveraging a CHIKV-based backbone. The outcomes anticipated from this study include stable and highly immunogenic chimeric VLPs against ZIKA and all four serotypes of DENV (1-4), ensuring effective protection while eliminating the risk of ADE and serotype-specific immunity in the case of DENV.



Title

Handling Problem of Data Quality in Artificial Intelligence and its Application to Software Quality, Fairness and Explainable AI (DAQUA)

PI : Prof. Sandeep Kumar
Department of CSE

Email ID : sandeep.garg@cs.iitr.ac.in

Link : https://iitr.ac.in/~CSE/Sandeep

Sponsor : Ministry of Education, Govt. of India

Abstract

This project addresses the critical issue of data quality in Artificial Intelligence and Machine Learning, emphasizing its impact on model performance and reliability. While traditional software quality metrics—such as complexity, variable usage, and failure frequency—have proven useful, the abundance and variability of features often hinder predictive accuracy. The proposal explores advanced techniques for feature and instance selection, aiming to enhance data quality and model efficiency. It integrates meta-learning strategies and leverages Large Language Models (LLMs), whose effectiveness depends heavily on the quality and complexity of training data. The research will apply data complexity metrics (e.g., feature overlap, class imbalance, neighborhood separability) to guide preprocessing and model selection. Key tasks include analyzing feature distributions, evaluating distribution shifts, and developing preprocessing guidelines for both traditional machine learning and LLM-based models. The project also emphasizes explainability and fair evaluation, aiming to produce reproducible results and actionable insights.

Title

Development of a Real Time Digital Simulator for Pumped Storage Plants (PSPs)

PI : Prof. Himanshu Jain
Department of Hydro and Renewable Energy

Co-PI: :
Prof. Arun Kumar

Email ID : Himanshu.jain@hre.iitr.ac.in

Link : https://iitr.ac.in/~HRE/Himanshu_Jain

Sponsor: NHPC Ltd.

Abstract

The real-time digital PSP simulator will be a unique R&D development and facility that does not exist in India today and that will support the country's aggressive foray into PSP development to integrate high levels of renewable energy in the power grid. Besides the real time digital PSP simulator itself, the other knowledge products that will be generated from the project include:

- In-depth understanding of various PSP technologies (fixed speed vs variable speed vs hydraulic short-circuit)
- Understanding of mode transitions and the speed at which these can be undertaken
- Types of ancillary services that various PSP technologies can provide
- PSP behaviour under various mechanical and electrical malfunctions including grid disturbances

The simulator is planned to be operational by mid 2028

Title

Decentralized Rainwater Harvesting and Greywater Treatment Using Electrocoagulation-Ceramic Membrane Systems in the Indian Himalayan Region

PI : Prof. Abhijit Maiti
Department of Polymer & Process Engineering

Email ID : abhijit.maiti@pe.iitr.ac.in

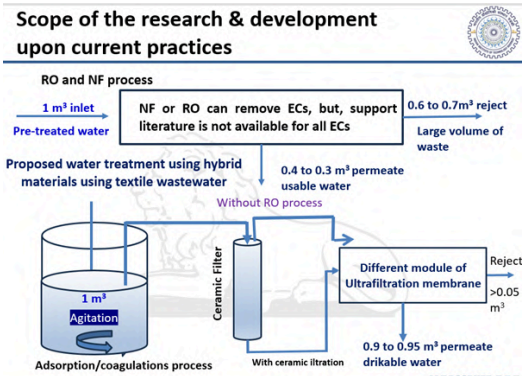
Co-PI: :
Co-PIs from Industry & NGO: M/S Quest Engineering & Consultancy & Kalpavriksha Sustainable Development Society, Dehradun

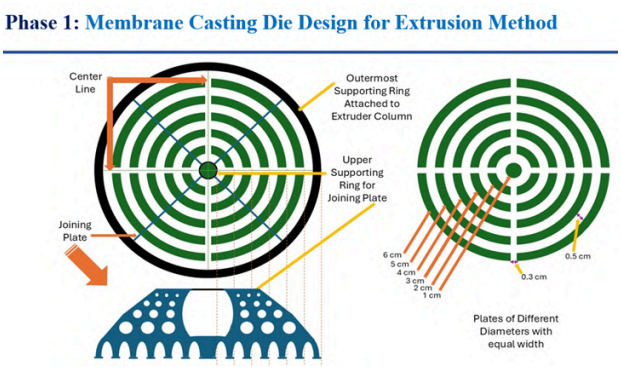
Link : Abhijit Maiti & Membrane Separation & Water Treatment Lab - Researches

Sponsor : National Mission on Himalayan Studies (NMHS)

Abstract

The project represents the field-level application of a decentralized greywater and rainwater/spring water treatment model in the Indian Himalayan Region (IHR) that combines electrocoagulation and/or novel ceramic membrane filtration developed at IIT Roorkee, specifically designed for rural households. Unlike conventional soak pits or STPs, this system offers a measurable water recovery solution that is compact, low-maintenance, and functional even in cold, off-grid environments. By exploring novel lab-developed ceramics for membrane fabrication, the project opens avenues for rural enterprise development in pottery clusters. Coupling this system with rainwater harvesting enhances year-round water availability, offering a dual-layered water security model. This approach goes beyond infrastructure; it fosters community ownership by training SHGs and youth for system maintenance and management. A household of four can reuse up to 100 to 120 liters of greywater daily, reducing freshwater dependency by nearly 40,000–50,000 litres annually per household. The system reduces pressure on local springs, improves hygiene, and eases the daily burden of water collection, especially for women and children. Aligned with Jal Shakti Abhiyan, this initiative promotes sustainable rural water governance and creates a scalable template for eco-resilient water reuse solutions across the Himalayas.





Title

Tapping GaN potential: Heterogeneously integrated packaging of GaN devices for low voltage high current electric vehicle drives.

PI : Prof. Prashant Surana
Department of Hydro and Renewable Energy

Email ID : prashant.surana@hre.iitr.ac.in

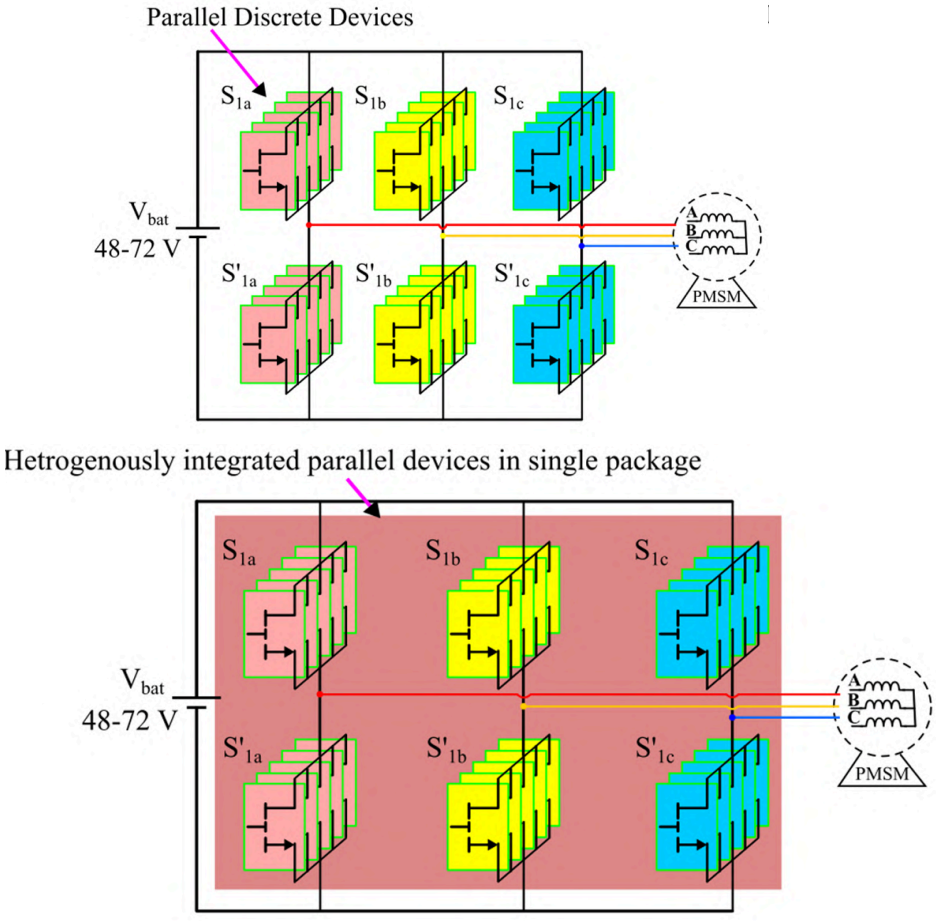
Co-PI: :
Prof. Apurv Kumar Yadav (EED),
Prof. Biplab Sarkar (ECE)

Link : https://iitr.ac.in/ps

Sponsor : SPARC, Ministry of Education

Abstract

This project develops high-current GaN-based inverter solutions for 48–72 V PMSM drives in electric two- and three-wheelers by overcoming limitations of discrete parallel devices through a heterogeneously integrated GaN package. It adopts a dual approach, discrete and custom-packaged GaN inverters, targeting >97% efficiency and >10 kW/L power density with optimized gate driver and thermal design. The Indo–Taiwan collaboration combines strengths in GaN fabrication and EV power electronics to deliver compact, efficient, and scalable solutions for next-generation electric mobility.



SOME OF MAJOR COLLABORATIONS

- Indian Army (HQ Central Command)
- Airbus India Pvt. Ltd.
- Quinas Technology Limited
- National Institute of Urban Affairs (NIUA)
- AccelESG India Pvt. Ltd (Accel1)
- VBF Studios Pvt. Ltd. (eAsia)
- Imgenex India Pvt. Ltd.
- Graphic Era Institute of Medical Sciences (GEIMS)
- Quest Engineering and Consultancy & Kalpavriksha Sustainable Development Society
- Teamlease Edtech Ltd.
- Indian Academy of Highway Engineers (IAHE)
- ICFAI University, Dehradun
- Guru Gobind Singh Indraprastha University, Delhi (GGSIU)
- Memorial Sloan-Kettering (MSK)
- PFC Consulting Ltd. (PFCCL)
- Centre for Development of Telematics (C-DOT)
- Trident Ltd.
- Soket Labs Tech & Research Pvt. Ltd.
- Adani Cement
- TIH Foundation for IoT & IoE
- Haridwar University
- CICERO & IIT Bombay
- International Neurodegenerative Disorders Research Center (INDRC), Czech Republic
- MaxVolt Energy Industry Ltd
- Indian Oil Corporation (IOCL)
- Indian Nurserymen Association (INA)
- NBCC
- Directorate of Technical Education (DTE- Haryana)
- National Capital Region Transportation Corp. (NCRTC)
- BITS Pilani
- ITM Mussoorie
- Uttarakhand State Disaster Management Authority (UKSDMA)
- STMicroelectronics International NV
- MDS IndoCan Inc.
- Bangalore Metro Rail Corporation Limited (BMRCL)
- Pinaka Green Pvt. Ltd
- Bihar Institute of Public Administration and Rural Development
- Central Power Research Institute (CPRI)
- College of Military Engineering, Pune
- Tripartite MoA- DRDO, BEG & IIT Roorkee
- Michelin India Pvt Ltd
- Office of Joint Magistrate, Roorkee
- Conveyor & Ropeway Services Pvt Ltd (CRSPL)
- Uttarakhand Technical University
- NIT Jamshedpur
- Centre for Development of Telematics C-DOT
- Prayas Greentech Pvt Ltd
- ONGC Energy Centre Trust
- Spring and River Rejuvenation Authority (SARRA)
- Vyakti Vikas Kendra India (Art of Living)

OTHER RECENTLY REGISTERED PROJECTS

OUTLAY OF 50 LAKHS AND ABOVE

Principal & Co -Principal Investigator(s)	Title of Project	Sponsor Agency
Prof. Anupam Chakrabarti, Prof. Sonalisa Ray Prof. Pradip Bhargava	Recommendations for Design Parameters of Ultra High Performance Concrete for use in Railway Structures	Research Designs & Standard organisation (RDSO), Lucknow
Prof. Ajit Kumar Dubey	Theoretical and experimental determination of burn rate of metals/ metals oxides and product species of high explosives through spectroscopy	DRDO, TBRL, Chandigarh
Prof. Yogesh kumar Sharma	Design and Development of Power Back up of 1-5 wh based on sodium ion cell operable at sub zero temperature for renewables	MNRE
Prof. Arup kumar Das	Inerting and purging for zeroe aircraft refuelling	Airbus India Pvt. Ltd, New Delhi
Prof. Karun Rawat	Design and Implementation of Advance Techniques in Nonlinear Power Amplifiers optimizing Size weight & Power (SWAP)	DRDO, NEW DELHI
Prof. Komal Tripathi	Research study on Evaluation and Strengthening of Uttarpradesh bio energy policy solar energy policy and green hydrogen policy	UP-INVEST Lucknow
Prof. Palas Kumar Farsaiya	Fundamental investigations of Physicochemical Phenomena in interfacial flows using direct numerical simulations (DNS) and controlled experiments	ANRF, New Delhi
Prof. Saugata Hazra (BSBE)	Development and evaluation of a Bioink containing human lipoaspirate-derived adipocyte stem cells in silk fibroin gel for 3d bioprinting of skin construct an in vivo study	ICMR, New Delhi
Prof. Gaurav Kumar Nayak (MFS)	Visual Place Recognition for Interior Scenes	Graylark Technologies Inc. San Francisco, California, USA
Prof. Deepak Sharma (BSBE)	Development of a machine-learning based diagnostic tool for predicting Carcinoma Cervix on Ultrasonography and MRI	ICMR, New Delhi
Prof. Kenkera Rayappa Naveen (PPE)	Design. Synthesis and Characterization of Tricoordinated organo-Boron ii Conjugated Luminophores for sustainable color pure high efficiency optoelectronic devices via tandem one shot borylation and structure property driven engineering	ANRF, New Delhi

OTHER RECENTLY REGISTERED PROJECTS

OUTLAY OF 50 LAKHS AND ABOVE

Principal & Co -Principal Investigator(s)	Title of Project	Sponsor Agency
Prof. Rajesh kumar Ulagamathan (CON)	Emerging van der Waals Heterostructures for flexible light weight and efficient optoelectronic devices	ANRF, New Delhi
Prof. Ram Sateesh Pasupuleti (APD)	Development of an Integrated Intelligent Disaster Management System for Mountain Communities in India	DST, New Delhi
Prof. Yadagiri Donagari (CY)	Ring Strain Enabled Catalytic generation and functionalization of metallocarbenes from Bicyclo (1,1,0) butanes	ANRF, New Delhi
Prof. Ravindra Pandey (CY), Prof. Pradeep Srivastava (ESD)	Interface specific spectroscopic insight into nature guided crystallization mechanisms	ANRF, New Delhi
Prof. Kaushik Ghosh (CY)	Targeting Amyloidogenesis : transition metal complexes as therapeutic and diagnostic agents in Alzheimer's and related neurodegenerative disorders	ANRF, New Delhi
Prof. Dheerendra Kumar Dwivedi, Prof. Shamik Basak (MIED)	Joining of AA6061 and CFRP using Hybrid joining and Novel Surface treatment	ANRF, New Delhi
Prof. Puneet Gupta (CY)	Computational exploration of dual metal atom catalytic sites on graphene for efficient hydrogenation insight into electronic structure stability and reactivity	ANRF, New Delhi
Prof. Kaushik Parida (PPE)	Non-surgical Bioresorbable electronic thread for spatio temporally precise neuromodulation in spinal cord injury rehabilitation	ICMR, New Delhi
Prof. Prasenjit Mondal (ChED)	Green Recovery of Lithium from brine solution and waste lithium ion battery using functionalized biochar and thermochemical processing	ANRF, New Delhi
Prof. Nitish Arya (MIED)	Aeroelastic analysis and control of shock buffeting in combat aircraft vertical tails	ANRF, New Delhi

TECHNOLOGY TRANSFERRED

Prof Yogesh Kumar Sharma & team IIT Roorkee,
Technology Transfer agreement with Indigenous Energy Storage Technologies Pvt. Ltd

Prof Kaushik Pal & team IIT Roorkee,
Technology Transfer agreement With Indobell Insulations Limited

Prof Sunil Singhal, Prof. Sonal Thengane & team IIT Roorkee,
Technology Transfer agreement with Indo Climate Lab Private Limited

TECHNOLOGY TRANSFERRED

Prof Sunil Singhal, Prof. Sonal Thengane & team IIT Roorkee,
Technology Transfer agreement with Dhiman Enterprises

Prof Sunil Singhal, Prof. SonalThengane & team IIT Roorkee,
Technology Transfer agreement with Jai Maa Durga Engg Co.

AWARDS & RECOGNITION

CII Industry Academia Partnership Award- 2025

FICCI Higher Education Excellence Award
for Excellence in Research & Innovation- 2025

CII Awards 2025: Excellence for Women
in STEM and Intellectual Property (IP)

CORRESPONDENCE

Dean, Sponsored Research & Industrial Consultancy

dsric@iitr.ac.in

Volume 22