



Translating Research, Transferring Technology

ANNUAL REPORT
2024-2025

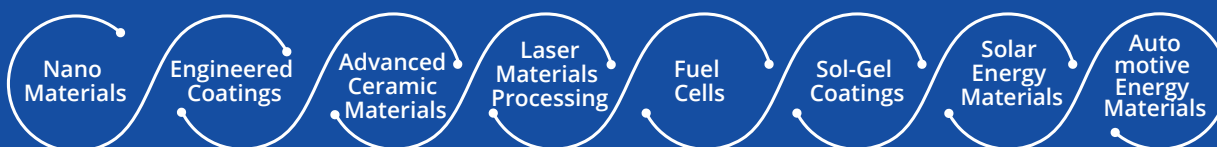


ARCI is an autonomous R & D Centre of Department of Science and Technology (DST), Government of India, set-up with a mission to develop unique, novel and techno – commercially viable technologies in the area of advanced materials and subsequently transfer them to industries.

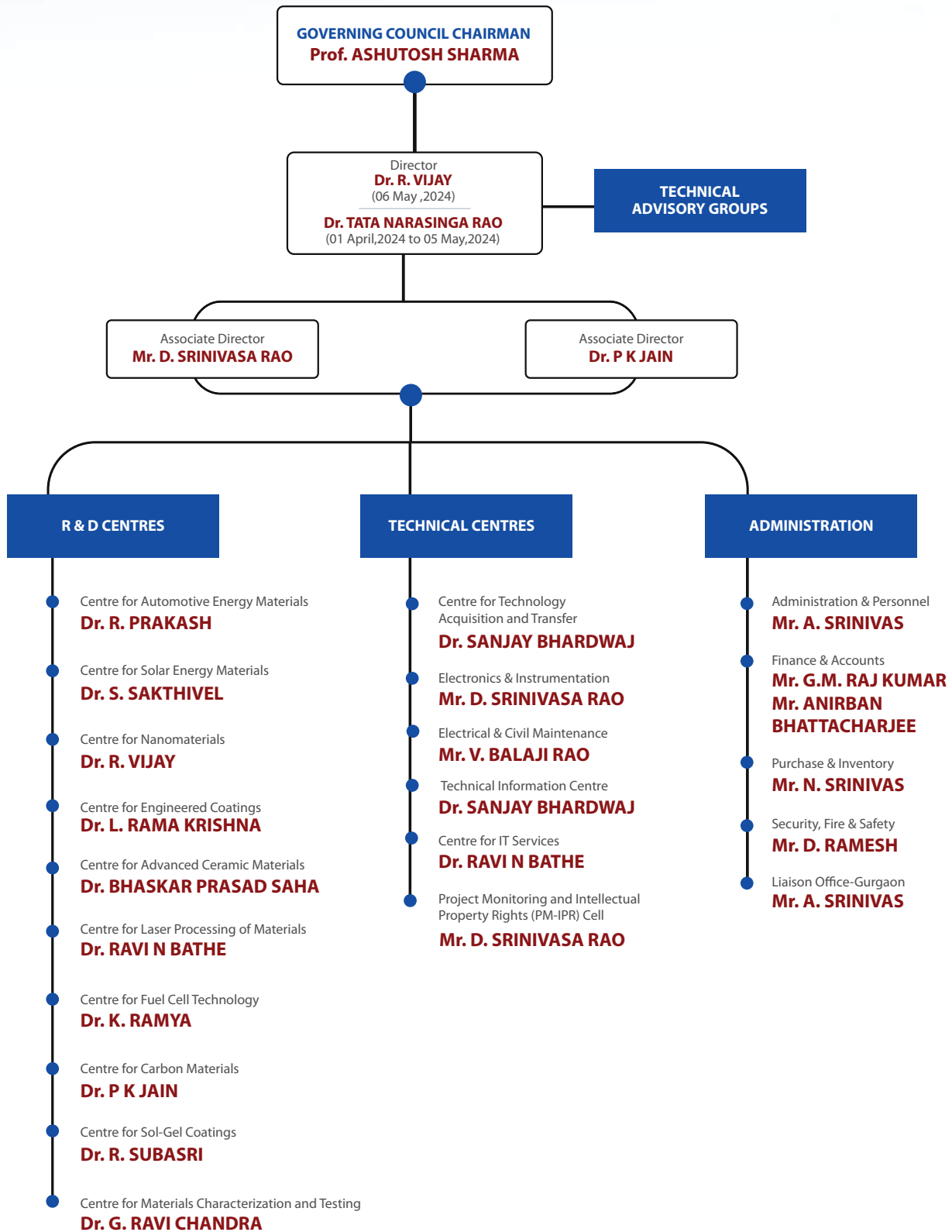
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Thrust Areas



Organizational Structure



Governing Council (as on 31st March 2025)

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President, Indian National Science Academy
Chairman, Life Sciences Research Board, DRDO

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Vice President - Group Innovation
TATA Sons Private Limited, Mumbai

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Engineering, Indian Institute of Science,
Bengaluru

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Head, Department of Metallurgical Engineering and
Materials Science, Indian Institute of
Technology-Bombay, Mumbai

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Department of Chemical Engineering
Indian Institute of Technology, Kanpur

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Secretary, Department of Science and
Technology, New Delhi

Shri Chetan Prakash Jain (Member (Ex-officio))

Financial Adviser, Department of Science and
Technology, New Delhi

Dr. R. Balamuralikrishnan (Member (Ex-officio))

Director, Defence Metallurgical Research
Laboratory, Hyderabad

Shri Praveen Roy (Member (Ex-officio))

Head, Technology, Translation and Innovation (TTI)
Division, Department of Science &
Technology,
New Delhi

Dr. Praveen Kumar Somasundaram (Member (Ex-officio))

Head, International Cooperation
Department of Science & Technology, New Delhi

Dr. R. Vijay (Member Secretary)

Director, ARCI

Shri D. Srinivasa Rao (Non- Member Secretary)

Associate Director, ARCI

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Centre for Nanomaterials

Prof. V. Ramgopal Rao (Chairman)

Fellow of IEEE, TWAS, INAE, INSA, IASc, NASI
Group Vice-Chancellor, Birla Institute of Technology &
Science (Pilani, Hyderabad, Goa, Dubai & Mumbai)
BITS Pilani, Rajasthan

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Former Director, Indira Gandhi Centre for
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Engineering, Indian Institute of Technology,
Bombay

Dr. B. L. V. Prasad

Director, Centre for Nano and Soft Matter
Sciences, Arkavathi Campus, Bengaluru

Dr. Anish Kumar

Associate Director, Materials Characterization
Group & Head, Non-Destructive Evaluation
Division, Metallurgy and Materials Group, Indira
Gandhi Centre for Atomic Research, Kalpakkam

Centre for Advanced Ceramic Materials and Centre for Carbon Materials

Dr. Govind Bajargan (Chairman)

Group Director, Materials and Mechanical Entity,
Vikram Sarabhai Space Centre,
Thiruvananthapuram, Kerala

Dr. K. Annapoorna

Senior Principal Scientist, CSIR-CGCRI, Kolkata

Prof. Parag Bhargava

Professor, Metallurgical Engineering and
Materials Science, IIT Bombay, Powai, Mumbai

Dr. Anil Kumar

Scientist 'H' & Associate Director, ASL, DRDO
Hyderabad

Dr. Harender Singh Bisht

Director, CSIR-Indian Institute of Petroleum
(CSIR - IIP), P.O. IIP Mohkampur, Dehradun

Dr. Vivek Arya

AGM (MMC-3), BHEL, Corporate R&D,
Vikasnagar, Hyderabad

Technical Advisory Groups (as on 31st March 2025)

Centre for Automotive Energy Materials & Centre for Fuel Cell Technology

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Sector-13, Faridabad

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Prof. Raghunathan

Professor of Practice, IIT, Madras

Prof. Yogesh Sharma

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Joint Faculty, Center For Sustainable Energy,
Associate Faculty, Centre of Nanotechnology,
IIT Roorkee.

Prof. Anil Verma

Professor, Department of Chemical Engineering,
IIT, Delhi

Prof. Pratibha Sharma

Associate Dean (Academic Programmes),
Cummins Chair Professor, Department of Energy
Science and Engineering, IIT Bombay

Centre for Engineered Coatings & Centre for Materials Characterization and Testing

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Dept. of Aerospace Engineering, Defence Institute
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Project Director, VISHNU, Defence Research &
Development Laboratory (DRDL), Hyderabad

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Engineering IISc Bangalore

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Head and Professor, Department of Metallurgical and
Materials Engineering, IIT Madras

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General Manager, Materials Development and
Production Group, ISRO, Thiruvananthapuram

Centre for Laser Processing of Materials

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Adjunct Professor, NIT Warangal, Telangana
Chairman, INAE Hyderabad Chapter
Professor of Practice, College of Engineering,
Andhra University, Outstanding Scientist and
Director (Retd), Defence Metallurgical Research
Laboratory, DRDO, Hyderabad.

Dr. B. Hari Prasad

Outstanding Scientist and Associate Director
Engineering & Product Development
Defence Research & Development Laboratory
(DRDL), DRDO, Kanchanbagh, Hyderabad

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Head, Engineering Design and Manufacturing
Division Head, AIC π -Hub & Technology Transfer
Cell; Professor, Homi Bhabha National Institute,
Raja Ramanna Centre for Advanced Technology
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Dr. Kanwer Singh Arora

Head R & D, Tata Steel Limited, Jamshedpur

Centre for Solar Energy Materials & Centre for Sol-Gel Coatings

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Director General, National Institute of Solar
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Gurugram

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Former Distinguished Scientist and
Former Director, Materials Group, Bhabha Atomic
Research Centre (BARC), Mumbai

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Scientist-'G' and Head, Polymers and Rubber Division,
DMSRDE, (DRDO), Kanpur

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Engineering, National Institute of Technology (NIT)
Tiruchirappalli

Prof. K. S. Narayan

Professor and JC Bose National Fellow
Jawaharlal Nehru Centre for Advanced Scientific
Research, (JNCASR), Jakkur, Bangalore

Prof. K. Srinivasa Reddy

Professor, Heat Transfer and Thermal Power
Laboratory, Department of Mechanical
Engineering, IIT Madras, Chennai

Centre for Technology Acquisition & Transfer

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Director & Ram Charan Chair Professor in
Innovation & Leadership, IITM Bangalore
Bannerghatta Road, Bengaluru

Dr. Aravind Chinchure

Founder & CEO, QLEAP Academy,
Nandan Prospera, Baner Road, Pune

Dr. Premnath Venugopalan

Head, NCL Innovations, NCL Innovation Park Dr Homi
Bhabha Road, Pune

Ms. Poyani Bhatt

Chief Executive Officer, Society for Innovation
and Entrepreneurship (SINE), IIT Bombay

Director's Report



It is my privilege to present the Annual Performance Report of ARCI for 2024–25. This year, the institute has continued to strike a strategic balance between fundamental research and technological development, ensuring that scientific advances are effectively translated into publications and patents as well as impactful technologies for both strategic sectors and industries. Our scientists have pursued government-funded, industry-sponsored, and prototype development projects, reaffirming ARCI's role as a nationally relevant translational research organization.

A significant highlight of the year was the know-how transfer of Lithium Iron Phosphate (LFP) cathode material technology for Li-ion batteries on a non-exclusive basis within India. This achievement underscores ARCI's pivotal role in strengthening India's clean energy and e-mobility sectors. The establishment of a pilot facility for large-scale battery materials production further underlines our commitment to building a self-reliant ecosystem in energy storage. Research on the development of materials for next-generation batteries (Na-ion and Li-S) has reached the next level for prototyping and demonstration.

In the field of renewable energy technologies, ARCI achieved significant milestones. Industrial adoption of anti-reflective coatings for solar PV panels marked a substantial step in the commercialization of efficient energy solutions. Progress in PEM fuel cell stacks, electrolysers, and solid oxide fuel cell components demonstrates ARCI's contributions to clean and efficient technologies for energy, reinforcing India's efforts towards self-reliance in this sector.

This year, ARCI's research in strategic materials, coatings, and carbon-based technologies has also made notable advances. The institute successfully developed dispersion-strengthened tungsten plates for aerospace and defence applications, alongside the indigenous production of low-expansion glass ceramics, providing a vital import substitute for strategic sectors. Thermal barrier and wear-resistant coatings were successfully developed for scramjet engines and pumps for nuclear reactors, respectively. Laser-based processing facilities were also established to enhance industrial productivity. Efforts are being carried out to establish a facility to produce rare-earth-based permanent magnets. Together, these efforts reflect ARCI's growing ability to translate advanced research into nationally relevant solutions, in alignment with the country's mission of technological self-reliance.

The Advanced Materials Technology Incubator (AMTI) at Hyderabad has further reinforced its role as a flagship national platform for supporting startups as well as technology receivers. Another milestone of the year was the establishment of the country's first pilot plant by M/s. ALTMIN Pvt. Ltd. at AMTI for the manufacture of carbon-coated lithium iron phosphate (C-LFP) cathode materials. The facility is now operational and supplying material for validation by leading industries, marking a significant step toward self-reliance in battery materials.

This year's research performance is reflected in a substantial number of high-impact publications, a commendable portfolio of patents filed and granted, and several technologies transferred to industries. Our outreach initiatives, including training programmes, internships, workshops, and collaborations with academia and industries, have further enhanced ARCI's visibility and engagement with stakeholders, while inspiring the next generation of researchers.

I sincerely thank the Department of Science and Technology (DST), the Chairman and Members of the Governing Council, and the Technology Advisory Groups (TAGs) for their valuable guidance and continued support. I also wholeheartedly appreciate the dedication of ARCI's scientists, technical and administrative staff, and enthusiastic students, whose commitment to excellence remains the driving force in advancing the institute's mandate and contributing to India's national goals.

Dr. R. Vijay
Director, ARCI



TECHNOLOGY TRANSFERS



Technology Transfers (Completed)

Lithium Iron Phosphate (LFP) Cathode Powder Material for Li-ion Batteries (Non-Exclusive Rights within India).

Technology transfer agreement was signed with M/s. ALTMIN Pvt Ltd., Hyderabad on 3rd May 2024, for making Lithium Iron Phosphate (LFP) Cathode Powder Material for Li-ion Batteries (Non-Exclusive Rights within India). M/s. ALTMIN Pvt Ltd., already has the exclusive rights for the same technology for territories other than India, there are no responsibilities pending from ARCI. After signing agreement, the technology transfer process has been completed with M/s. ALTMIN Pvt Ltd. M/s ALTMIN made the technology transfer fee completely to ARCI. Currently, M/s. ALTMIN is working on establishing the C-LFP cathode powder material production line with a capacity of 10000 MT/yr to meet the requirement of 4.5 GWh Li-ion cell plant.



Figure 1: Technology Transfer Agreement signing with M/s. ALTMIN Pvt Ltd., Hyderabad, for licensing Non-Exclusive Rights within India on 3rd May 2024.



Figure 2: Blending Process



Figure 3: Milling Process



Figure 4: Training on Electrode Coating Process



Figure 5: Cell Testing

Commercialization of Antireflective Coating Technology for Solar Photovoltaic

Light reflection from a solar panel's cover glass limits the amount of light entering the photovoltaic (PV) panel, which in turn reduces its overall power conversion efficiency. Applying an anti-reflective (AR) coating is a proven method to minimize this reflection. ARCI developed a specialized anti-reflective (AR) coating solution. This solution, known as an "AR-coating sol," uses metal oxide nanoparticles dispersed in a combination of organic solvents with suitable binders. Laboratory studies showed that the optimal AR-coated cover glasses achieved over 95% transmittance and maintained excellent stability in harsh environmental conditions. The AR coating technology was transferred to Borosil Renewables Ltd in 2023. Since then, multiple industrial trials have focused on preparing the solution in bulk, optimizing its deposition with a high-throughput industrial roller coater, and ensuring the coating's durability. By fine-tuning the sol preparation and process parameters, the team achieved over 95% transmittance on commercial solar glass measuring 1 by 2 meters. During the fiscal year 2023-24, Borosil Renewables produced approximately 100,000 m² of AR-coated solar cover glass, utilizing 70,000 liters of the AR coating solution. During the year, ARCI also received Royalty worth Rs. 11 Lakhs as per the Technology Transfer Agreement.



Figure 1: AR coating sol preparation in bulk quantity.

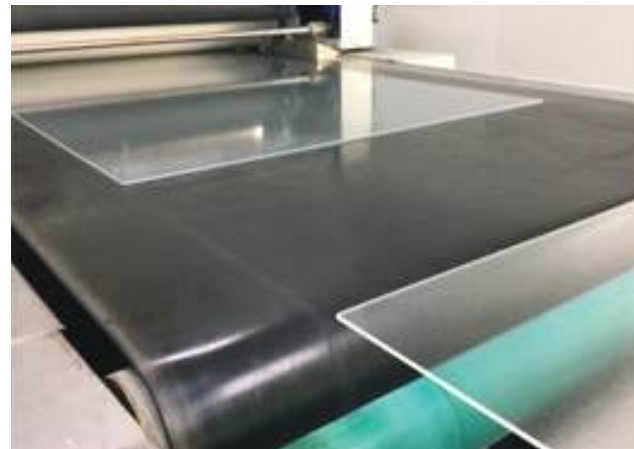


Figure 2: AR coating deposition in Industrial Roller Coater



Figure 3: AR coated 1mx 2m size solar cover glass: Transmittance of Bare and AR coated glass

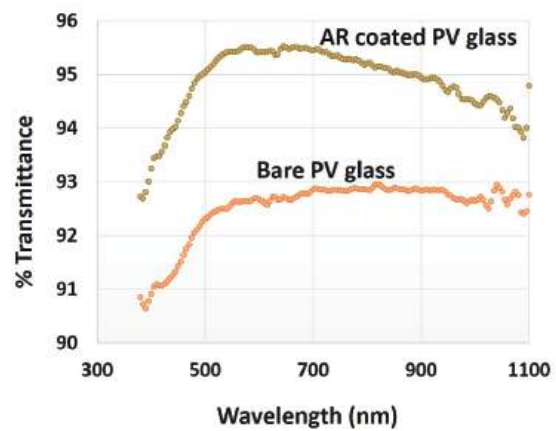


Figure 4: Technology Demonstration at Borosil Renewables

Technology Transfers (In Progress)

Establishment of LIB Pilot Facility (1MWh) and Manpower Training

An agreement with Nsure Reliable Power Systems, Bengaluru, was signed on 4th October 2021 for the transfer of technology know-how to establish an LIB pilot facility and provide manpower training. Two batches of hands-on training were conducted for the Nsure staff, each lasting two months. Technical specifications for the LIB process equipment and dry rooms required to establish the 1 MWh facility were finalized. Accordingly, a 2 MWh pilot plant was established and commissioned by March 2025. More than 1,000 pouch cells (30 Ah) were fabricated during the trials and are currently being tested for their cycle life performance. The performance evaluation is ongoing, after which the agreement terms will be deemed completed. This collaboration is the first of its kind in the PPP mode to be established at an industrial site.



Figure 1: ARCI Team visited Pilot & GWh Plants at Bengaluru



Figure 2: Aerial View of Pilot and R&D facilities



Figure 3: Electrode Blanking



Figure 4: Electrode Blanking



Figure 5: Pouching M/C



Figure 6: Side/Corner sealing M/C

Technology Transfers Undertaken / Collaborations Forged

Based on the perceived market size of products/ services based on ARCI technologies, ARCI has adopted exclusive and non-exclusive modes of technology transfer to facilitate healthy competition in the market. So far, ARCI has successfully transferred 33 technologies to 48 receivers (Know-How Document has been handed over) and few technologies are under transfer. The following table depicts the technologies transferred:

S.No	Technology	Applications Targeted	Status
1	Novel powder metallurgy (PM) process for fabricating dispersion strengthened Tungsten plates technology	Jet vanes	Transfer complete
2	Exclusive rights in territories other than india for the transfer of know-how for making Lithium iron phosphate cathode material for Li-ion batteries	Li-ion batteries for electric vehicles	Transfer complete
3	Know-how for a) synthesis of sol and b) scratch and abrasion resistant coatings of solon acrylic and PVC laminates	Acrylic and PVC laminates	Transfer complete
4	Anti-reflective sol from organic solvent based composition for solar PV glass	Solar PV glass	Transfer complete
5	Electrocatalysts for use in fuel cells	Fuel cells	Transfer complete
6-7	Lithium Iron Phosphate (LFP) Cathode materials technology for li-ion batteries	Li-ion batteries for electric vehicles	Transfer complete to two companies on non-exclusive basis within india
8	UVC based disinfection cabinet (UVC Safe box and UVC safe blade handheld) to fight against COVID-19	Offices, hospitals etc.	Transfer complete
9	UVC based disinfection trolley to fight against COVID-19 by rapid cleaning of hospital environment.	Hospitals, medical care centres etc.	Transfer complete
10	UVC based tunnel baggage disinfection system for disinfection of baggage to fight COVID-19	Commercial Complexes, Hospitals etc.	Transfer Complete
11	High temperature complaint glass sealants	Missile applications	Transfer complete
12-14	Super hydrophobic easy to clean coatings	Solar PV panels	Transfer complete to 3 companies
15	Ceramic inserts for anti-mine boots	Strategic application	Transfer complete
16	MWIR ZnS domes	IR seeker application	Transfer complete
17	LWIR ZnS domes	IR seeker application	Transfer complete
18	Laser Cladding technology for burner tip nozzles	Thermal power plants applications	Transfer complete

19	Ceramic honeycomb based energy efficient air heaters and eco-friendly sanitary napkin incinerators	Incinerator Applications	Transferred on exclusive basis.
20	Aerogel Flexible Sheet technology	Thermal insulation applications	Transferred on exclusive basis
21	Decorative coatings on glass	Aesthetic applications	Transferred on non-exclusive basis
22	Nano Titanium Dioxide based textile finishes for self cleaning applications	Self-cleaning applications	Transferred on exclusive basis
23	Nanosilver based textile finishes for antibacterial applications	Anti-bacterial applications	Transferred on exclusive basis
24	Nanosilver impregnated ceramic water filter candles to impart antibacterial function	Water purification	Transferred on non-exclusive basis
25	ESC equipment manufacturing	Diverse segments	Transferred on non-exclusive basis
26-28	Micro Arc Oxidation (MAO)	Hard (1800 vhn) wear resistant coatings on Aluminum and Titanium alloys	Transferred to 3 companies on region exclusive basis
29	Calcium Aluminate cements and furnace sealants	Refractory castables	Transferred on an exclusive basis
30	Ceramic honeycomb molten metal filters	Molten metal filtration	Transferred on an exclusive basis
31	Evaporation boats	Metallization	Transferred on an exclusive basis
32	Heat pipes heat sinks	Waste heat recovery systems, solar energy applications, and power electronics	Transferred on an exclusive basis
33	Reinforced graphite sheets and seals	Automotive sector	Transferred on an exclusive basis
34-37	Detonation Spray Coating (DSC)	Wear and corrosion-resistant coatings on various components	Transferred to 4 companies on a region-exclusive basis
38	Energy efficient air heaters from ceramic honeycombs	Industrial heating	Transferred on an exclusive basis
39	Ceramic crucibles	Carbon and Sulphur analysis	Transferred on an exclusive basis
40	Magnesia Aluminate Spinel (MAS)	Steel, cement, and power plants	Transferred on an exclusive basis
41-48	Electro Spark Coating (ESC) equipment	Hard, wear-resistant coatings	Transferred to 8 companies on a non-exclusive basis



TECHNOLOGIES AVAILABLE FOR TRANSFER / ADAPTATION

Technologies Available for Transfer

S. No.	Technology	Key Features	Applications
1.	<p>Nano-sized Lithium Iron Phosphate (Lfp) cathode material for high-power Li-ion battery application</p> <p>Level: Transferred to two companies on a non-exclusive basis for the Indian territory; transferred to one company exclusively for territories other than India; and ready for transfer on a non-exclusive basis in India.</p>	<ul style="list-style-type: none"> Simple and cost-effective process Developed the process with identified sources of lithium and iron precursors Nano-sized powder particles and uniform carbon coating of 2-5 nm Designing a suitable large capacity furnace and optimum heating cycles with less time LFP's electrochemical performance in terms of specific capacity, cyclic stability, and rate capability is at par with the performance of the commercially available LFP Very safe and reliable (no thermal runaway) Demonstrated the process at semi-pilot scale 	<ul style="list-style-type: none"> Electrode material for rechargeable batteries in electric vehicles Stationary storage applications
2.	<p>Broad-band Anti-Reflective (AR) coating development by using an organic solvent-based composition</p> <p>Level: Transferred to one company and ready for transfer to other interested companies</p>	<ul style="list-style-type: none"> 2 % Transmission enhancement on Photo Voltaic (PV) cover glass on a single side The coating was demonstrated through an Industrial Roller Coating process and validated to meet industrial standards. 	<ul style="list-style-type: none"> AR Coating on PV cover glasses. Concentrated Solar Power (CSP) cover glasses. Optical lenses, displays, etc.
3.	<p>Platinum (Pt) based electrocatalysts.</p> <p>Level: Ready for transfer</p>	<ul style="list-style-type: none"> High durability On par with efficiency with commercially available electrocatalysts Facile synthetic route High corrosion resistance 	<ul style="list-style-type: none"> Fuel cells Hydrogenation reactions
4.	<p>Exfoliated graphite and its value-added products</p> <p>Level: Ready for transfer</p>	<ul style="list-style-type: none"> Binder-free compaction of material Shape-tailored material Lightweight Density-controlled compaction Sandwich or reinforced material with better mechanical properties Efficient and cost-effective 	<ul style="list-style-type: none"> Flexible sheets Flexible tapes Bipolar plates Seals Reinforced seals, sheets, and tapes Ultra-lightweight boards.
5.	<p>Bio-friendly self-disinfecting coating on fabric against COVID-19, H1N1, and bacteria.</p> <p>Level: Ready for transfer</p>	<ul style="list-style-type: none"> Efficacy > 99.9% against gram-positive and negative bacteria. Efficacy \geq 99.2% and \geq 99.997% against SARS-CoV-2 (CCMB) and H1N1 (BUREAU VERITAS), respectively (ISO 18184). The four layered mask exhibited bacterial filtration efficiency \geq 99.7% (ASTM F2101), particulate filtration efficiency at 0.3 Microns: \geq 99.3 (ASTM F 2299/F2299M-03: 2017) Breathability: 61.2 Pa/cm² (EN 14683: 2019). Splash resistance and water repellent, and classified as Class 1 in the flammability test Technology developed in collaboration with Centre for Cellular and Molecular Biology (CCMB) and Resil Chemicals Pvt. Ltd. 	<ul style="list-style-type: none"> Self-disinfection masks Medical suits Medical textiles Sports textiles

S. No.	Technology	Key Features	Applications
6.	Nano-Sized Lithium Titanium Oxide (LTO) Anode material for high-power Li-ion battery application Level: Ready for transfer	<ul style="list-style-type: none"> A process for the large-scale production (15 kg/batch) of lto was developed. LTO delivers a superior rate capability of 145 mah/g at 4c with good cyclic stability Patents in India, the USA, and China for this invention were granted 	<ul style="list-style-type: none"> Electrode material for rechargeable batteries in electric vehicles Stationary storage applications
7.	Petcoke-based high-energy supercapacitor for EV application Level: Ready for transfer	<ul style="list-style-type: none"> Process for the production of Supercapacitor-grade Porous Carbon. Indigenous supercapacitor devices of 1200 F, 2.7V, and 1.2Wh were produced. Supercapacitor module of 75F, 43V, 19.2 Wh demonstrated Technology developed in collaboration with Hindustan Petroleum Corporation Limited (HPCL), Bengaluru 	<ul style="list-style-type: none"> Automotive (E-bicycle, public transportation) Stationary energy storage applications Smart grid applications
8.	Advanced Detonation Spray Coating technology Level: Prototype testing/ Free trials ongoing	<ul style="list-style-type: none"> High productivity due to high pulse frequency Less maintenance: absence of mechanically moving parts Good adhesion strength (>10000 psi) Dense microstructure (< 1%) Negligible thermal degradation and excellent tribological properties Ability to coat a wide range of powders, Carbide, Oxide, and metal powders Lower substrate temperature & low Oxide content Coatings with 50-2000 microns thickness can be produced 	<ul style="list-style-type: none"> Steel industry applications, such as Bridle rolls Textile & Paper industry applications such as wire passing pulleys, plungers, steeped cone pulleys, bearing stopper plates, and guide rolls Gas compressor applications such as spindle valve, compressor disc, compressor shaft HP & LP turbine blades, compressor discs, LCA nozzles, thrust bearing sleeves, propeller shaft seals. Power and Energy applications include guide vanes, spindle valves, and hydro turbine blades.
9.	High power LFP-LTO cells (Super battery) Level: Prototype testing/ free trials ongoing	<ul style="list-style-type: none"> Tab-less technology Fast charging capability (17C) High-rate capability Long cycle life No thermal runaway 	<ul style="list-style-type: none"> Power tools Drones Cranking Two wheelers
10.	Lithium Ion Battery (LIB) cell (LFP/graphite) fabrication technology Level: Prototype testing/ free trials ongoing	<ul style="list-style-type: none"> Cylindrical/Prismatic cells with 3.2V, 2-25 Ah fabricated Cyclic stability >1200 cycles with >85% capacity retention at 1C Energy density 100-110 Wh/Kg 	<ul style="list-style-type: none"> Electric mobility and energy storage systems

S. No.	Technology	Key Features	Applications
11.	Broadband anti-reflective coating development by using cost-effective and environmentally friendly aqueous solvent composition Level: Prototype testing / free trials ongoing	<ul style="list-style-type: none"> 2 % Transmission enhancement on PV cover glass on a single side Coating demonstrated through an industrial roller coating process and validated to meet the industrial standards 	<ul style="list-style-type: none"> AR Coating on PV and CSP cover glasses, optical lenses, displays, etc.
12.	Carbon Nano particles-based lubricants Level: Prototype Testing / Free Trials Ongoing	<ul style="list-style-type: none"> > 50% reduction in Coefficient of Friction (CoF) by incorporating Carbon Nanoparticles into base lubricant oil. Observed no significant change in the density and viscosity of the base lubricant oil after incorporation of Nanoparticles 	<ul style="list-style-type: none"> Nano lubricants for bearings, automobiles, heavy vehicles, machinery, etc.
13.	Polymer Electrolyte membrane-based electrochemical Methanol reformer for Hydrogen generation Level: Prototype testing / free trials ongoing	<ul style="list-style-type: none"> Grid-independent fuel cell systems in the range of 1-20kW power PEM fuel cells continuously operated for 500 hrs and intermittently for several thousand hours with stable performance Suitable control systems for load following cycle, cell monitoring characteristics, power conditioners, and thermal management 	<ul style="list-style-type: none"> Power generation, electric vehicle applications As a decentralized power pack for homes, industries, etc. As combined heat and power units for homes As an uninterrupted power source, even when the power outage is for a long duration (>8hrs) As backup power for telecom industries.
14.	Indigenous Components for PEM fuel cell Level: Prototype testing/ free trials ongoing	<ul style="list-style-type: none"> Membrane Electrode Assembly (MEA): Employs a state-of-the-art membrane coating technique (nozzle-less ultrasonic spray coating) to precisely control the electrocatalyst's deposition on the membrane, minimizing material wastage. Flow Field Plates: Fabricated flow field plates domestically, characterized by reduced weight and high design flexibility. Humidifiers: Humidification system features two chambers for easy control, ensuring continuous humidification of the fuel cell system. Automatic water refilling capability minimizes fuel cell shutdown time. 	<ul style="list-style-type: none"> Fuel cells
15.	Polymer electrolyte membrane-based electrochemical methanol reformer for hydrogen generation Level: Prototype testing/ Free trials ongoing	<ul style="list-style-type: none"> Grey Hydrogen (99.99%) Modular stacks Demonstrated up to 5kg/day Renewable energy compatible Adaptable to Graphitic bipolar plates Power consumption is 1/3rd of conventional PEM-based electrolyzers 	<ul style="list-style-type: none"> Fuel Cell Steel industry Pharma industry Cement industry

S. No.	Technology	Key Features	Applications
16.	Pulse electro deposition Level: Prototype testing/ free trials ongoing	<ul style="list-style-type: none"> • Non-line of sight process, economical and eco-friendly • Porosity-free finished product, higher production rates • Control over microstructure, mechanical properties, particle content in composite coating • Higher current efficiency and deposition rates compared to the traditional hard chrome process 	<ul style="list-style-type: none"> • Corrosion resistance and decorative coatings: automobiles include car, truck trim, motorcycle, kitchen, and bathroom appliances • Wear resistance: hydraulic actuators, railway engine shafts, aircraft landing gears, shaft journals, farm machinery, earth movers, snow plows, road repair equipment, mining equipment, automobile engine valves • Industrial tools such as rolls for aluminum and steel manufacturing, stamping tools and dies, molds for plastic manufacturing, utilized chrome plating for increasing their (tool) life

Technologies Available for Adaptation

S. No.	Technology	Key Features	Applications
1.	Repair and refurbishment of critical components using Laser Cladding Level: Repeatability/ consistency check ongoing at the coupon level	<ul style="list-style-type: none"> • Negligible porosity • Controlled heat input • Minimal heat-affected region • Precise and controlled process • No distortion • Materials: Cast Iron, Ni-based superalloys, tool steel, Stellite, Ni-WC, Co-WC, NiCr-CrC, INCONEL + CrC, Alternative to Chrome-Plating 	<ul style="list-style-type: none"> • Aerospace • Automotive • Energy • General Engineering sectors
2.	High-performance varistors made from doped ZnO Nano powders Level: Repeatability/ consistency check ongoing at the coupon level	<ul style="list-style-type: none"> • Breakdown voltage 10-33 kV/cm • Low leakage current density $0.7\mu\text{A}/\text{cm}^2$ • Coefficient of non-linearity (70-160) • Superior to the commercially available varistors 	<ul style="list-style-type: none"> • Power distribution • Automobiles and Electronics

S. No.	Technology	Key Features	Applications
3.	<p>Large-scale low-cost production of two-dimensional Tungsten Disulfide and Molybdenum Disulfide powder</p> <p>Level: Repeatability/consistency check ongoing at the coupon level</p>	<ul style="list-style-type: none"> Production capability: 1 kg per day (scalable up to 2 kg per day) using the existing pilot-scale reactor. Particle size: Can be customized based on required use or properties. Typical size: thickness = 8 to 12 nm, lateral dimension = 800 to 1200 nm Thermal stability: Up to 3500 °C in air for free-standing 2D-WS₂ powder (Up to 4500 °C in composite form); Up to 2500 °C in air for free-standing 2D-MoS₂ powder. Purity: Grade 1: 99%+ purity; Grade 2: 98% purity (with up to 2% C) 	<ul style="list-style-type: none"> As a solid lubricant. As a Nano-Additive to automotive lube oil for enhanced performance. As a Nano-Additive to EP-grease for improved performance. As a casting and forging mould release lubricant additive. For Polymer-bonded lubricating coatings. As a candidate for a petrochemical and Hydrogen evolution reaction catalyst.
4.	<p>Sol-gel coating formulation for imparting anti-bacterial property by inhibiting the biofilm formation</p> <p>Level: Repeatability/consistency check at the coupon level completed</p>	<ul style="list-style-type: none"> Aqueous formulation Room temperature curable coating Anti-bacterial Hydrophobic Improved mechanical properties at 80° C curing temperature 	<ul style="list-style-type: none"> Surgical sutures Contact lens case, Hernia repair mesh Hearing aids and surgical appliances.
5.	<p>Scratch resistant, tarnish protection sealant coatings for metals</p> <p>Level: Repeatability/consistency check at the coupon level completed</p>	<ul style="list-style-type: none"> Easy-to-clean High pencil scratch hardness (8H) and abrasion resistance High temperature tarnish protection (200 °C) Low temperature curable compositions used as a replacement for chrome-free primers to protect against corrosion (130 °C x 0.5h) Protection against acid attack and ion leaching Possibility of coloured coating 	<ul style="list-style-type: none"> Household appliances Packaging industry, such as Copper bottles Automotive industry, such as exhaust parts and wheel rims of motorcycles, cars, etc. Architectural and interior decoration Sealant coatings for anodizing and thermal spray coatings in industry
6.	<p>Antibacterial powders for the prevention of infections and improved sanitation</p> <p>Level: Repeatability/consistency check at the coupon level completed</p>	<ul style="list-style-type: none"> Easy-to-apply Compatible with sols, resin, lacquer, and paints Offers excellent protection against corrosion >98% log reduction against Escherichia coli, Staphylococcus Aureus, and Klebsiella Pneumoniae. 	<ul style="list-style-type: none"> Walls, railings, elevators, etc. Operating theatres Schools Scrub pads for domestic and industrial applications. Paints and lacquer
7.	<p>Oxide Dispersion Strengthened (ODS) iron aluminide powders for thermal spray coatings</p> <p>Level: Repeatability consistency check at the coupon level completed</p>	<ul style="list-style-type: none"> Wear resistance is higher than NiCr-Cr₃C₂ coatings Erosion resistance is comparable to NiCr-Cr₃C₂ coatings up to 75° C 	<ul style="list-style-type: none"> Wear and corrosion resistance coatings for power plants, Aerospace, and other industrial applications
8.	<p>Fe-P soft magnetic materials</p> <p>Level: Repeatability/consistency check ongoing at the coupon level</p>	<ul style="list-style-type: none"> Bs (saturation induction) ~ 1.9 T μmax (Permeability) ~ 1.5x10⁴ Coercivity < 1 Oe Core loss ~ 170 - 200 W/Kg 	<ul style="list-style-type: none"> Motors, Alternators, Relays, and other Electromagnetic devices

S. No.	Technology	Key Features	Applications
9.	Quantum-sized TiO ₂ particles-based super-Hydrophilic and self-cleaning anti-soiling coating for Photovoltaic application. Level: Repeatability/consistency check ongoing at the coupon level	<ul style="list-style-type: none"> High omni transparency with no transmittance/power loss after coating Excellent photo-induced superhydrophilicity and self-cleaning property 2.5% lower soiling loss compared to that of an uncoated PV module High weather and mechanical stabilities 	<ul style="list-style-type: none"> Anti-soiling coating for PV modules & architectural glasses
10.	Novel ambient temperature curable spinel nanoparticles absorber based Flat Plate Collector Level: Repeatability/consistency check ongoing at the coupon level	<ul style="list-style-type: none"> Optical properties with a high solar absorptance of 95% and wide angular solar absorptance of 98-99% and over incidence angles of 10°-50° High photo thermal conversion efficiency (>70%), and high durability, competitive with commercial coatings 	<ul style="list-style-type: none"> Non-concentrated solar thermal conversion systems (e.g., solar water heater, solar dryer, etc.)
11.	Cold gas dynamic spray coating technology Level: Repeatability/consistency check ongoing at the coupon level	<ul style="list-style-type: none"> Indigenously developed state-of-the-art PLC-based automated portable control panel (Max Pressure -20 bar) Different set of nozzles For low melting materials (Polymer-based) <ul style="list-style-type: none"> High deposition rate or coverage area Low deposition rate or coverage area For Ni-based materials, steel (Optional) Compressed AIR as process and carrier gas Max Pressure-20 bar; Maximum Temperature-600°C Cu, Al, Ag, Zn, Sn, Ni, SS, Ta, Nb, Ti, and alloys and composites 	<ul style="list-style-type: none"> Repair and refurbishment applications Coatings for electrical contacts, lugs, EMI shielding, heat sinks Coatings for high temperature corrosion resistance, biomedical, and sputter target applications Cathodic protection coatings Anodic protection coatings Wear-resistant coatings Nanostructured/amorphous coatings High entropy alloy coatings for high temperature applications
12.	Large-scale synthesis of Hydroxyapatite (HAP) nanopowders for biomedical applications Level: Repeatability/consistency check ongoing at the coupon level	<ul style="list-style-type: none"> Ca₁₀(PO₄)₆(OH)₂ Particle size having less than 23 nm with narrow size distribution Phase purity greater than 99% Process parameters for the production of phase pure HAP and a mixture of HAP and Ca₃(PO₄)₂ nanopowders of different sizes at 1 Kg level have been optimized 	<ul style="list-style-type: none"> Bone tissue engineering; Bone void fillers for Orthopedic, Traumatology, spine, Maxillofacial & Dental surgery Orthopedic and Dental implant coating; Restoration of Periodontal defects Desensitizing agent in post-teeth bleaching; Remineralizing agent in toothpastes
13.	Cost-effective and highly durable electrodes for Alkaline Electrolyzer Level: Repeatability/consistency check ongoing at the coupon level	<ul style="list-style-type: none"> Long-term durability & stability Cost-effective fabrication Enhanced Electrochemical performance Nanoporous surface structure (Provides excellent uniformity and strong interlayer adhesion for durability). 	<ul style="list-style-type: none"> Green Hydrogen production Decentralized & on-site Hydrogen generation Energy storage systems
14.	Carbon Quantum Dots (CQDs) for the improved performance of lubrication and Photoluminescence properties Level: Repeatability/consistency check ongoing at the coupon level	<ul style="list-style-type: none"> Synthesized by a cost-effective Hydrothermal process Photovoltaic (PV) performance enhancement Can be mixed with machinery lubricant oils and automobile lubricants. 	<ul style="list-style-type: none"> Automobile applications Heavy machinery Solar PV Lubricants



ADVANCED MATERIALS TECHNOLOGY INCUBATOR (AMTI) AT ARCI



Advanced Materials Technology Incubator (AMTI) at ARCI

Forging India's Deep-Tech/ Start-up Future

Under a bold national push for innovation-led industrial transformation, India's critical initiatives - such as the Critical Minerals Mission, Anusandhan National Research Foundation (ANRF), MAHA-EV Mission, National Programs in Energy, materials, and others, and selective export tariffs on critical materials - are paving the way for self-reliant manufacturing and technology resilience. These national programs strengthen India's capacity to innovate, scale indigenous technologies, and ensure long-term economic sustainability.

ARCI's Advanced Materials Technology Incubator (AMTI) aligns seamlessly with these national missions by offering deep-tech companies/ start-ups a platform to redefine material science markets, contribute to economic growth, and elevate India's global position in advanced materials and manufacturing.

Unlocking Innovation at AMTI

AMTI is a dedicated incubation ecosystem at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) to support innovation-led entrepreneurs/startups/ MSMEs in materials science and manufacturing. Located within the ARCI's campus, AMTI provides with the essential infrastructure, expertise, and collaboration needed to build, test, and scale their entrepreneurs/startups/ MSMEs innovations.

Key offerings include:

- Infrastructure Support - AMTI provides ready-to-use industrial space with essential utilities and access to ARCI's advanced material characterization and testing facilities. Aligned with ARCI's expertise in Coatings, Additive Manufacturing, Energy Materials (Batteries, Solar, Fuel Cell), Nano Materials, and more.
- Expertise, Mentorship & Technical Collaboration - AMTI facilitates close collaboration with ARCI's scientists, enabling joint R&D, expert mentoring, and seamless knowledge transfer to accelerate innovation.
- Regulatory & Operational Enablement - AMTI ensures that startups are operationally ready with essential utilities - electricity, water, safety systems, and maintains both infrastructure and the surrounding ecology. Startups receive guided support in securing statutory clearances (e.g., PCB, safety norms), enabling compliance from day one.

The incubator is a conduit for transforming lab-scale innovations into scalable, market-ready technologies, particularly in priority sectors like energy storage, e-mobility, materials, coatings, and sustainable manufacturing.

AMTI not only empowers startups to build breakthrough products but also anchors them within India's national mission framework - fuelling economic growth, technological self-reliance, and global leadership in advanced materials and manufacturing.

Progress of M/s. ALTMIN Private Limited at AMTI

ARCI transferred the carbon-coated lithium iron phosphate (C-LFP) cathode materials technology to M/s. ALTMIN Pvt. Ltd., Hyderabad, has granting them global exclusive rights (excluding India) for the commercial production of carbon-coated lithium iron phosphate (C-LFP) cathode material, following successful third-party validation. As a significant milestone, ALTMIN established India's first pilot-scale C-LFP manufacturing facility, with a capacity of 100 kg/day, at ARCI's Advanced Materials Technology Incubator (AMTI), Hyderabad. This facility is now operational and producing large quantities of C-LFP cathode material powder (Figure). ALTMIN supplies LFP material to multiple stakeholders, including Amara Raja, Exide, OLA, and Nah Energy, for validation and subsequent qualification in Li-ion cell manufacturing.

Further strengthening its commercial strategy, ALTMIN also secured non-exclusive domestic licensing rights from ARCI on 3rd May 2024 for the production of C-LFP material for Li-ion battery applications. ALTMIN is now moving towards setting up a full-scale commercial LFP production plant. The company is planning to set up a Giga Factory shortly, which will have an initial capacity of 8 GWh and a long-term target of 100,000 MTPA (metric tons per annum) by 2030. This collaboration between ARCI and ALTMIN represents a major milestone in India's mission to develop a robust, self-reliant battery materials ecosystem.



Figure: Large scale production of LFP cathode powder material by M/s. ALTMIN @ ARCI-AMTI

During the year, a few companies have expressed interest in collaborating with ARCI regarding battery materials (lithium-ion) and in leveraging AMTI's facilities along with ARCI's expertise to fabricate commercial-scale cylindrical and pouch cells using their independently developed concepts and proprietary materials-further strengthening AMTI's role as a hub for India's emerging battery and energy storage ecosystem.



PATENT PORTFOLIO



ARCI Patent Portfolio

National Patents Granted

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
1.	Durable corrosion resistant coating for fuel cell separator and the process thereof	558766	27/01/2025	202111051526	10/11/2021
2.	Method for reducing friction on metallic substrates by preparing micro dimpled textures by ultrafast laser	547040	02/08/2024	202111051880	12/11/2021
3.	Method of producing nanoporous graphene sheet-like structured high and low surface area carbon sheets from petroleum coke	545250	18/07/2024	202011007399	20/02/2020
4.	Method of manufacturing the catalyst coated membrane for the proton exchange membrane fuel cells	532830	12/04/2024	202011046496	25/10/2020
5.	Post-calcination modification of morphology and improvement of coercivity in high energy-milled strontium hexaferrite powders	530705	28/03/2024	202111003235	23/01/2021
6.	Refurbishment of aircraft components using laser cladding	528806	18/03/2024	201911007994	28/02/2019
7.	An improved solar selective absorber coating with excellent optical absorptance, low thermal emissivity and excellent corrosion resistance property and a process of producing the same	527219	15/03/2024	1129/DEL/2013	16/04/2013
8.	A laser-based surface processing apparatus and a method to process metallic materials and components	523424	11/03/2024	201611034362	07/10/2016
9.	Microwave assisted sol-gel process for preparing in-situ carbon coated electrode materials and the product thereof	520936	06/03/2024	201911008004	28/02/2019
10.	A device and method for converting sunlight into heat energy using semiconducting materials immersed in a stable organic solvent for electricity generation	517962	29/02/2024	202041039082	10/09/2020
11.	Process for preparing durable solar control coatings on glass substrates	506428	02/02/2024	201811024034	27/06/2018
12.	Laser based clad coatings for protecting the power plant components for life enhancement	486341	20/12/2023	201811039663	19/10/2018
13.	A method of producing strontium hexaferrite powders having high coercivity suitable for bonded magnets	480912	12/12/2023	202111008252	26/02/2021
14.	Method of preparation of highly efficient skutterudite thermoelectric materials for thermoelectric modules and the product thereof	480419	11/12/2023	202111036278	11/08/2021
15.	A method for producing inorganic bonded silica based eco-friendly artificial marble articles and the product thereof	478839	07/12/2023	201611036479	25/10/2016

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
16.	Oxide dispersion strengthened iron aluminides with high strength and ductility and method of preparation of the same	478056	07/12/2023	202011044124	09/10/2020
17.	Method of producing single layer omnidirectional broadband antireflective and super hydrophilic coatings for solar and other applications	473000	24/11/2023	202011051833	27/11/2020
18.	Method of preparing gas diffusion layer for the electrode of ECRM cell for hydrogen generation method of preparing gas diffusion layer for the electrode of ECRM cell for hydrogen generation	469592	16/11/2023	201911030852	31/07/2019
19.	Method of fabricating tungsten based composite sheets by spark plasma sintering technique for making components	469058	14/11/2023	201911014933	13/04/2019
20.	A novel equipment to accomplish power metallurgy processing starting from the 'raw materials' to finished product	460596	19/10/2023	201711011552	30/03/2017
21.	An ecofriendly incinerator to dispose of the used sanitary napkins and bio medical waste	459775	17/10/2023	201821021430	07/06/2018
22.	Antibacterial scrub pads and process of preparing the same	456240	03/10/2023	202111041925	16/09/2021
23.	Process for the fast formation of solid electrolyte interphase layer on the anode surface in lithium-ion battery	452811	20/09/2023	202011052906	04/12/2020
24.	Method of producing porous particles-fibers carbon composite material for supercapacitor applications and the product thereof	444960	14/08/2023	202011027265	26/06/2020
25.	An improved process for the preparation of stable nano silver suspension having antimicrobial activity	443383	07/08/2023	201611027145	09/08/2016
26.	Method for preparing multifunctional isotropic and uni-directional super hydrophobic surfaces on substrates using femtosecond laser	441368	28/07/2023	202011022242	27/05/2020
27.	Biofilm inhibiting sol-gel composition for coating on substrates and process of preparing the same	440726	27/07/2023	202111001104	11/01/2021
28.	A grid independent fuel cell system with a unitized (DC & AC) power conditioner	440238	24/07/2023	201911006700	20/02/2019
29.	Transition metal-based solar selective absorber coated substrate and method of manufacturing the same	439790	20/07/2023	201911019139	14/05/2019
30.	High temperature polymer electrolyte membrane fuel cells with exfoliated graphite based bipolar plates	431480	10/05/2023	494/DEL/2014	20/02/2014
31.	An improved gas and coolant flow field plate for use in polymer electrolyte membrane fuel cells.	423285	27/02/2023	1449/DEL/2010	22/06/2010
32.	Solar selective coating for solar energy collector / absorber tubes with improved performance and a method of producing the same	421064	09/02/2023	2142/DEL/2015	15/07/ 2015

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
33.	Method of preparation of carbon supported platinum electrode catalyst for PEM fuel cells and product thereof	418482	18/01/2023	202011035825	20/08/2020
34.	A process for in-situ carbon coating on alkali transition metal oxides	416052	29/12/2023	201611007451	03/03/2016
35.	Method of producing in-situ carbon coated lithium iron phosphate cathode material for lithium ion batteries	412586	28/11/2022	202011056608	28/12/2020
36.	An improved aqueous method for producing transparent aluminium oxy nitride (ALON) articles	412454	25/11/2022	1409/DEL/2012	08/05/2012
37.	Antimicrobial aqueous based sol-gel composition for coating on substrate and process of preparing the same	411262	11/11/2022	201911045386	07/11/2019
38.	Process of electroless nickel/nickel phosphide (EN) deposition on graphite substrates	408686	10/10/2022	201811041418	01/11/2018
39.	Method of producing carbon nanostructure materials for heat transfer, lubrication and energy storage applications	404762	28/08/2022	202011017775	25/04/2020
40.	Method of producing porous MgF ₂ nanoparticles, antireflection coating suspension and coatings for solar optical UV and IR transparent window applications	394551	08/04/2022	4041/DEL/2014	31/12/2014
41.	Method of producing graphene like structured nanoporous carbon material from jute stick based bio-waste for energy storage applications and the product thereof	394477	07/04/2022	201711006697	24/02/2017
42.	Process for producing the nano boron by cryo-milling	391804	11/03/2022	201911025690	27/06/2019
43.	A system for treating the surface of bearing components and a process thereof	388398	03/02/2022	201711046511	23/12/2017
44.	A super hydrophobic coating with high optical properties having easy to clean property, UV and corrosion resistance properties, a process of preparation and application of the same	382971	29/11/2021	402/DEL/2014	13/02/2014
45.	A process and a multi-piston hot press for producing powder metallurgy component, such as cerametallic friction composite	379250	13/10/2021	3844/DEL/2011	28/12/ 2011
46.	An improved method for making sintered polycrystalline transparent sub-micron alumina article	378836	07/10/2021	1358/DEL/2011	10/05/2011
47.	An improved process of carbon - metal oxide composites prepared by nano casting of wood and the product thereof	376509	06/09/21	201611034531	07/10/2016
48.	Multi-track laser surface hardening of low carbon cold rolled closely annealed (CRCA) grades of steels	375427	26/08/2021	1411/KOL/2013	13/12/2013
49.	An improved coating composition to provide prolonged corrosion protection to anodizable metal surfaces and process of preparing the same	370802	30/06/2021	3082/DEL/2015	28/09/ 2015

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
50.	A device for and a method of cooling fuel cells	370365	25/06/2021	1408/DEL/2012	08/05/2012
51.	Exfoliated graphite separator-based electrolyzer for hydrogen generation	369206	14/06/2021	3073 DEL/2013	17/10/2013
52.	An improved test control system useful for fuel cell stack monitoring and controlling	366702	14/05/2021	269/DEL/2013	31/01/2013
53.	An improved process for preparing durable multifunctional coatings on metal/alloy substrates	366262	06/05/2021	201711020529	12/06/2017
54.	A method of preparing anti-tarnishing organic-inorganic hybrid sol-gel and coating the same	366131	05/05/2021	2049/DEL/2015	07/07/2015
55.	A method of producing high performance lithium titanate anode material for lithium ion battery applications	365560	28/04/2021	201711006147	21/02/2017
56.	Ambient condition curable transparent super hydrophobic coating for easy to clean applications and method of producing the same	361991	18/03/2021	201911009429	11/03/2019
57.	Method of deposition of double perovskite of Sr-Fe Niobium oxide film on a substrate by spray coating technique and the coated substrate thereof	356708	27/01/2021	1151/DEL/2014	29/04/2014
58.	Electronically and ionically conducting multi-layer fuel cell electrode and a method for making the same	351830	20/11/2020	2198/DEL/2012	17/07/2012
59.	A method of preparation of supported platinum nano particle catalyst in tubular flow reactor via polycol process	350276	28/10/2020	1571/DEL/2013	24/05/2013
60.	A process to improve strength and fatigue life of HR grade low carbon steel sheet by laser surface hardening adaptable to produce automotive component	349560	19/10/2020	600/KOL/2012	25/05/2012
61.	Method of producing hollow MgF ₂ nanoparticles, anti-reflection coating sols and coatings for optical and solar applications	348807	07/10/2020	201611041804	07/12/2016
62.	An improved performance of nanocomposite oxide selective absorber coating with excellent optical and thermal resistant properties and method of manufacturing the same	345443	28/08/2020	1111 DEL/2015	22/04/ 2015
63.	A novel laser surface modification technique for hardening steel	343960	12/08/2020	337/DEL/2013	06/02/2013
64.	An improved process for obtaining a transparent, protective coating on bi-aspheric / plano-convex lenses made of optical grade plastics for use in indirect ophthalmoscopy	343375	05/08/2020	3072/DEL/2013	17/10/2013
65.	An improved composition for antireflective coating with improved mechanical properties and a process of coating the same	342046	20/07/2020	2330/DEL/2013	05/08/2013

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
66.	Method of producing nano structured C-TiO ₂ composite material for visible light active photocatalytic self-cleaning applications	340592	06/07/2020	201811011478	28/03/2018
67.	An improved composition for solar selective coatings on metallic surfaces and a process for its preparation and a process for coating using the composition	340426	03/07/2020	3324/DEL/2011	22/11/ 2011
68.	An improved composition for coating anodizable metal surfaces and a process of coating the same	339945	30/06/2020	1310/DEL/2013	03/05/2013
69.	Enhanced thermal management systems for fuel cell applications using nanofluid coolant	339836	30/06/2020	1745/DEL/2012	07/06/2012
70.	Process for producing anti-reflective coatings with anti-fogging (super hydrophilic), UV, weather and scratch resistance properties	339326	25/06/2020	2919/DEL/2013	03/10/2013
71.	Methods of preparation of high performance ZnO varistors and improved compositions	339072	22/06/2020	2765/DEL/2015	03/09/2015
72.	A polymer electrolyte membrane (PEM) cell and a method of producing hydrogen from aqueous organic solutions	338862	19/06/2020	3313/DEL/2012	29/10/2012
73.	An improved process to make coating compositions for transparent, UV blocking coatings on glass and a process of coating the same	338641	17/06/2020	1152/DEL/2014	29/04/2014
74.	A novel electrochemical method for manufacturing CIGS thin film containing nanomesh like structure	337455	28/05/2020	426/DEL/2015	16/02/2015
75.	A method and an apparatus for preparing nickel tungsten based nanocomposite coating deposition	337108	20/05/2020	201611001190	13/01/2016
76.	Method of producing multifunctional self-assembled mixed phase titania spheres	335724	22/04/2020	3777/DEL/2014	19/12/2014
77.	Production of graphene-based materials by thermal spray	335723	22/04/2020	2626/DEL/2015	25/08/ 2015
78.	An improved gas flow field plate for use in polymer electrolyte membrane fuel cells (PEMFC)	332242	18/02/2020	2339/DEL/2008	13/10/2008
79.	An improved process for preparation of nanosilver coated ceramic candle filter	327532	17/12/2019	1249/DEL/2011	28/04/2011
80.	Catalytically and chemically modified carbon nanostructures for storage of hydrogen	323653	24/10/2019	405/CHE/2013	30/01/2013
81.	A high thermal stable selective solar absorber layer with low emissive barrier coating over a substrate and a process of producing the same	323497	23/10/2019	3312/DEL/2012	29/10/2012
82.	An improved hybrid methodology for producing composite multilayered and graded coatings by plasma spraying utilizing powder and solution precursor feedstock	323443	22/10/2019	2965 DEL/2011	17/10/2011

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
83.	Fuel cell system equipped with oxygen enrichment system using magnet	321825	27/09/2019	2985/DEL/2012	25/09/2012
84.	Improved magnetron cathode and a process for depositing thin films on surfaces using the said cathode	320582	16/09/2019	21/DEL/2008	03/01/2008
85.	A method for synthesis of tungsten disulphide nanosheets	320209	11/09/2019	1703/DEL/2012	04/08/2012
86.	Process for producing anti-reflective coatings with scratch resistance property	314900	27/06/2019	1777/DEL/2012	11/06/2012
87.	A process for preparing nanocrystalline olivine structure transition metal phosphate material	310620	31/03/2019	405/DEL/2012	14/02/2012
88.	Novel copper foils having high hardness and conductivity and a pulse reverse electrodeposition method for their preparation	306501	29/01/2019	1028/DEL/2009	19/05/2009
89.	An improved process for producing silica aerogel thermal insulation product with increased efficiency	305898	18/01/2019	2141/DEL/2015	15/07/2015
90.	An improved coating composition to provide flame retardant property to fabrics and process of preparing the same	305214	01/01/2019	201611040091	23/11/2016
91.	An improved method of preparing porous silicon compacts	304349	12/12/2018	912/DEL/2011	31/03/2011
92.	An improved solar selective multilayer coating and a method of depositing the same	303791	30/11/2018	1567/DEL/2012	22/05/2012
93.	An improved process for preparing nano tungsten carbide powder useful for fuel cells	303338	22/11/2018	81/DEL/2007	12/01/2007
94.	Improved fuel cell having enhanced performance	301158	19/09/2018	606/DEL/2007	20/03/2007
95.	An improved abrasion resistant and hydrophobic composition for coating plastic surfaces and a process for its preparation	297072	24/05/2018	1278/DEL/2011	02/05/2011
96.	Improved scratch and abrasion resistant compositions for coating plastic surfaces, a process for their preparation and a process for coating using the compositions	295221	28/03/2018	2427/DEL/2010	12/10/2010
97.	An improved method for producing ZnO nanorods	293775	05/03/2018	2759/DEL/2010	19/11/2010
98.	A hydrophilic membrane based humidifier useful for fuel cells	291871	18/01/2018	95/DEL/2007	16/01/2007
99.	Improved process for the preparation of bi-functional silica particles useful for antibacterial and self-cleaning surfaces	291408	04/01/2018	3071/DEL/2010	22/12/2010
100.	Improved catalyst ink for catalyst coated membrane of electrode membrane assembly and the process thereof	290765	18/12/2017	631/DEL/2008	13/03/2008
101.	An improved composition for coating metallic surfaces, and a process for coating such surfaces using the composition	290592	14/12/2017	620/DEL/2010	17/03/2010
102.	Improved method for producing carbon containing silica aerogel granules	290370	07/12/2017	2406/DEL/2010	08/10/2010

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
103.	Improved process for the preparation of stable suspension of nano silver particles having antibacterial activity	289543	14/11/2017	1835/DEL/2010	04/08/2010
104.	An improved method for the generation of hydrogen from a metal borohydride and a device thereof	285257	17/07/2017	1106/DEL/2007	23/05/2007
105.	An improved method for preparing nickel electrodeposited having predetermined hardness gradient	285178	14/07/2017	1455/DEL/2009	15/07/2009
106.	A process for the preparation of Nano silver and Nano silver-coated ceramic powders	284812	30/06/2017	2786/DEL/2005	19/10/2005
107.	Improved method of producing highly stable aqueous nano titania suspension	282988	28/04/2017	730/DEL/2009	09/04/2009
108.	An improved process for the preparation of exfoliated graphite separator plates useful in fuel cells, the plates prepared by the process and a fuel cell incorporating the said plates	281504	20/03/2017	1206/DEL/2006	DEL/2006
109	An improved catalyst ink useful for preparing gas diffusion electrode and an improved PEM fuel cell	277778	30/11/2016	680/DEL/2008	18/03/2008
110.	A device for controlling the on & off time of the metal oxide semiconductor field effect transistor (MOSFET), a device for spark coating the surfaces of metal workpiece incorporating the said control device and a method of coating metal surfaces using the said device	262189	05/08/2014	1610/DEL/2005	21/06/2005
111.	An improved process for the preparation of doped zinc oxide Nano powder useful for the preparation of varistors	254913	03/01/2013	1669/DEL/2006	20/07/2006
112.	A method of and an apparatus for continuous humidification of hydrogen delivered to fuel cells	247547	19/04/2011	670/CHE/2007	30/03/2007
113.	An improved method of forming holes on a substrate using laser beams	239647	29/03/2010	3205/DEL/2005	29/11/2005
114.	Titanium based bio composite material useful for orthopedic and other implants and a process for its preparation	228353	03/02/2009	2490/DEL/2005	14/09/2005
115.	An improved boronizing composition	220370	27/05/2008	289/MAS/2001	03/04/2001
116.	A method and a device for applying protective carbon coating on metallic surfaces	211922	13/11/2007	719/MAS/1999	08/07/1999
117.	A process for forming coatings on metallic bodies and an apparatus for carrying out the process	209817	06/09/2007	945/MAS/2001	22/11/2001
118.	A process for preparing ceramic crucibles	207700	20/06/2007	806/MAS/2000	26/09/2000
119.	Process for carbothermic reduction of iron oxide in an immiscible flow with constant descent in vertical retort of silicon carbide	205728	09/04/2007	546/CHE/2003	01/07/2003
120.	An evaporation boat useful for metallization and a process for the preparation of such boats	201511	01/03/2007	882/CHE/2003	31/10/2003
121.	Device for gas dynamic deposition of powder materials	198651	25/01/2006	944/MAS/2001	22/11/2001

S.No	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
122.	An improved method for making honeycomb extrusion die and a process for producing ceramic honeycomb structure using the said die	198045	13/01/2006	538/MAS/2001	03/07/2001
123.	A process for the production of dense magnesium aluminate spinel grains	198208	16/02/2006	520/MAS/2000	06/07/2000
124.	A process for the preparation of improved alumina based abrasive material, an additive composition and a process for the preparation of the composition	198068	16/02/2006	122/MAS/2000	18/02/2000
125.	Ceramic honey comb based energy efficient air heater	200787	02/06/2006	30/MAS/1999	07/01/1999
126.	Improved process for the preparation of magnesium aluminate spinel grains	200272	02/05/2006	29/MAS/1999	07/01/1999
127.	New composite material having good shock attenuating properties and a process for the preparation of said material	194524	02/01/2006	976/MAS/1998	06/05/1998
128.	A process for preparation of reaction bonded silicon carbide components	195429	31/08/2006	1886/MAS/1996	28/10/1996
129.	A process of producing chemically treated expanded graphite and a device having such graphite	187654	05/12/2002	562/MAS/1994	07/06/1995
130.	A process for the preparation of short ceramic fibres	186751	07/06/2002	537/MAS/1994	20/05/1994
131.	An indirect heated catalytic converter for use with vehicles	185433	10/08/2001	809/MAS/1994	25/08/1994
132.	A solar cooker	184675	25/05/2001	498/MAS/1994	13/06/1994
133.	A solar drier	184674	23/09/2000	487/MAS/1994	08/06/1994

National Patent Applications Awaiting Grant

S.No	Title of Patent Application	Application Number	Date of Filing
1.	Silica based aerogel thermal insulation product	202541029826	28/03/2025
2.	Fe-Mn based alloy composition and a method of fabricating biodegradable implants using the same	202541029825	28/03/2025
3.	A method for surface reengineering for metal blank or part improving formability using laser processing	202541029824	28/03/2025
4.	An Anisotropic ferrite powder, a method of producing the same, and uses thereof	202541030191	28/03/2025
5.	Carbon Quantum Dots (CQDs) and method for synthesizing the same thereof for lubrication and photoluminescence	202541028047	25/03/2025
6.	An improved grain boundary diffusion method for the preparation of sintered Nd-Fe-B magnet	202441086050	08/11/2024

S.No	Title of Patent Application	Application Number	Date of Filing
7.	Process for synthesizing carbon coated sodium vanadium phosphate and product thereof	202441052014	08/07/2024
8.	A top-lid assembly for a battery cell and a method for producing the top-lid assembly	202441016527	07/03/2024
9.	Improved intercalation process via cryo treatment to produce high quality exfoliated graphite	202341067942	10/10/2023
10.	A zirconium oxide layer-based Mg-Zn-Zr alloys and its method of preparation thereof	202341055508	18/08/2023
11.	Metals-embedded resorcinol-formaldehyde xerogel based carbon cathode for high-performance batteries and a method of preparation thereof	202341042659	26/06/2023
12.	Method of producing ambient temperature curable and sprayable spinel nanoparticles based wide angular solar absorber coating for flat plate collector system	202341034683	17/05/2023
13.	A biomass-derived porous carbon as sulfur host for energy storage device and a method of preparing thereof	202341033390	11/05/2023
14.	Opto-electronic device and method of fabricating opto-electronic device	202341027664	14/04/2023
15.	Bi-layered dental implant and process for the preparation thereof	202341014475	03/03/2023
16.	Fabrication of tab-less and high power cylindrical LFP-LTO cell for fast charging lithium ion battery applications	202341004527	23/01/2023
17.	Method of producing spinel nanostructured materials and spinel-PCM nanocomposites for thermal energy storage applications	202241064003	09/11/2022
18.	Method of producing highly crystalline TiO ₂ nanoparticles suspension and its use in perovskite solar cell	202241054454	22/09/2022
19.	A superhydrophilic, omni transparent antisoiling coating for photovoltaics, and a method for synthesizing the same	202241052009	12/09/2022
20.	System and method for fast charging of lithium-ion batteries	202241044449	03/08/2022
21.	An automated spray coating deposition system	202241037966	01/07/2022
22.	A method for the fabrication of web-reinforced EPDM rubber-ZrO ₂ composite membrane for separating H ₂ and O ₂ gases formed in water electrolysis reaction	202241028888	19/05/2022
23.	A process for fabricating a polypropylene cloth web-reinforced EPDM rubber-CaCO ₃ composite membrane and an electrochemical cell	202241028889	19/05/2022
24.	Anti-clogging cold-spray nozzle to deposit clog-prone materials	202211017972	28/03/2022
25.	Autogenous laser welding system and method for joining thick metallic parts without filler wire feeder	202211005404	01/02/2022
26.	A method of preparing the thermoelectric module for power generation from automotive exhaust and the thermoelectric module thereof	201911045857	11/11/2019
27.	An improved gas dynamic cold spray device and method of coating a substrate	201711006749	26/02/2017
28.	Process and apparatus for protection of structural members from wear, corrosion and fatigue damage	1839/DEL/2015	22/06/ 2015
29.	Novel ceramic materials having improved mechanical properties and process for their preparation	3396/DEL/2005	19/12/2005

International Patents Granted & Applications Awaiting Grant

S.No	Title of Patent	Country	Patent Number / Application Number	Date of Grant	Date of filing with patent office	Indian Patent/ Family details
1.	Process for forming coatings on metallic bodies and an apparatus for carrying out the process	USA	US6893551B2	17/05/2005	02/08/2002	IN 209817
2.	A device for controlling the on & off time of the metal oxide semiconductor field effect transistor (MOSFET), a device for spark coating the surfaces of metal workpiece incorporating the said control device and a method of coating metal surfaces using the said device	USA	US8143550B2	27/03/2012	20/03/2006	IN 262189
3.	A process for the preparation of nano silver and nano silver-coated ceramic powders	South Africa	2006/8591	30/04/2008	13/10/2006	IN284812
		Sri Lanka	14258	02/11/2011	17/10/2006	
		Indonesia	IDP000044402	06/02/2017	18/10/2006	
4.	A process for continuous coating deposition and an apparatus for carrying out the process	South Africa	2009/06786	26/05/2010	30/09/ 2009	1829/DEL/2008
		UK	2464378	15/05/2013	02/10/2009	
		USA	US8486237B2	16/07/2013	14/10/2009	
		Japan	5442386	27/12/2013	15/10/2009	
		France	2937342	18/12/2015	12/10/2009	
5.	Method of depositing electrically conductive electrode material onto the surface of an electrically conductive work piece	USA	US8674262B2	18/03/2014	12/08/2011	IN 262189
6.	Improved process for the preparation of stable suspension of nano silver particles having antibacterial activity	United Kingdom	GB2496089	18/06/2014	19/07/2011	IN 289543
7.	A process for continuous coating deposition and an apparatus for carrying out the process	USA	US9365945B2	14/06/2016	17/08/2012	1829/DEL/2008

S.No	Title of Patent	Country	Patent Number / Application Number	Date of Grant	Date of filing with patent office	Indian Patent/ Family details
8.	An improved hybrid methodology for producing composite, multilayered and graded coatings by plasma spraying utilizing powder and solution precursor feedstock	South Africa	2012/02480	28/11/2012	05/04/2012	IN 323443
		Canada	2784395	16/09/2014	31/07/2012	
9.	Multi-track laser surface hardening of low-carbon cold-rolled closely annealed (CRCA) grades of steels	USA	US11186887B2	30/11/2021	10/12/2014	IN375427
		Australia	AU2014362928	21/02/2019	10/12/2014	
10.	A method of producing high-performance lithium titanate anode material for lithium-ion battery applications	Japan	JP7121734B2	09/08/2022	10/04/2019	IN365560
		Germany	DE112018000205B4	17/07/2023	28/06/2019	
		USA	US11001506B2	11/05/2021	22/05/2019	
		China	CN110023245B	11/01/2022	22/05/2019	
		Korea	KR102512034B1	15/03/2023	02/07/2019	
11.	An improved gas dynamic cold spray device and method of coating a substrate	Russia	RU2744008	01/03/2021	24/09/2019	IN201711006749
12.	Microwave-assisted sol-gel process for preparing in-situ carbon coated electrode materials and the product thereof	Japan	JP7074870B2	16/05/2022	16/09/2020	IN520936
		Republic of Korea	KR102497808B1	03/02/2023	09/09/2020	
		Europe	EP20763813.1	-	11/09/2020	
13	Method of producing single layer omnidirectional broadband antireflective and super hydrophilic coatings for solar and other applications	USA	US18254847	-	26/05/2023	IN473000
14.	Method of producing in-situ carbon coated lithium iron phosphate cathode material for lithium-ion batteries and the product thereof	Japan	JP7642819	28/02/2025	09/06/ 2023	IN412586
		USA	18/254,730	-	29/05/ 2023	
		UAE	P6001377/2023	-	06/06/ 2023	
		Australia	2021412505	-	01/05/ 2023	
		Europe	21914895.4	-	09/06/ 2023	
		China	CN1166861098	-	20/06/ 2023	
		Israel	IL 304060A	-	26/06/ 2023	
		Brazil	BR112023012812-9	-	26/06/ 2023	



KEY PROJECTS



IMPORTANT PROJECTS UNDERTAKEN BY ARCI DURING 2024 - 25

ARCI is at the forefront of innovation, forging dynamic partnerships with both governmental and private sectors to propel groundbreaking research and development initiatives. It focuses on a wide spectrum of cutting-edge technologies in the areas of Powder Metallurgy, Battery Materials, Surface engineering, Sol-gel Coatings, Laser Processing of Materials, Ceramic processing, Carbon Materials, Fuel Cell Technology, Solar Energy Materials, and Automotive Energy Materials. Additionally, ARCI offer technical solutions tailored to the unique needs of various industries, delivering expert job work and detailed characterisation assignments that drive progress and innovation.

List of Major Projects undertaken by ARCI during the year 2024-25 are as follows:

S.N	Project Title	Funding Body
1.	Assessing suitable additive manufacturing technology for processing gamma titanium aluminide components with desired microstructures and high temperature properties for aero engine applications	Directorate of Futuristic Technology Management (DFTM)- DRDO
2.	Computational design and development of Ti-Al-Nb based alloys with rare earth metal additions for PM and AM applications (Indo-Russian)	Department of Science and Technology (DST)
3.	Development of high energy supercapacitors by dry coating process for smart toys	DST
4.	Conductivity tailored scalable gel-Li ion pouch cell battery with innovative functional carbon additives (Indo-French)	IFCPAR (Indo-Frech Centre for Promotion of Advanced Research)
5.	Demonstration of cylindrical high power impulse magnetron sputtered HiPIMS coatings to prevent hydrogen embrittlement or permeation	DST
6.	Development of multi component oxidation resistant coatings	Defence Research & Development Laboratory (DRDL)
7.	Development of low thermal conductivity ceramic coating for combustor panels	DRDL
8.	Development of luminescent transparent ceramics for scintillation and dosimetry applications	Defence Laboratory Jodhpur
9.	Demonstration of hard chrome replacement through thinner carbide coatings on industrial shafts using HVOF spray technology	DST
10.	Boron Nitride nanosheets strengthened Ti64 alloy manufactured using laser powder fusion AM technologies for improved corrosion and wear resistance	Anusandhan National Research Foundation (ANRF)
11.	Safe energy efficient Cobalt free-Lithium batteries with printed thermoelectric as over heat protector and energy harvester	ANRF
12.	Laser spiral micro grooving on X-Ray tube components such as shafts, seals and sleeves	GE Healthcare
13.	Development of doped sodium metal oxide cathode materials	Amara Raja Advanced Cell Technologies Pvt Ltd
14.	Development of two-dimensional nano material-based metal/polymer matrix composites for electromagnetic radiation absorption	Hindustan Petroleum Corporation Ltd. (HPCL)
15.	Fabrication, testing and supply of MgO and ZrH _x ceramic composite circular disc pellets	Bhabha Atomic Research Centre (BARC)
16.	Coating on pump shaft for reactor coolant pump using detonation spray coating unit.	KSB Ltd.
17.	Development of durable high temperature resistant coatings for electric arc chutes using APS	ABB Global Industries and Services Private Ltd
18.	Laser cutting of microheaters for MEMS	Larsen & Toubro Ltd.
19.	Development of Cr ₂ C ₂ -25% NiCr coatings using DSC technique: Process parameter optimization, coating on coupons, microstructure, mechanical and performance evaluation tests	Sealmatic India Private Ltd.
20.	Thin coating on pump sleeves for reactor coolant pump using HVOF	KSB Ltd.



APPLICATIONS - PRODUCTS DEVELOPED



1. Demonstration of Cylindrical and Pouch Cells

Cylindrical and pouch cells were fabricated using C-LFP cathodes and graphite anodes, respectively, using the facilities that were established recently at ARCI. Processes including slurry mixing, coating, calendaring, stacking, winding and welding have been optimized to obtain high-quality Li-ion cells. 18650 cylindrical cells delivered a capacity of 1.05 Ah, with 75 % capacity retention after 900 cycles at 1C. Whereas Li-ion pouch cell (120 mm x 80 mm) (H x W) exhibits a capacity of 9.21 Ah and retains 93% capacity after 100 cycles. These results demonstrate strong potential for high-energy-density storage. A 48V, 30–40Ah battery module using 10Ah pouch cells will be fabricated and tested for 2-wheeler applications, highlighting efficient design, stability, and suitability for future electric mobility needs with reliable and compact lithium-ion energy solutions.

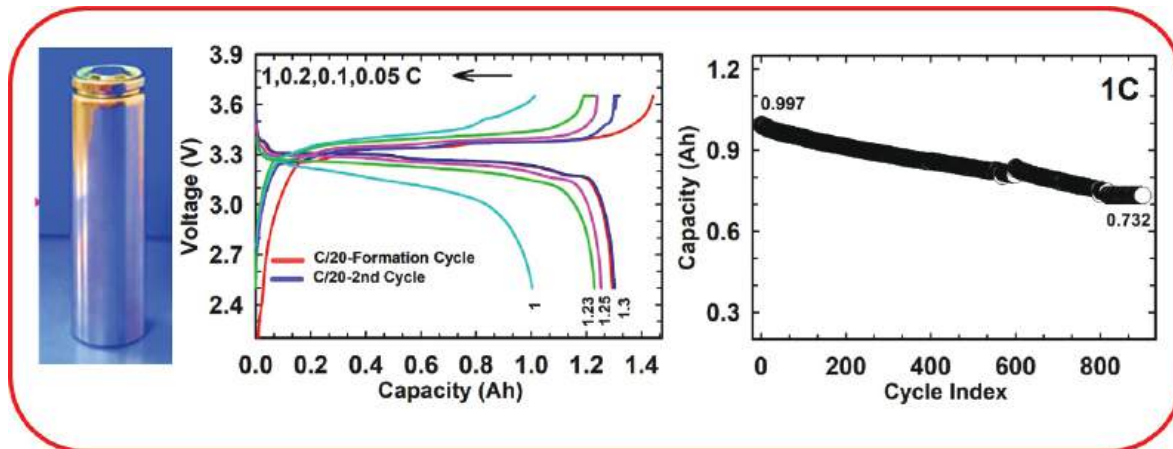


Figure 1: 18650 cylindrical Li-ion cell made at ARCI and its electrochemical performance

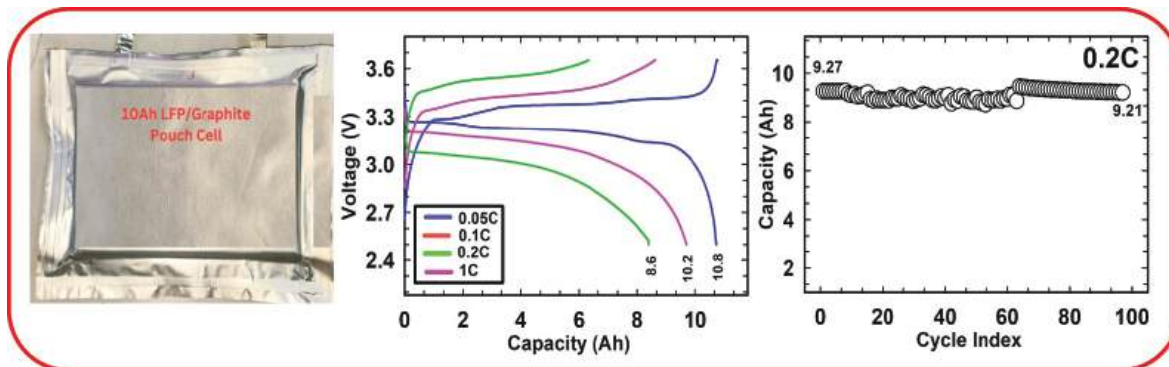


Figure 2: Li-ion pouch cell made at ARCI and its electrochemical performance

2. Development of PCM-Composite with Enhanced Thermal Transport for Battery Thermal Management System (BTMS)

Phase change materials (PCMs) are highly promising for thermal management in electronics, crucial for device safety and efficiency. Despite their potential, widespread adoption has been hampered by challenges such as high phase change temperatures, low thermal conductivity, and leakage. To address these issues, innovative, eco-friendly, bio-based PCM composite materials with different weight percentage of conductive additive (10 to 50 wt.%) have been successfully developed. This novel PCM composite exhibits five times increase in thermal conductivity and significantly enhanced leakage resistance compared to parent PCMs. Furthermore, it demonstrates a three-fold improvement in mechanical strength. These evaluations confirm the exceptional potential of this bio-based composite PCM as an effective and sustainable solution for advanced battery thermal management applications.



Figure 1: PCM Composite



Figure 2: PCM & PCM Composite For BTMS Application

3. Automated PEM Fuel Cell (PEMFC) Component/Stack Fabrication Pilot Line

ARCI's Centre for Fuel Cell Technology (CFCT) established an automated assembly line for the fabrication of PEMFC components/stack. PEMFC is an assembly of several components, The key elements in a PEMFC system are gas-diffusion electrodes, a catalyst-coated membrane, and graphite bipolar plates. These components range from graphite plates measuring several millimetres in thickness to a catalyst-coated membrane measuring only 60 micrometres. The above-said operations and components have been handled using a proper automation solution, such as a roll cutter, conveyor, screen printing, pneumatic handling, robotic arm for the pick-and-place process. In addition, a gluing station for binding of MEA and gasket, and a torquing station for clamping the final stack on the assembly table have been developed. The entire process parameters and steps are controlled through a supervisory control and data acquisition (SCADA) system. A PEMFC stack/ components of capacity about 20 kW were fabricated using this infrastructure. These automation facilities enable the realization of mass manufacturing of PEMFC components/stack development with reduced time and improved reliability of the process.

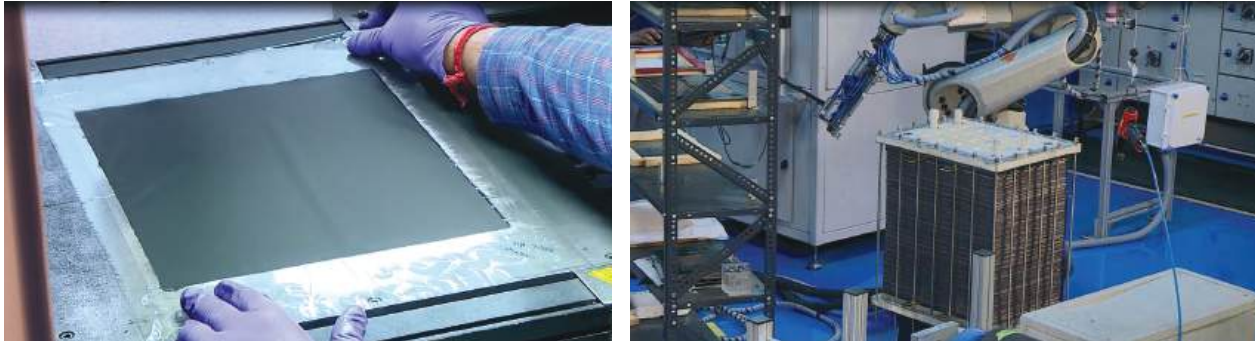


Figure: Fabricated PEMFC Components / stack

4. Air-Cooled Open Cathode PEMFC Stack as Portable Power Supply

An open-cathode, air-cooled Proton Exchange Membrane Fuel Cell (PEMFC) stack offers a relatively simple and compact electric generation system for vehicle applications, due to its reduced system complexity and minimal number of components. A critical factor influencing the performance and electrochemical efficiency of such a PEMFC stack is the internal temperature distribution. Uniform thermal conditions are difficult to maintain, and traditional computational models have often assumed a uniform stack temperature, limiting their accuracy and scalability. In reality, temperature gradients do exist, typically with higher temperatures observed at the stack edges, which can adversely affect performance and durability.

A niche application for open-cathode fuel cells can be found in the context of nuclear reactors. During reactor operation, cold traps are used to capture and remove hydrogen and other gases, such as tritium, generated through processes like water radiolysis, corrosion, and radiolytic decomposition of organic compounds. These cold traps cool the reactor coolant, allowing the gases to condense and be collected. Periodic regeneration of the traps by heating releases the captured hydrogen gas.

This released hydrogen can serve as a valuable fuel source for PEMFC systems, particularly in environments where the use of water is restricted or undesirable, such as near cold trap systems. Since PEM fuel cells only require hydrogen and produce water as a byproduct, they provide a clean and compatible energy conversion system in such settings. Moreover, parametric studies have shown that certain design factors, such as fan-to-stack distance, have a negligible impact on overall performance, reinforcing the practicality of deploying open-cathode PEMFCs in specialized, hydrogen-rich environments like those surrounding nuclear cold trap systems. CFCT has successfully demonstrated an 80 W air-cooled open cathode system integrated with its Balance of Plant, ready for deployment

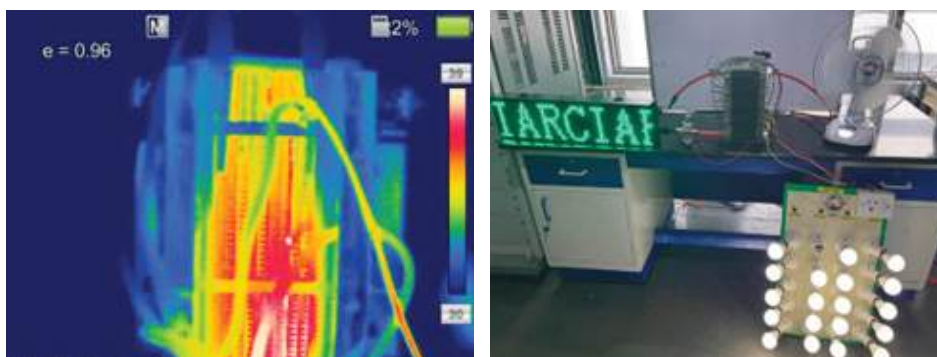


Figure: Thermal Image of the air-cooled stack under operational conditions

5. Ultrafast Laser-Based Spiral Micro-Grooving for X-ray Tube Components

A precision micromachining process using ultrafast laser technology has been successfully developed for fabricating spiral grooves on key X-ray tube components. These include the journal bearing, thrust bearing, and sleeve, which are integral to the rotating anode assembly of medical X-ray tubes. These components function within a spiral groove bearing system that operates hydrodynamically using liquid gallium as a lubricant. The spiral grooves, having a depth of 10 μm and a width of 500 μm , are critical for achieving smooth rotation, handling axial loads, and maintaining vacuum integrity. Conventional machining techniques are inadequate for such precise and damage-free fabrication. Ultrafast laser micromachining provides high accuracy, minimal thermal effects, and excellent repeatability, making it ideal for this application. This process supports the domestic development of high-performance diagnostic imaging systems by enabling the reliable production of critical, high-precision components for rotating anode X-ray tubes.

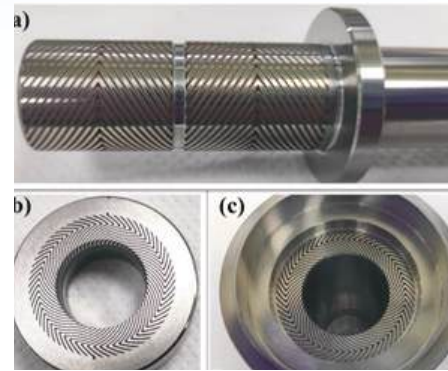


Figure : Ultrafast laser-fabricated spiral grooves on X-ray tube components: (a) journal bearing, (b) thrust bearing, and (c) sleeve

6. A Top-lid Assembly for a Battery Cell and a Method for Producing the Top-lid Assembly

A novel stud-type top-lid assembly for cylindrical cells was designed and fabricated. This assembly design comprises of three main parts: a nickel-coated steel stud, an aluminium top lid, and a polypropylene insulator. The nickel-coated steel stud serves as a terminal and is designed as a single, integrated part. It consists of upper and lower collars, which are joined together through a tubular stem that serves as an electrolyte fill-port. The bottom side of the upper collar in the steel stud contains a circular groove, and the lower portion of the tubular stem has an internal threaded design. The aluminium top lid is a circular disc with a central hole and a circular groove on the bottom side of the lid. A designed moulding die tool has been developed to fabricate a top-lid assembly. The single component of the top-lid assembly, fabricated via moulding, reduces the number of components. Efficient tab to terminal joining in the top-lid assembly improves the electrical conductivity. The integrated degassing feature of the top-lid assembly enhances contact between the electrodes, leading to improved overall cell performance. Uniform heat dissipation minimizes temperature rise during charge/discharge cycles at high C-rates, ensuring the safety of the lithium-ion cells.



Figure 1: Novel stud-type top lid assembly setup

Using a novel stud-type top lid assembly, NMC/graphite-based cylindrical cells (26650) have been fabricated, and their performances were compared with the conventional cells having a rivet-type top lid assembly. The cell with a stud-type lid assembly delivers a discharge capacity of 2.35 Ah at 1C after 300 cycles compared to the rivet-type cell exhibiting only 2.2Ah. However, the stud-type cell demonstrates excellent rate capability up to 6C rate with a low temperature rise (<60 $^{\circ}\text{C}$) and uniform heat dissipation. In contrast, the rivet-type cell supports only up to 4C (<60 $^{\circ}\text{C}$) and shows non-uniform heat dissipation. Thus, the cells incorporating the novel stud-type top-lid assembly play a vital role in enhancing safety and sustainability for next-generation lithium-ion batteries for high-energy and power applications.

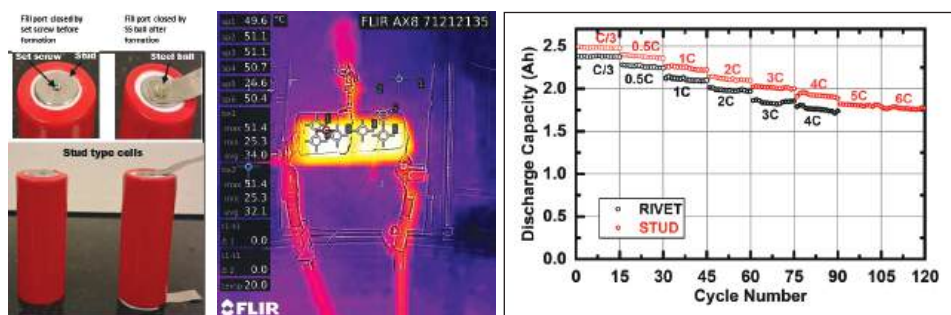
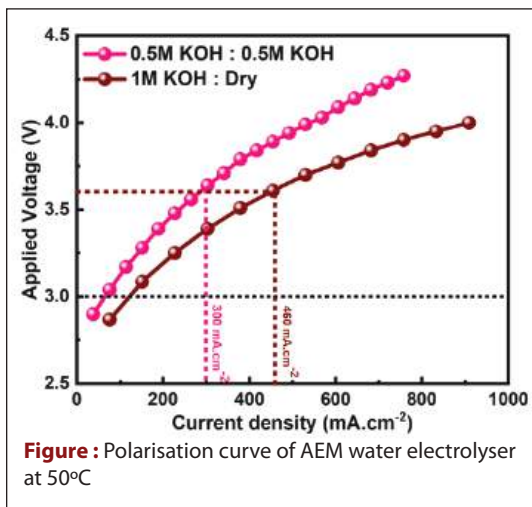


Figure 2: Stud-type top-lid assembly in cylindrical cells showing improved heat dissipation and higher capacity compared to rivet-type design

7. Anion Exchange Membrane-based Water Electrolyzer

The worldwide transition towards sustainable energy solutions has intensified the demand for efficient and cost-effective green hydrogen production methods. Green hydrogen production through water electrolysis pathways results in effectively zero greenhouse gas and pollutant emissions. Among all available technologies, low-temperature water electrolysis represents a key technology for a renewable energy economy as it can be used to efficiently store the electricity from renewable energy sources in the form of high-purity hydrogen. Anion Exchange Membrane Water Electrolyzer (AEMWE) has gained significant attention due to its potential, performance, and cost-effectiveness. Non-noble metal catalysts have been successfully developed for both the oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) in Anion Exchange Membrane Water Electrolyzer (AEMWE), for green hydrogen production technology. These catalysts were systematically evaluated through electrochemical and stability studies in laboratory-scale systems, including half-cell configurations and a 25 cm² single-cell electrolyzer.

Furthermore, the electrode area was successfully scaled up from 25 cm² to 150 cm² in a two-cell stack configuration, achieving a green hydrogen production rate of 100 L/hour. Notably, this scale-up was achieved without compromising electrocatalytic activity or operational durability. Electrochemical testing under standard AEMWE operating conditions confirmed that the current density, overpotential, and stability of the scaled-up system were consistent with the lab-scale performance. Figure 1 presents the polarization curves for the 150 cm² two-cell AEMWE stack. When 0.5 M aqueous KOH was used as the input at both the anode and cathode, the system achieved a current density of 300 mA/cm² at 3.6 V. While 1 M aqueous KOH circulating at anode and with cathode no aqueous electrolyte, performance improved significantly, reaching 460 mA/cm².



This achievement marks a significant milestone toward the commercialization of scalable AEM-based water electrolysis systems for clean and sustainable hydrogen production.

8. Sol-gel Based Additives to Reduce Corrosion in Silver Mirrors

Silver mirrors having a configuration as shown in Figure 1 are often susceptible to corrosion from the edges of the glass due to deterioration of the protection provided by paint and also due to poor adhesion between the silver layer/glass and the silver layer/paint. Ambient-curable sol-gel nanocomposite coatings can act as good adhesion promoters. Self-healing additives added to the paint or adhesion promoter layer can reduce corrosion and improve the durability of the silver mirrors. Three products, namely (a) adhesion-promoting sol, (b) self-healing sol and (c) self-healing additive as shown in Figure 2, were supplied to a Chennai-based company for their trials.



Figure 1: Schematic showing configuration of silver-based mirror



Figure 2 : a) Adhesion promoting sol; (b) Self-healing sol and (c) Self-healing additive

9. Large-Scale Synthesis of Hydroxyapatite (HAP) and Tri-Calcium Phosphate (TCP) Nano powders for Biomedical Application

Hydroxyapatite (HAP) nanoparticle size in the range of 20-200 nm with high purity > 99% has been synthesized using a low-cost precursor by pilot-scale Flame Spray Pyrolysis (FSP) as shown in Figure 1. The process parameters of FSP heat treatment cycle to obtain phase-pure HAP and a mixture of HAP and $\text{Ca}_3(\text{PO}_4)_2$ (TCP) nanopowders of different sizes have been optimized. The powder production is demonstrated up to the kilogram level using the pilot-scale FSP unit. The powder is being tested for biocompatibility, suitable for medical use.

The major applications of these powders are bone void fillers for orthopaedic, traumatology, spine, maxillofacial & dental surgery, orthopaedic and dental implant coating; restoration of periodontal defects, fillers for reinforcing restorative glass ionomer cement (GIC) and restorative composite resin.

10. Flexible Perovskite Solar Cell

Perovskite solar cells have emerged as strong contenders to mainstream Crystalline Silicon (c-Si) solar cells due to higher efficiency and simple fabrication processes. Intrinsic mechanical flexibility and low-temperature annealing of perovskite further enable the development of flexible solar cells. Solution precursor engineering enabled the scalable deposition of a homogeneous Electron Transport Layer (ETL)/ Perovskite/ Hole Transport Layer (HTL) device stack on a 50mm x 50mm size, conductive layer coated transparent polymer substrate and a power conversion efficiency of 8 % was achieved.

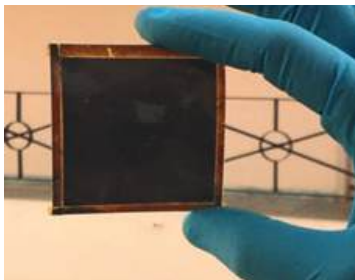


Figure: 50 mm x 50mm size flexible perovskite solar cell

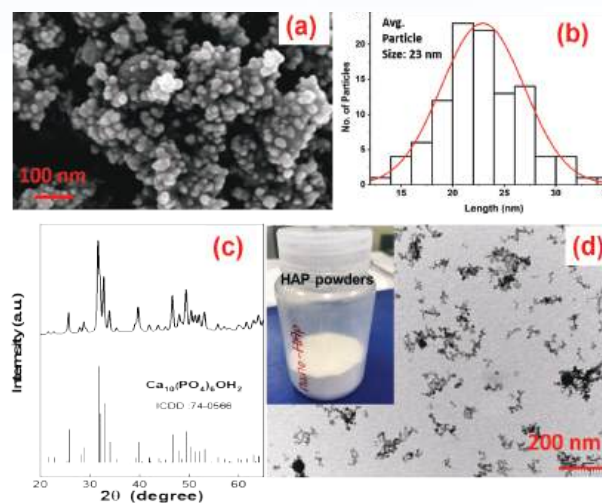


Figure 1: (a) FE-SEM, (b) Particle size distribution, (c) XRD, and TEM of HAP nanopowders

11. Chromium Interconnect for Solid Oxide Fuel Cell

Chromium Iron Yttrium (CFY) based alloy is used as an interconnect material for solid oxide fuel cells. The interconnect plates of 125 mm X 100 mm X 5 mm were indigenously developed through the powder compaction method with a sintered density of 92-95%, good oxidation resistance, and electrical conductivity. The coefficient of thermal expansion is on par with the electrode material. Advantages of CFY interconnects are that they can be used at 700-900 °C, have a long life, better oxidation resistance, and a low cost, as it is indigenously produced.



Figure: CFY interconnect plate

12. Thermoelectric Device for Low-Temperature Industrial Waste Heat Utilization

Thermoelectric device utilizing doped bismuth telluride and bismuth selenide materials was developed, demonstrating an open-circuit voltage of 0.6 V under a temperature difference of 100°C. The device leverages the Seebeck effect, converting thermal gradients into electrical energy efficiently. Bismuth telluride and bismuth selenium telluride alloys offer favourable thermoelectric properties such as a high Seebeck coefficient and low thermal conductivity, contributing to enhanced performance. The 0.6 V output indicates significant potential for waste heat recovery and small-scale power generation applications. This advancement highlights the suitability of doped bismuth selenide for thermoelectric devices operating in moderate temperature ranges, supporting sustainable energy solutions through effective thermal-to-electrical energy conversion.

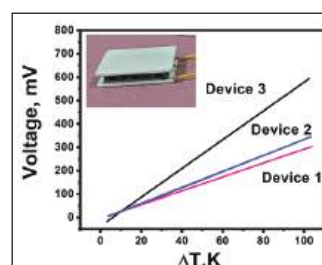
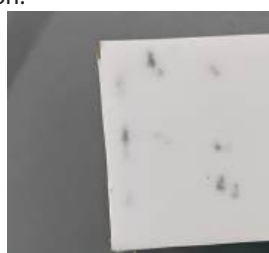


Figure: A thermoelectric device fabricated using doped bismuth selenide and telluride



RESEARCH HIGHLIGHTS



1. Tackling Li_2CO_3 Impurity in NCA Cathodes for Better Battery Performance

Contributors: Sahana B Moodakare, Mahender Peddi, Sasikala Natarajan, Nagini Macha, and Raghavan Gopalan

Nickel-rich lithium nickel cobalt aluminum oxide (NCA) is a key cathode material that enables high energy density in lithium-ion batteries, making it essential for electric vehicles and advanced energy storage applications. One of the major industrial challenges in manufacturing NCA-based batteries is the formation of lithium carbonate (Li_2CO_3) impurities, which negatively affect both performance and processability. Our research focused on understanding the impact of lithium content on the structural and electrochemical properties of NCA. Two NCA samples were synthesized using different lithium-to-metal ratios (1:1 and 1.03:1). The sample with excess lithium (1.03:1) showed significant Li_2CO_3 formation and lithium segregation within particles. These impurities reduced the shelf life and caused non-uniformity in the slurry, making cell fabrication difficult and reducing battery efficiency. In contrast, the 1:1 ratio sample exhibited uniform lithium distribution, minimal impurities, and better electrochemical performance. This study emphasizes the importance of eliminating Li_2CO_3 and precisely controlling lithium addition to ensure high-quality, long-lasting battery materials.

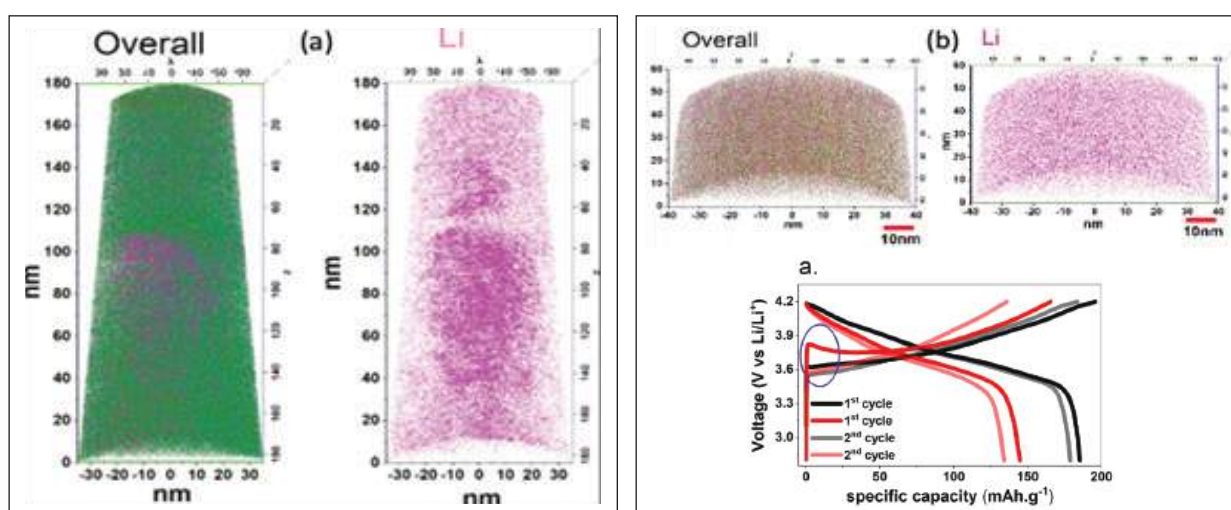


Figure 1.1: (a) Lithium segregation in a sample prepared with Li: M =1:1, (b) Uniform distribution of Lithium as identified by Atom probe tomography, (c) Comparison of Electrochemical performance of the Sample with high Li_2CO_3 due to lithium segregation (red lines) with optimized NCA (black lines)

Reference: P Mahender Reddy, S Natarajan, M Nagini, R Gopalan, R, MB Sahana, "Investigating Lithium Segregation in Nickel-Rich Layered Oxides via Atom Probe Tomography and its Impact on Performance", Batteries & Supercaps, Vol. 8(8), Art. e202400752, 2025

<https://doi.org/10.1002/batt.202400752>

2. A Comparative Study of Lithium Tungstate and Hexagonal Tungsten Trioxide as Anode Materials for Li-ion Batteries – Influence of *ab initio* Presence of Electroactive Species in the Host Lattice

Contributors: R. Prakash, P. Ganesan, Sumit R. Sahu, S. Bhuvaneshwari, and U. V. Varadaraju

Tungsten Trioxide (WO_3) exhibits superior reversible capacities (693 mAh/g) as a LIB anode, attributed to its ability to undergo reduction from W^{6+} to W^0 . The hexagonal polymorph of WO_3 (h-WO_3) is particularly attractive for Li-storage due to its large hexagonal tunnels, which facilitate the smooth intercalation and deintercalation of Li^+ ions. In this study, Li_2WO_4 has been explored as an anode material for LIBs, demonstrating superior electrochemical performance compared to h-WO_3 . Li_2WO_4 delivers a high discharge capacity of 547 mAh/g with a coulombic efficiency of 100 %. Under similar conditions, h-WO_3 exhibits a significantly lower discharge capacity of 187 mAh/g despite achieving a similar coulombic efficiency. At higher C-rates, the advantages of Li_2WO_4 become even more apparent. At a 1C rate, the discharge capacity of Li_2WO_4 remains 355 mAh/g after 70 cycles, while h-WO_3 demonstrates only 67 mAh/g . Remarkably, at a 5C rate, Li_2WO_4 retains a discharge capacity of 280 mAh/g even after 1500

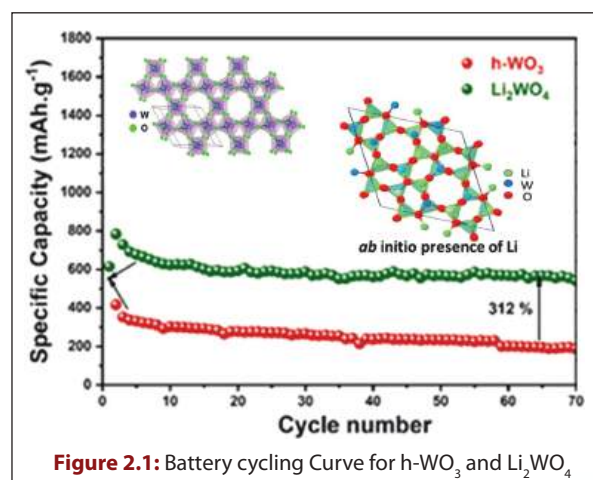


Figure 2.1: Battery cycling Curve for h-WO_3 and Li_2WO_4

cycles, underscoring its outstanding cycling stability and rate capability. The superior performance can be attributed to the presence of electro-active lithium species in the host lattice, which facilitates efficient lithiation and delithiation processes. The higher number of Li^+ ions available in the Li_2WO_4 matrix, combined with enhanced diffusion pathways, enables better ion transport and sustained electrochemical activity compared to h-WO_3 . In conclusion, Li_2WO_4 is a highly promising anode material for LIBs, offering excellent capacity retention, cycling stability, and rate performance, making it a compelling candidate for next-generation energy storage systems.

Reference: P Ganesan, Sumit Ranjan Sahu, S Bhuvanewari, R Prakash, M Pardha Saradhi, UV Varadaraju, "A Comparative Study of Lithium Tungstate and Hexagonal Tungsten Trioxide as Anode Materials for Li-ion Batteries - Influence of ab Initio Presence of Electroactive Species in the Host Lattice", *Inorganic Chemistry Communications*, Vol. 176, Art. 114251, 2025

<https://doi.org/10.1016/j.inoche.2025.114251>

3. Eco-Friendly Preparation of Stable Lithium Iron Phosphate Cathodes for Lithium-Ion Batteries

Contributors: V.V.N. Phani Kumar, K. Shanmugam, A. Sivaraj, T. P. Sarangan, T. Mohan, and R. Prakash

Currently, the LIB cells using Lithium Iron Phosphate (LFP) cathode have attracted more attention due to their temperature stability, durability, safety, and fast-charging capability. LIB electrodes are fabricated using a non-aqueous-based process, by dispersing the active material and conductive carbon in polyvinylidene fluoride binder (PVDF) using N-methyl-2-pyrrolidone (NMP) solvent. The fabrication process requires dehumidified rooms with a relative humidity of <20%. It is a tedious process and not environmentally friendly in nature, and it requires an NMP recovery unit, which is a cost-intensive process. The nano-sized LFP cathodes have been well-studied for various applications of LIBs, in particular, electric vehicles and energy storage systems. Herein, we used the open-pore micron-sized LFP material as a cathode using an eco-friendly electrode fabrication process for LIBs. The electrodes have been fabricated using LFP, carbon black, and sodium carboxymethyl cellulose/styrene butadiene rubber binder with various active materials contents (80–85 wt.%; LFP80/LFP83/LFP85). They have been characterized with FTIR, Raman, Peel strength, Swelling, XPS, CV, and EIS analyses. The existence of Fe^{2+} in the electrode was confirmed by high-resolution XPS spectra. From EIS, the obtained solution resistance and charge transfer resistance values of the electrodes are comparable to the standard LFP electrode prepared using PVDF binder. LFP80 exhibited an initial discharge capacity of 131 mAh/g at 1C-rate with a capacity retention of > 90% after 300 cycles. The electrode shows excellent rate capability, even at 4C-rate, it delivered a capacity of 116 mAh/g. In addition, the electrode displayed a stable capacity as high as 148 and 75 mAh/g at 1C-rate at 65 °C and -10 °C, respectively. The eco-friendly electrode fabrication process can be used in large-scale electrode production, which can potentially reduce the manufacturing cost of LIBs significantly.

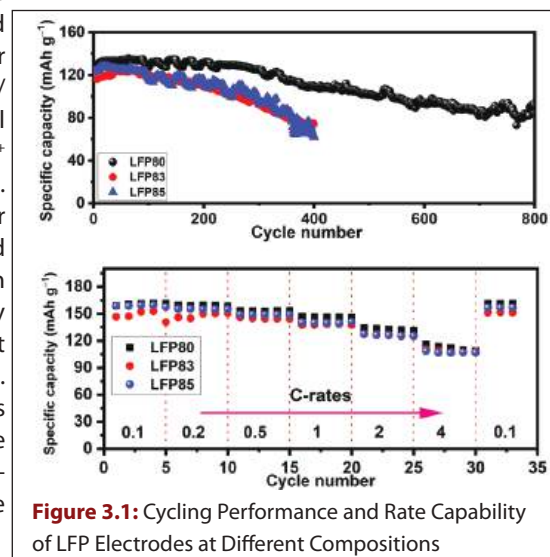


Figure 3.1: Cycling Performance and Rate Capability of LFP Electrodes at Different Compositions

Reference: VVN Phani Kumar, K Shanmugam, A Sivaraj, TP Sarangan, T Mohan, and R Prakash, "Eco-Friendly Preparation of Stable Lithium Iron Phosphate Cathodes for Lithium-Ion Batteries", *Chemistry Select*, Vol. 10, Art. e202402870, 2025
<https://doi.org/10.1002/slct.202402870>

4. Spent Graphite from Depleted Li-Ion Batteries as Functional Additives for Methanol-Tolerant Oxygen Reduction Reaction Electrocatalyst

Contributors: S. Maheswari, Raman Vedarajan, and K. Ramya

Lithium-ion (Li-ion) batteries are widely used in various applications due to their high energy density, long lifespan, and ability to be recharged. The global production of end-of-life (EoL) lithium-ion batteries (LIBs) is projected to reach approximately 4 million tons by 2030, and hence, recycling holds substantial significance from both economic and environmental perspectives. While metallic components are commonly recovered and reused, the graphitic carbon from the anode is often neglected—typically landfilled, incinerated, or treated at high temperatures.

Despite undergoing numerous charge–discharge cycles, the graphite structure in LIB anodes generally remains structurally intact. In this work, the recovered graphite was exfoliated (EFG) and employed as a functional additive in electrocatalysts for the oxygen reduction reaction (ORR). EFG was incorporated in varying weight percentages into a

catalyst slurry composed of 20 wt.% Pt on functionalized acetylene black (Pt/FAB) and Nafion for evaluation as ORR catalyst in acidic media (0.1 M HClO₄), both in the presence and absence of methanol, addressing two major challenges in direct methanol fuel cells (DMFCs): methanol crossover and CO poisoning of Pt active sites.

The dual role of EFG, as a conductive additive and as a functional barrier, proved advantageous in enhancing methanol tolerance. The higher surface area and abundance of functional groups in EFG are believed to trap methanol molecules, thereby limiting their interaction with Pt and protecting the catalyst from poisoning. This approach not only aligns with the institute's mission to advance sustainable energy materials but also opens new avenues for the value-added recovery of battery waste materials for application in electrocatalysis and energy conversion systems.

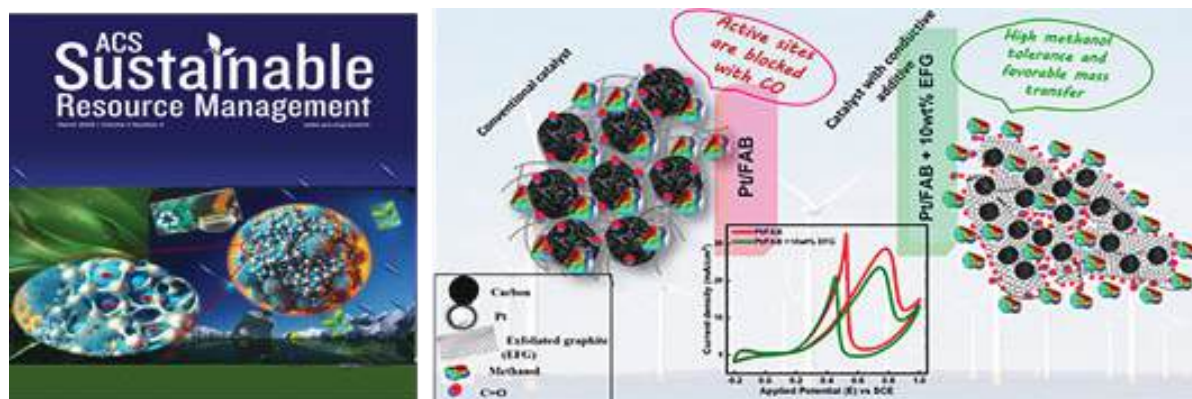


Figure 4.1: Mechanistic Insights and Performance of Advanced Catalysts for DMFCs

Reference: S. Maheswari, R Vedarajan, Mamata Mohapatra, K Ramya, "Spent Graphite from Depleted Li-Ion Batteries as Functional Additives for Methanol-Tolerant Oxygen Reduction Reaction Electrocatalyst", ACS Sustainable Resource Management, Vol 2(3), p 386-390, 2025

<https://doi.org/10.1021/acssusresmgmt.4c00452>

5. Beyond Barrier Function: Exploring The Potential of Polymer Coatings for High-Performance Aluminum-Air Batteries

Contributors: AB Aravind, and K Ramya

Aluminium–air batteries are known for their high energy density but are hindered by aluminium corrosion. This research delves into the utilization of polymer coatings through dip coating to enhance discharge longevity by treating aluminium electrodes with poly (vinyl alcohol) (PVA), poly (vinylidene fluoride) (PVDF), and poly (tetrafluoroethylene) (PTFE), and studying their effects on surface hydrophobicity and discharge duration. A standardized 0.5 M KOH electrolyte and a carbon-based air-breathing cathode were utilized. Among the polymers tested, PTFE exhibits the most favorable outcome due to its superior hydrophobic properties. Under the conditions of 0.5 M KOH electrolyte concentration and a current density of 1 mA / cm², uncoated electrodes exhibit a discharge duration of around 5 h. PTFE-coated electrodes achieve discharge durations surpassing 30 h, marking a several-fold enhancement. Furthermore, PTFE-coated electrodes sustain satisfactory performance even at a higher current density of 10 mA / cm², underscoring their potential for practical use. This indicates an enhanced aluminum conversion and protection process with the use of PTFE coating. Furthermore, it exhibits a reduced corrosion current, indicating heightened safeguarding of the aluminum electrode due to the hydrophobic properties of poly-(tetrafluoroethylene) (PTFE) in an alkaline potassium hydroxide (KOH) electrolyte environment.

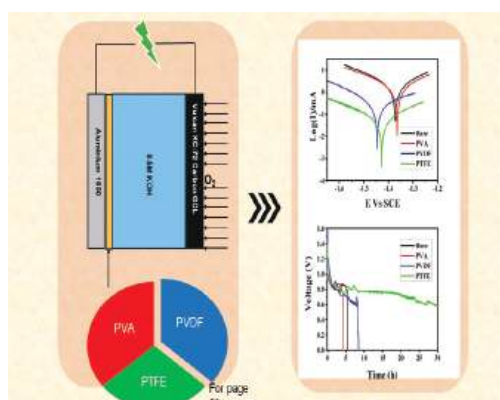


Figure 5.1: Schematic of Al–Air Battery with Polymer Binders (PVA, PVDF, PTFE) and Electrochemical Performance: Tafel Curves & Discharge Stability

Reference: AA Baburajan, AB Aravind, A Bose, K Ramya, "Beyond Barrier Function: Exploring the Potential of Polymer Coatings for High-Performance Aluminum–Air Batteries", ACS Applied Energy Materials, Vol. 7(18), p 7915-7926, 2024 <https://doi.org/10.1021/acsaem.4c01522>

6. Quasi-Gel Polymer Electrolyte Interfaced with Electrodes Through Solvent-Swollen Poly (Ethylene Oxide) For High-Performance Lithium /Lithium-Ion Batteries

Contributors: Sahana MB and Raman Vedarajan

Solid polymer electrolytes (SPEs) are considered a superior option to traditional liquid electrolytes in lithium-ion batteries (LIBs) due to their enhanced safety. However, SPEs encounter challenges such as low ionic conductivity at room temperature and poor interfacial contact, resulting in high resistance at electrode-electrolyte interfaces. Development of a quasi-gel polymer electrolyte (QGPE) as a solution to circumvent the disadvantages of SPE has been considered as a viable alternative. The QGPE developed encompassed poly (vinylidene fluoride hexafluoropropylene) (PVDF-HFP), poly (ethylene oxide) (PEO), and succinonitrile (SN), designed for optimal mechanical strength, ionic conductivity, and interfacial stability using a straightforward solution casting method. The QGPE features a thin solvated PEO layer that wets the electrode surface, reducing interfacial resistance and ensuring uniform Li-ion flux. The optimized QGPE shows impressive lithium-ion conductivity of $1.14 \times 10^{-3} \text{ S/cm}$ and a high lithium-ion transference number of 0.7 at 25°C. In a Li/QGPE/Li symmetric cell, the QGPE demonstrates a highly reversible lithium plating-stripping process for over 1300 hours with minimal voltage polarization of ~20 mV. The Li/QGPE/LiFePO₄ full cell exhibits excellent rate capability and long-term cycling performance at a 0.1C rate at 25°C, maintaining a specific discharge capacity of 148mAh/g over 200 cycles. The efficacy of QGPE for LIBs is further validated with a Graphite/QGPE/LiFePO₄ 4x4 cm pouch cell, demonstrating remarkable flexibility and resilience to intentional abuse.



Figure 6.1: Pouch cell assembled with the QGPE - subjected to intentional abuse while under operation condition, showing no adversity.

Reference: B Mohana Priya, B Sahana, Raman Vedarajan, R Kothandaraman, "Quasi-Gel Polymer Electrolyte Interfaced with Electrodes through Solvent-Swollen Poly (Ethylene Oxide) for High-Performance Lithium/Lithium-Ion Batteries", ACS Applied Materials & Interfaces Vol.16(34), 2024

<https://doi.org/10.1021/acsaami.4c06192>

7. Developing High-Power Li₄Ti₅O₁₂ Anode Material for Accelerating EV Adoption

Contributors: S. Sivakanali, Gowthami Chandra, R. Vijay, TN Rao, and S. Anandan

Li₄Ti₅O₁₂ (LTO) is a promising anode due to its zero-strain characteristic during lithiation/delithiation, though its low conductivity limits the performance. In this study, LTO was synthesized via a solid-state route using varying ratios of anatase and rutile TiO₂. XPS and Raman analysis confirm oxygen vacancies and Ti³⁺ ions that enhance electronic conductivity. The optimized LTO (80% anatase, 20% rutile) achieved specific capacities of 169 to 84 mAh/g at 1C to 30C rates, respectively. An LFP||LTO pouch cell exhibited 95% capacity retention after 1000 cycles at 1C, highlighting the impact of structural and compositional tuning.

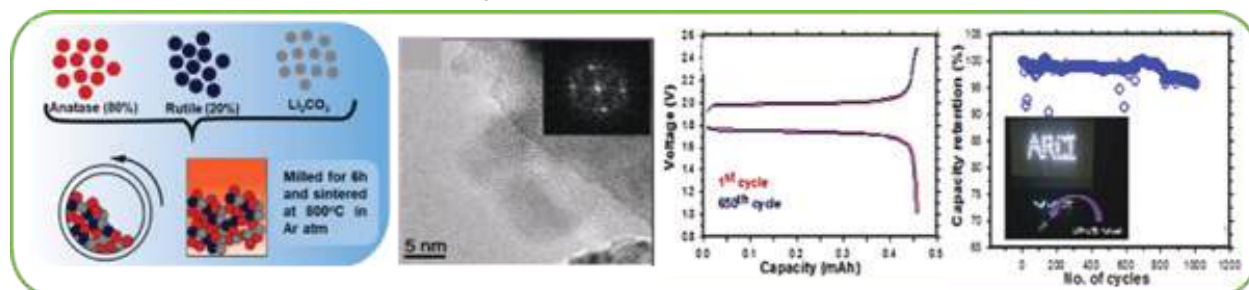


Figure 7.1: Methodology and electrochemical performance of Li₄Ti₅O₁₂ (LTO) anode material

Reference: PM Pratheeksha, S Sivakanali, SJ Kashyap, Chandra Gowthami, DP Joseph, R Vijay, TN Rao, S Anandan, "Effective Oxygen-Deficient Li₄Ti₅O₁₂ Anode Material Displaying Excellent Rate Performance and Outstanding Cyclic Stability", Chemistryselect, Vol. 9(37), Art. e202403479, 2024

<https://doi.org/10.1002/slct.202403479>

8. Metal Decorated Porous Carbon as Sulfur Host for Ultrahigh Rate and High Performance Lithium-Sulfur Batteries

Contributors: K. Nanaji, B.V. Sarada, and TN Rao

Lithium sulfur battery (LSB) is an alluring technology because of its high specific capacity, potential energy density, and natural abundance of sulfur in the Earth's crust. However, some notorious issues need to be mitigated before commercialization. Here we report a novel and scalable iron, cobalt co-embedded resorcinol formaldehyde-derived carbon framework as a sulfur host for high-performance LSB. To further increase the specific surface area and porosity of carbon, Polyvinyl Alcohol (PVA) is used as a sacrificial polymer. One-pot synthesis method is used for preparing the Fe, Co co-embedded PVA incorporated RF xerogel-derived carbon (FC-PRFC) framework. The porous structure and higher specific area of FC-PRFC enable high sulfur loading in the composite and show excellent rate performance and cyclability. FC-PRFC cathode host with a high areal sulfur loading of 4.2 mg / cm² delivers a high initial discharge capacity of 1283 mAh / g at 0.1C. At a high current rate of 4C, it retains a capacity of 372 mAh / g after 400 charge-discharge cycles with a capacity retention of 73%. This scalable, innovative, low-cost fabrication technique has the potential to pave the way for developing an outstanding carbon framework for high-performance LSBs for commercial applications.

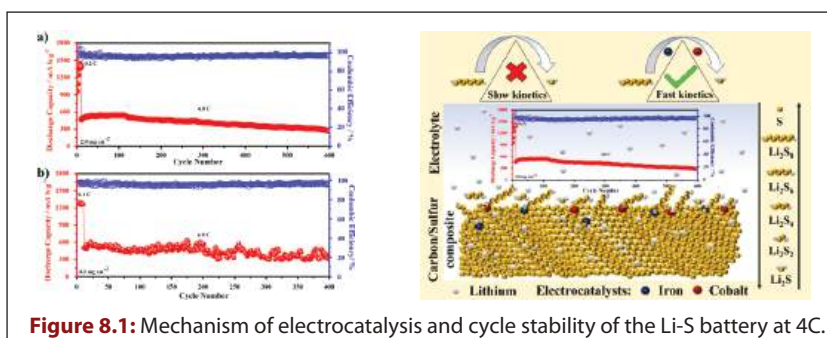


Figure 8.1: Mechanism of electrocatalysis and cycle stability of the Li-S battery at 4C.

Reference: SK Cherian, MM Gaikwad, K Nanaji, BV Sarada, TN Rao, CS Sharma, "Iron, Cobalt Co-embedded in Situ Graphitized Xerogel-derived Carbon as Sulfur Host for Ultrahigh Rate and High-performance Lithium-sulfur Batteries", *Journal of Energy Storage*, Vol. 95(1), Art. 112587, 2024

<https://doi.org/10.1016/j.est.2024.112587>

9. TiNb₂O₇ Nanobead Anode Coupled Porous Carbon Onion Cathode for High Energy and Power-Based Hybrid Lithium-Ion Capacitors

Contributors: Srinivasan Anandan, B.V. Sarada, and R. Vijay

Hybrid energy storage systems such as Lithium-Ion Capacitors are being sought recently to meet the demand of practical applications owing to their high power and comparable energy densities. A novel Li-ion Hybrid Energy Storage system (Li-HES) is designed in this work using solvothermally synthesized microspheres with nano-bead architecture TiNb₂O₇ anode coupled with a jute stick-derived NaOH-activated high surface area porous carbon onions as cathode. TiNb₂O₇ with nanobead architecture is found to be extremely stable in a potential window of 1.0–3.0 V vs. Li/Li⁺, giving a specific capacity of 261 mAh / g at 0.5C. Similarly, the activated carbon resulted in a specific capacity of 69 mAh / g with unique nano onion morphology at 0.1 A/g. The designed Li-HES system with TiNb₂O₇ anode and activated carbon cathode yielded a specific capacity of 124 mAh / g at 0.1 A / g in a stable potential window of 1.0–3.5 V, by carrying the advantages of both high-energy battery and high-power supercapacitor. The full cell system has also shown a high energy density of 154.5 Wh/g at 125 W/kg along with excellent rate capability and cycle stability performance. This work demonstrates a unique strategy to combine suitable nanostructured anode and cathode materials to design high-energy and power-based Li-HES.

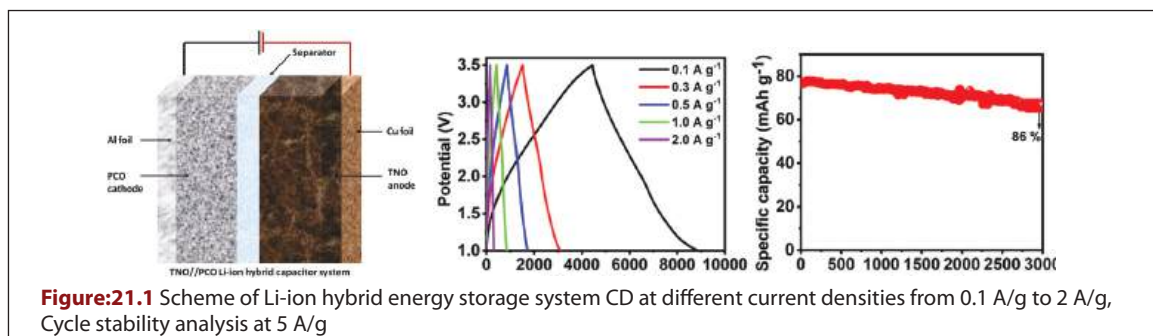


Figure 21.1 Scheme of Li-ion hybrid energy storage system CD at different current densities from 0.1 A/g to 2 A/g, Cycle stability analysis at 5 A/g

Reference: K Nanaji, P Samhita, S Anandan, BV Sarada, R Vijay, TN Rao, "TiNb₂O₇ Nanobead Anode Coupled Porous Carbon Onion Cathode for High Energy and Power-based Hybrid Lithium-Ion Capacitor", *Journal of Power Sources*, Vol. 629, Art. 236024, 2025

<https://doi.org/10.1016/j.jpowsour.2024.236024>

10. Sodium Storage Mechanism of Hard Carbon Anodes

Contributors: A Nagmani, Ashish Kumar, Chandra Gowthami, R. Vijay, TN Rao, and Srinivasan Anandan

Non-graphitizable hard carbon (HC) possesses numerous surface imperfections, functional groups, and randomly arranged graphene sheets (turbostratic), generating micro/meso/macropores. The sodium-ion storage mechanism in HC anodes remains unclear as it heavily relies on the diverse structures resulting from different precursor materials and heat treatment temperatures used for HCs. Various models have been proposed to comprehend the analysis of structural and sodium storage mechanisms in HCs. Amidst conflicting reports, the prevailing storage model suggests an “adsorption–intercalation–filling” mechanism. It is widely accepted that lithium insertion into the graphene interlayer forms “graphitic intercalation compounds” (GICs), which involve an intercalation mechanism. Conversely, the formation of sodium-based GICs is thermodynamically unstable, and most sodium storage is attributed to the pore-filling mechanism, resulting in the formation of pseudo-metallic clusters at a lower potential, near 0 V. The primary topic of debate regarding the storage mechanism revolves around whether the low-potential plateau capacity arises from intercalation, pore filling, or metallic deposition.

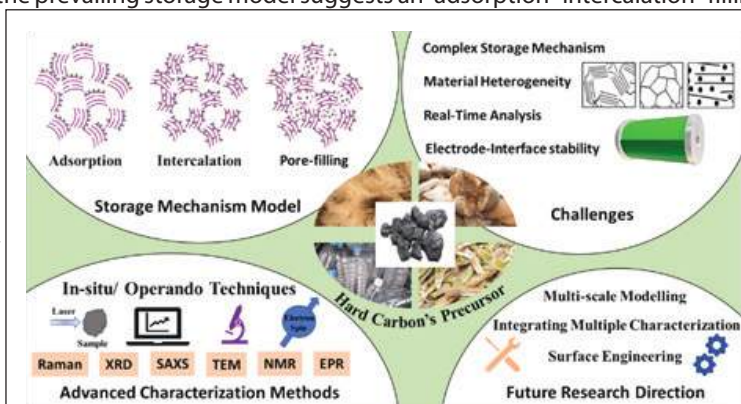


Figure 10.1: Challenges, Storage Mechanisms, and Characterization of Hard Carbon Precursors for Energy Storage Devices

Reference: A Nagmani, Ashish Kumar, Chandra Gowthami, R Vijay, TN Rao, S Anandan, “Mini-Review on Advanced Characterization Techniques for Insights into the Sodium Storage Mechanism of Hard Carbon Anodes: Recent Advances and Future Perspectives”, *Energy & Fuels*, Vol.38(19), p 18153-18168, 2024
<https://doi.org/10.1021/acs.energyfuels.4c01707>

11. Demonstration of Tab-less 6080 Cylindrical Super Battery

Contributors: K. Nanaji, Srinivasan Anandan, R. Vijay, and TN Rao

We demonstrate for the first time a tab-less 6080-sized Super Battery using safe, robust, chemically and thermally stable fast-charging lithium titanate (LTO) as the anode and carbon-coated LiFePO_4 (C-LFP) as the cathode. The resulting device exhibited extraordinary charge-discharge rates up to 17C and delivered a capacity of 4.8 Ah, attributed to the tab-less technology adopted in the LFP- LTO cell fabrication. This study presents a large-sized Li-ion battery with near-supercapacitor behaviour, addressing the key challenge of combining high energy and high power in a single device. The super battery demonstrates both energy and power in a single unit, indicating its potential for applications such as public transportation, where fast charging (<15 min) with a reasonable range is essential, as well as other uses like regenerative braking, power tools, and drones.

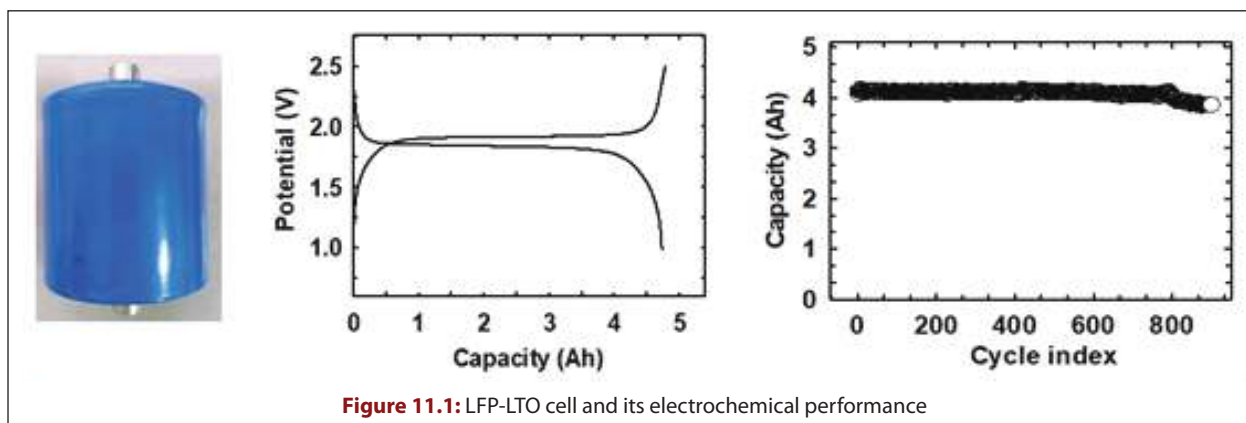


Figure 11.1: LFP-LTO cell and its electrochemical performance

Reference: K Nanaji, S Anandan, R Vijay, TN Rao “Tab-less 6080 Cylindrical Super Battery: Merging High Energy with Supercapacitor Speed for Next-gen Innovation”, *Journal of Power Sources*, Vol.630, Art. 236123, 2025
<https://doi.org/10.1016/j.jpowsour.2024.236123>

12. Development of Carbon-Coated $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_3$ Cathode for High-Voltage Sodium-Ion Battery Applications

Contributors: P. Laxman Mani Kanta, M. Venkatesh, R. Gopalan, and Bijoy Das

Sodium-ion batteries (SIBs) are considered promising alternatives to the widely used lithium-ion batteries (LIBs) due to their low cost, elemental abundance, favorable electrochemical performance, and enhanced safety features. However, there remains significant scope for the development of advanced electrode materials to achieve high-performance SIBs. The main objective of ARCI is to indigenously develop the potential electrode materials with high specific energy, power, and long cycle life to integrate them in a prototype SIB for stationary and EV applications. $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_3$ [NVPF] is identified as one of the potential cathodes for SIBs due to its outstanding electrochemical performance. We employed a simple microwave-assisted sol-gel route followed by calcination at different temperatures to prepare in-situ carbon-coated NVPF nanoparticles (<200 nm). The prepared carbon-coated NVPF shows a high reversible capacity of ~123 mAh/g at 1C (1C= 128 mA/g) with an average sodium-ion intercalation voltage of ~3.9 V vs. Na/Na⁺. When cycled at 5.0C - rate, it shows a specific capacity of ~111 mAh/g with 70% of capacity retention after 500 cycles. Even at 10C, equivalent to charging/ discharging in 6 minutes, the carbon-coated NVPF exhibits 90 mAh/g, justifying its high-power applications. Carbon coating, particle size, and morphology altogether have played a significant role in achieving high specific capacity and C- rate performance by providing a shorter diffusion path and larger sodium ion storage sites.

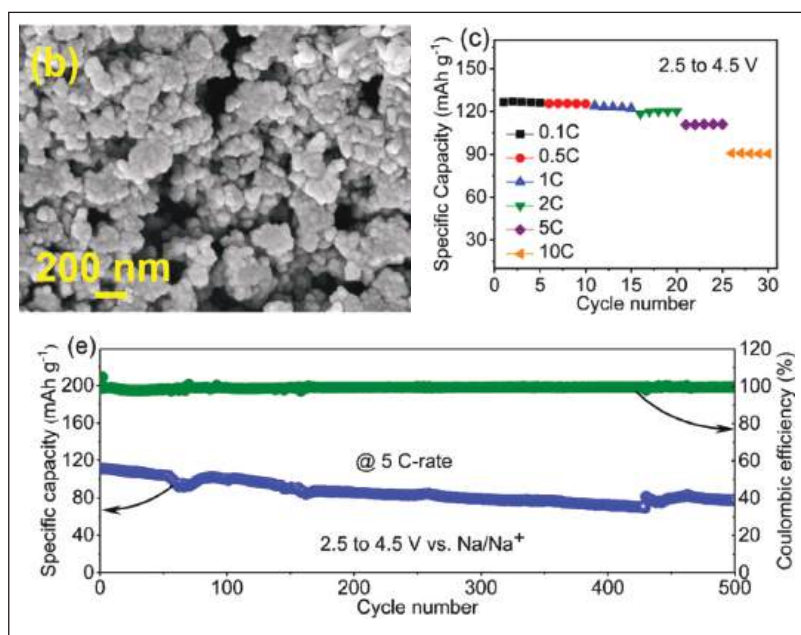


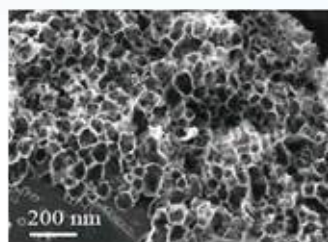
Figure 12.1: SEM image of carbon-coated NVPF nanoparticles prepared by microwave-assisted sol-gel synthesis route; Specific capacity vs cycle number plots for carbon-coated NVPF at (b) different C-rates (0.1-10C) and (c) 5.0C. Voltage: 2.5-4.5 V Na/Na⁺ and 1C = 128 mA/g.

Reference: P Laxman Mani Kanta, M Venkatesh, S Nandy, KH Chae, N Lakshmi Priya, SK Yadav, R Gopalan, Bijoy Das, "Outstanding Specific Energy Achieved via Reversible Cycling of V⁴⁺/V²⁺ Redox Couple in N-doped Carbon Coated $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_3$: An Ex-situ XRD, XPS and XAS Study", *Materials Today Energy*, Vol. 48, Art. 101802, 2025 <https://doi.org/10.1016/j.mtener.2025.101802>

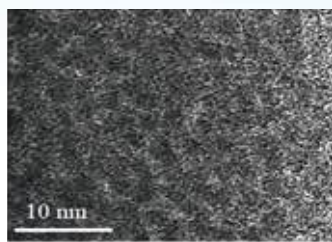
13. Hierarchical Porous Carbon derived from Bio-waste for High Performance Supercapacitor Electrodes with Enhanced Voltage and Energy Density

Contributors: Mani Karthik, P. Sakthivel, J. Jacob, R. Santhosh, N. Venkatesh, M. Vijayakumar, and G. Elsa

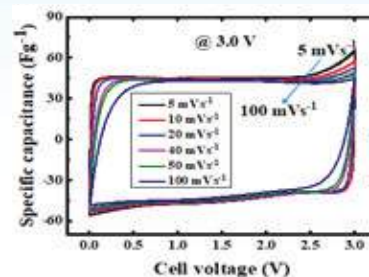
Supercapacitors are crucial for next-generation portable electronics due to their rapid energy delivery, but conventional materials often lack sustainability or availability. This study introduces a novel approach to create high-performance supercapacitor electrodes from *Strychnos Potatorum* Seeds (SPS), a sustainable and readily available bio-based resource. The research details the conversion of SPS into a hierarchical, high-surface-area bimodal porous carbon with a remarkable surface area of 1650 m²/g. Leveraging this innovative material, the developed supercapacitor electrodes demonstrate a wide operating voltage of 3.0V and a high volumetric capacitance of 76F/cm³. Crucially, these electrodes maintain excellent rate capability even at commercially relevant mass loadings and exhibit exceptional durability, retaining 95% of their capacitance after 10,000 charge-discharge cycles. This research signifies a significant advancement towards developing sustainable and high-performance supercapacitors for portable and wearable electronics.



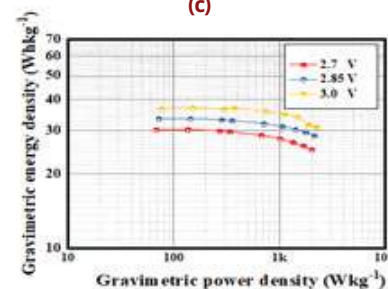
(a)



(b)



(c)



(d)

Figure 13.1: (a) FE-SEM image, (b) HR-TEM Image, (c) CV with different potential windows at different scan rates of 5mV/s to 100mV/s, (d) Gravimetric energy density Vs power density

Reference: J Jacob, R Santhosh, N Venkatesh, M Vijayakumar, Elsa George, P Sakthivel, Mani Karthik, "Hierarchical Porous Carbon derived from Strychnos Potatorum Seeds as Biowaste for High-performance Supercapacitor Electrodes with Enhanced voltage and Energy Density with Commercial Mass Loading", Journal of Energy Storage, Vol. 113, Art. 115744, 2025

<https://doi.org/10.1016/j.est.2025.115744>

14. Feasible Study of Chemical Oxidized SS304 Sheets as Solar Selective Absorbers for Flat Plate Collectors & Performance Validation in Solar Water Heater Systems

Contributors: S. Sakthivel, Md. Nishar. K. Phani Kumar, and S.R. Atchuta

Solar water heating systems are vital for reducing dependence on conventional heating methods by harnessing renewable solar energy. In this study, a cost-effective and scalable method was developed to fabricate solar selective absorber coatings using chemical oxidation on SS304 stainless steel sheets. The process involved sodium dichromate and sulfuric acid treatment at 90 °C, forming nanoporous oxide coatings with high solar absorptance (0.89–0.91) and low thermal emittance (0.20–0.30). Structural analysis confirmed the formation of Cr-Ni-Fe-O_x nanocomposites, enhancing solar absorption. The upscaled coating was applied on 2-meter-long SS304 sheets, integrated into a 1m × 2m flat plate collector (FPC), and installed in a solar water heater system. The FPC achieved an average thermal efficiency of 37.3% with excellent performance stability (± 0.75 deviation). This innovation offers a promising pathway for reducing system costs and enabling widespread deployment of solar thermal technology in domestic and industrial applications.

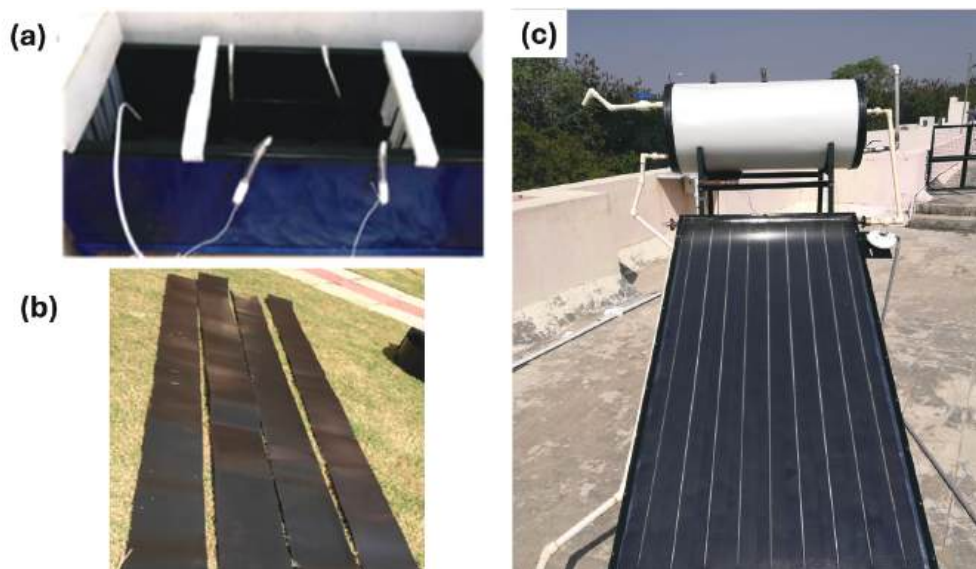


Figure 14.1: (a) Chemical bath reactor, (b) chemical oxidized SS304 sheets, (c) Solar water heater systems with chemical oxidized SS304 sheets

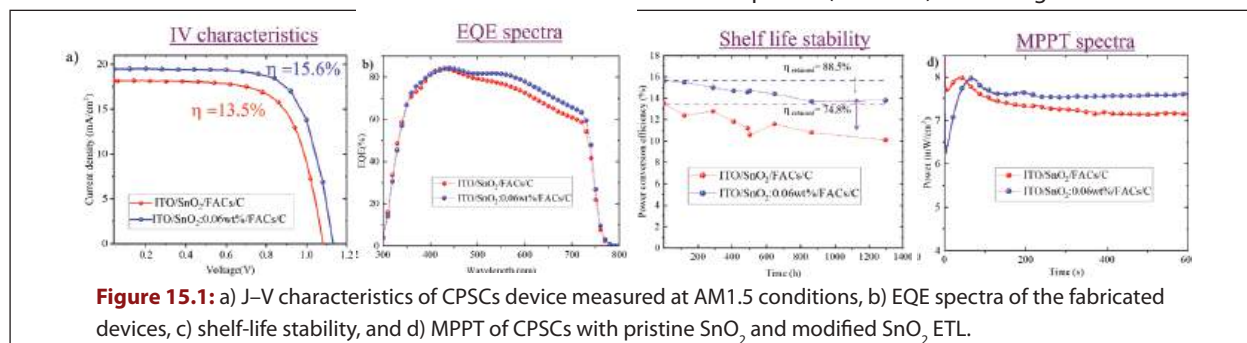
Reference: Md Nishar, K Phani Kumar, SR Atchuta, S Sakthivel, "Study of Chemical Oxidized SS304 Sheets as Solar Selective Absorbers for Flat Plate Collectors & Performance Validation in Solar Water Heater Systems", Solar Energy Materials and Solar Cells, Vol. 290, Art. 113712, 2025

<https://doi.org/10.1016/j.solmat.2025.113712>

15. Fluoroamine-Modified SnO₂ Electron Transport Layers for Efficient and Stable Perovskite Solar Cells

Contributors: V. Ganapathy, Reshma Dileep, R. Easwaramoorthi, TN Rao, and Eva Unger

SnO₂ is a widely used electron-transporting layer (ETL) in perovskite solar cells. Despite the high compatibility with the perovskite absorber layers, the presence of traps at the perovskite|SnO₂ interface results in performance losses; hence, their modification to improve the performance and stability of perovskite solar cells (PSCs) is important. Herein, the SnO₂ ETL is enhanced by incorporating a bifunctional aromatic amino fluorine molecule into the SnO₂ precursor solution. The fluorine molecule is found to partially substitute the Sn and alter the energy levels, while the aniline group aids in regulating the nucleation/growth rate of the perovskite crystalline films. Herein, hole-transporting material-free carbon-based PSCs (CPSCs) are fabricated. Devices made with the modified hybrid SnO₂ layers exhibit power conversion efficiencies of 15.6% significantly better than unmodified SnO₂ with 13.5%. CPSCs with these modified SnO₂ films also exhibit remarkable retention of 88.7% of their initial PCE for a shelf-life period (ISOS-D11) exceeding 1200 h.



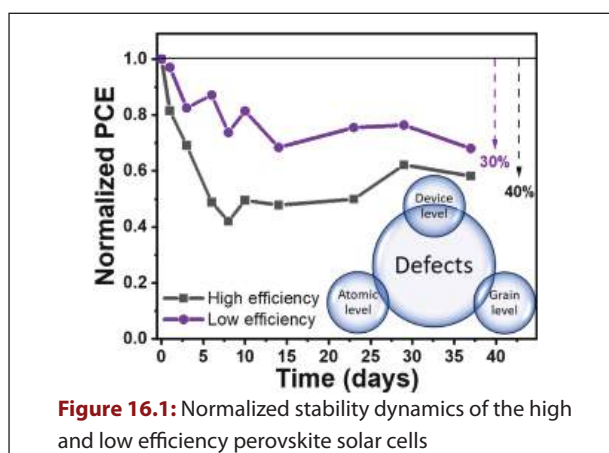
Reference: K Reshma Dileep, M Natalia, F Mathies, I Levine, D Janardan, G Paramasivam, S Mallick, TN Rao, E Unger, G Veerappan, "Hybrid Aromatic Fluoro Amine-Modified SnO₂ Electron Transport Layers in Perovskite Solar Cells for Enhanced Efficiency and Stability", *Solar RRL*, Vol 8(20), 2024

<https://doi.org/10.1002/solr.202300921>

16. Performance-Stability Correlation in MAPbI₃-Based Perovskite Solar Cells Developed Using Ink Derived from Single Crystals

Contributors: B. Ramya Krishna, Ganapathy Veerappan, and Easwaramoorthi Ramasamy

Perovskite precursor is obtained by exposing MAPbI₃ single crystals to methylamine vapor, which slices the crystal lattice, resulting in a solution processable precursor. The fabricated devices were grouped into two sets based on their Power Conversion Efficiency (PCEs), and their performance was studied for more than a month. As-prepared PSCs exhibited either efficiencies $\geq 15\%$ or efficiencies in the range of 10–15%. These two sets of devices are tested for ambient stability at $25 \pm 5^\circ\text{C}$ and 50–60% relative humidity for more than 35 days. We find an intriguing correlation between efficiency and stability; the higher efficiency devices degraded faster than the lower efficiency ones. This study focuses on establishing this interesting correlation between performance and stability of PSCs and discusses the possible reasons why the most efficient cells are more vulnerable to degradation. This intriguing observation will pave the way for addressing the stability dynamics of PSCs.



Reference: B Ramya Krishna, C Sudakar, P Bhyrappa, G Veerappan, R Easwaramoorthi, "Performance-stability Correlation in MAPbI₃ based Perovskite Solar Cells Developed using Ink Derived from Single Crystals", *Optical Materials*, Vol. 153, Art. 115538, 2024

<https://doi.org/10.1016/j.optmat.2024.115538>

17. Lead-Free $\text{Cs}_2\text{AgBiBr}_6$ Double Perovskite for Highly Stable Self-Powered Photodetector

Contributors: V. Ganapathy, B. Kumar Swamy Reddy, P. H. Borse, Aswin Kumar, Akash, and R. Easwaramoorthi

Conventional Lead-based hybrid perovskite photodetectors face significant challenges due to toxicity and poor ambient stability. This study contributes to the development of sustainable and efficient photodetectors by leveraging the exceptional properties of Lead-free $\text{Cs}_2\text{AgBiBr}_6$ double perovskite. The photodetector operates in a self-powered mode, detecting a broad spectral range from 350 to 600 nm, with impressive responsivity (50 mA/W), detectivity (5.1×10^{11} jones), and a fast rise time (160 ms). The Type-II band alignment at the $\text{Cs}_2\text{AgBiBr}_6$ - TiO_2 interface enables the self-powered operation. The inherent structural stability of $\text{Cs}_2\text{AgBiBr}_6$ results in excellent durability, maintaining performance over multiple photocycles (>500), prolonged exposure to simulated sunlight (>1h), high humidity (RH ~ 90 % for 4 h), and elevated temperatures (80°C for 4 h). Moreover, the device retained its responsivity for more than 60 days when stored under ambient conditions without encapsulation. With its simplified HTM-free architecture and Carbon electrode, the detector exhibits excellent photoresponse and resilience under harsh conditions, demonstrating the potential of $\text{Cs}_2\text{AgBiBr}_6$ in addressing the lead toxicity and stability issues in photodetectors.

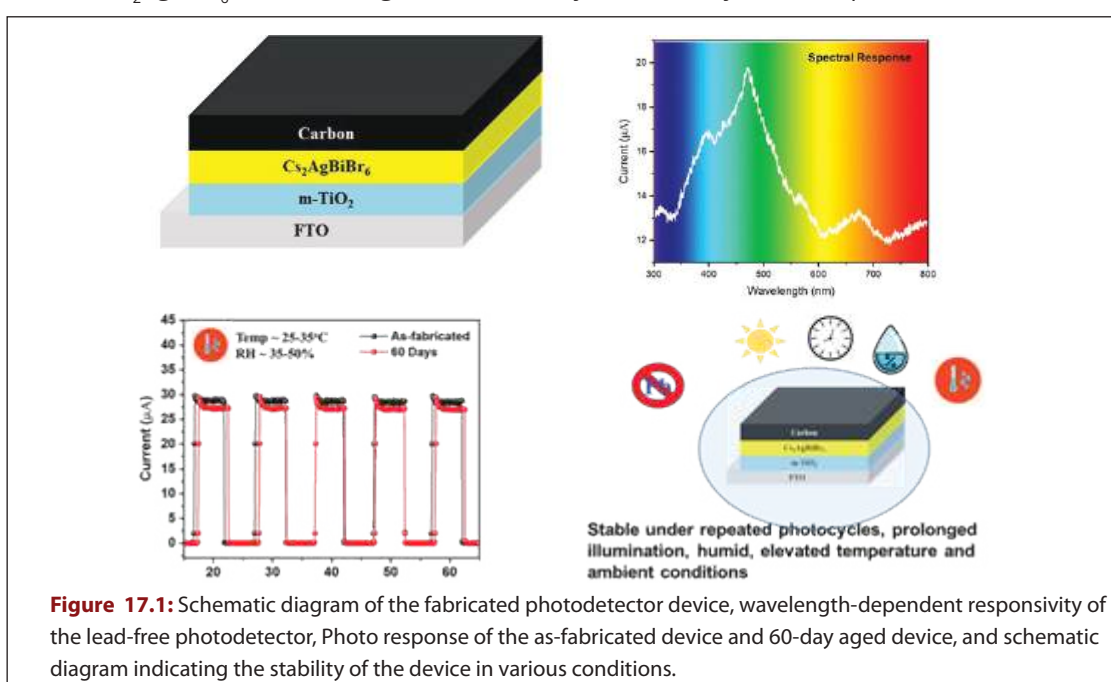


Figure 17.1: Schematic diagram of the fabricated photodetector device, wavelength-dependent responsivity of the lead-free photodetector, Photo response of the as-fabricated device and 60-day aged device, and schematic diagram indicating the stability of the device in various conditions.

Reference: AB Kumar Swamy Reddy, S Aswin Kumar, R Akash, R Easwaramoorthi, S Badhulika, G Veerappan, PH Borse, "Ambient Processed Highly Stable Self-powered Lead-free $\text{Cs}_2\text{AgBiBr}_6$ Double Perovskite Photodetector in HTM-free Architecture with Carbon as Electrode", *Solar Energy*, Vol. 283, Art. 112989, 2024

<https://doi.org/10.1016/j.solener.2024.112989>

18. Poly (Benzoquinone-Pyrrole)- MoS_2 – A Class of 2D Organic - Inorganic Hybrid Layered Catalysts for Electrochemical Hydrogen Generation

Contributors: Debdyuti Mukherjee, Ramesh Aswin, and K. Ramya

Hydrogen is attractive as a clean fuel as it can be produced directly from water and electricity (electrochemical hydrogen evolution reaction, one of the half-cell reactions in water-electrolyzers) and creates the same products (water and electricity) when utilized in a fuel cell. Electrocatalysts are often used to accelerate the kinetics of these reactions, which has led to a bloom in the field of electrocatalyst research to search for an efficient, stable, and cost-effective material. Hybrid organic-inorganic 2D electrocatalysts are presented in the current studies, which were prepared by combining two different classes of 2D layered materials: Poly (Benzoquinone-Pyrrole) polymer (BQ-Py polymer) as the organic counterpart and MoS_2 as the inorganic counterpart. The hybrid composite catalysts (named as BQ-Py- MoS_2 _NS_US and BQ-Py- MoS_2 _hyd) exhibit efficient HER activities with high durability in both acidic (aqueous 0.5 M H_2SO_4) and simulated seawater (3.5 wt.% of aqueous NaCl) solutions. The studies also reveal some kinetic parameters for electrochemical Hydrogen Evolution Reaction (HER), where it is observed that only 100 mV of extra overpotential is required for the hydrothermally formed hybrid composite to achieve 10 mA / cm^2 of current density as compared to the state-of-the-art HER catalyst (40 wt.% Pt-C). This opens an avenue to develop organic-inorganic hybrid composite catalysts for various electrochemical reactions.

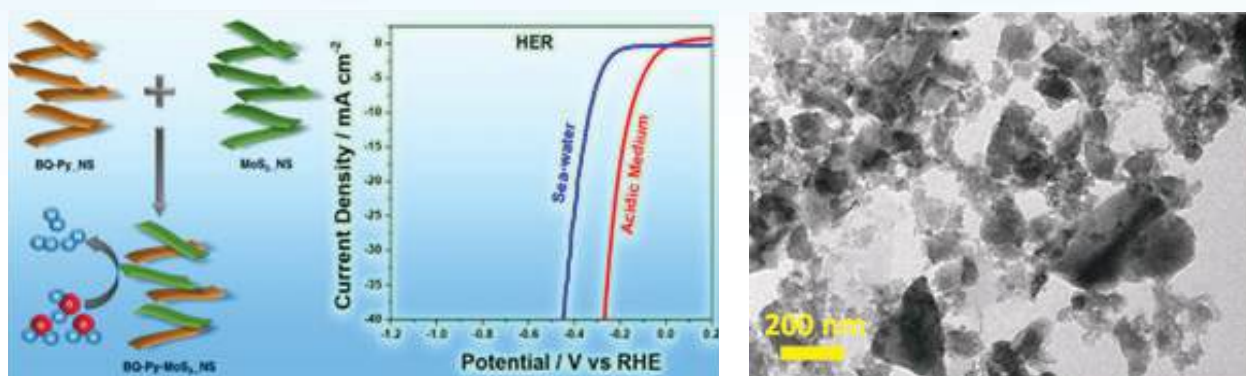


Figure 18.1: Electrochemical Performance and TEM image of BQ-Py-MoS₂ Nanosheets

Reference: Debdyuti Mukherjee, Ramesh Aswin, K Ramya, "Poly(benzoquinone-pyrrole)-MoS₂ A Class of 2D Organic–Inorganic Hybrid Layered Catalysts for Electrochemical Hydrogen Generation", ACS Applied Engineering Materials, Vol 2(10), Art. 2351–2360, 2024

<https://doi.org/10.1021/acsaenm.4c00356>

19. Patterned Noble Metal Coating on Bipolar Plates for PEM Water Electrolyzer

Contributors: R. Balaji, K. Ramya, and Sri Harsha Swarna Kumar

The reliance on noble metals and specialized materials contributes significantly to the cost associated with PEM water electrolyzer systems for Hydrogen production. In terms of cost, a detailed analysis of PEM water electrolyzers reveals that the flow field plates contribute approximately 48% to the overall cost of the stack. Typically, titanium is employed as a flow field plate; however, its affinity to oxygen leads to the formation of an oxide layer, which increases the electrical resistance.

Hence, an innovative approach involving the controlled electrodeposition of platinum (Pt) in a specific pattern, coupled with the development of a semiconductive titanium oxide layer through thermal oxidation on the Ti-alloy surface, is attempted. Also, this strategy of selective deposition of noble metal on the flow field plates can lead to stack cost reduction. The modified surface is employed as a flow field plate for a PEM water electrolysis cell, and it explores the potential of the modified Ti-alloy for enhancing the efficiency and durability of PEM water electrolysis.

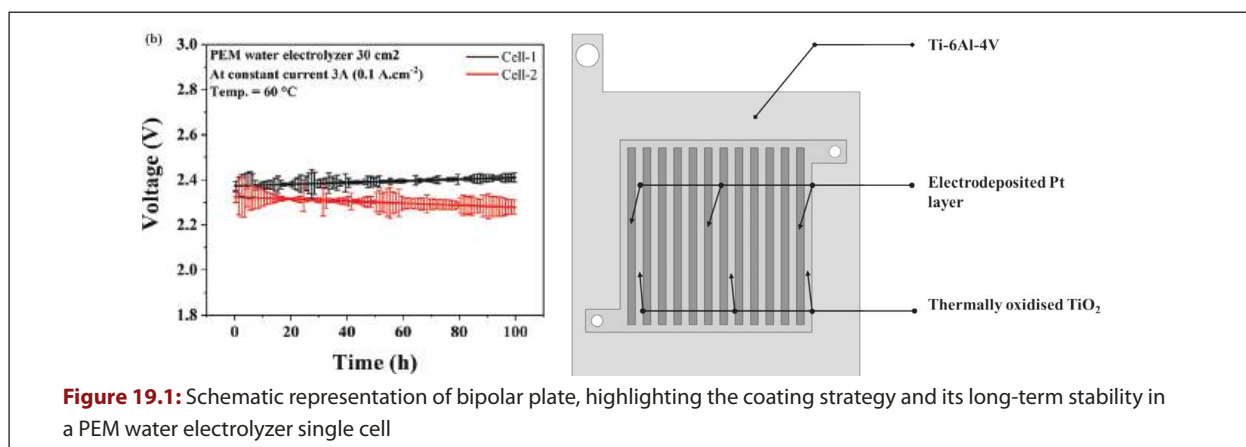


Figure 19.1: Schematic representation of bipolar plate, highlighting the coating strategy and its long-term stability in a PEM water electrolyzer single cell

Reference: Sri Harsha Swarna Kumar, R Balaji, N Lakshman, K Ramya "Patterned Pt-TiO₂ Coated Flow Field Plates in PEM Water Electrolyzers for Hydrogen Production", Journal of Solid State Electrochemistry, Vol. 28, p 4193-4205, 2024

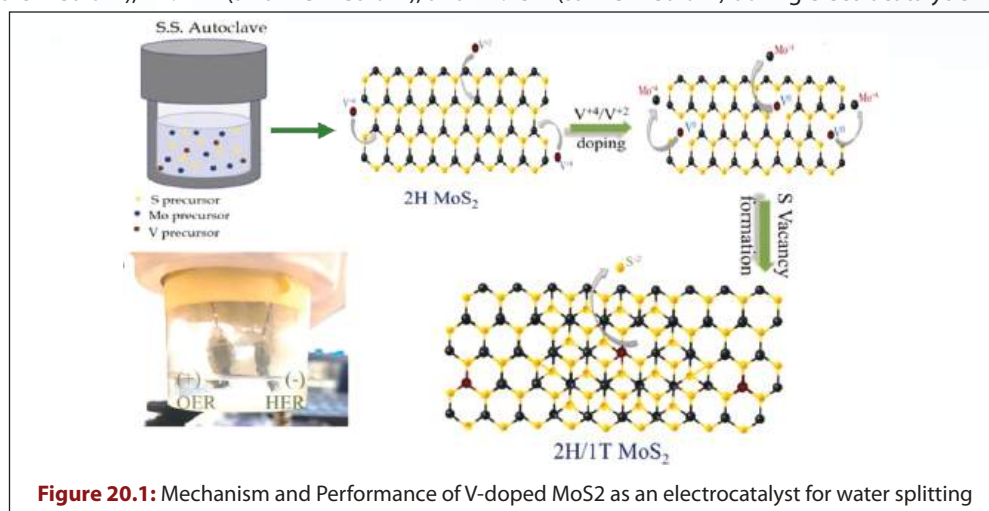
<https://doi.org/10.1007/s10008-024-06016-z>

20. Vanadium-Doped MoS₂ Nanosheets as an Efficient Cathode for Electrocatalytic Splitting of Saline Water

Contributors: Jyoti Gupta, Pramod H. Borse, and B.V. Sarada

A simple and facile single-step hydrothermal process has been approached for the synthesis of Vanadium (V) doped MoS₂ and utilized as an Hydrogen Evolution Reaction (HER) cathode during electrocatalytic splitting of acidic, alkaline, and saline water. V(II) and V(IV) co-doping results in narrowing of the electronic band gap, increasing the intrinsic conductivity of MoS₂, and optimizing the free energy for hydrogen adsorption. Moreover, V doping is also responsible for the formation of defects and sulfur vacancies, as well as a high content of 1T phase to improve the electrocatalytic activity of MoS₂ towards HER and exhibited the lowest overpotential of only 111 mV vs. Reversible Hydrogen Electrode

(RHE) (acidic medium), 218 mV vs. RHE (alkaline medium) & 266 mV vs. RHE (saline medium) at a cathodic current of 10 mA/cm² and excellent electrochemical stability. Furthermore, as HER cathode, V-MoS₂ displayed cell potential of +2.08 V (acidic medium), +2.12 V (alkaline medium), and +2.23 V (saline medium) during electrocatalytic water splitting.

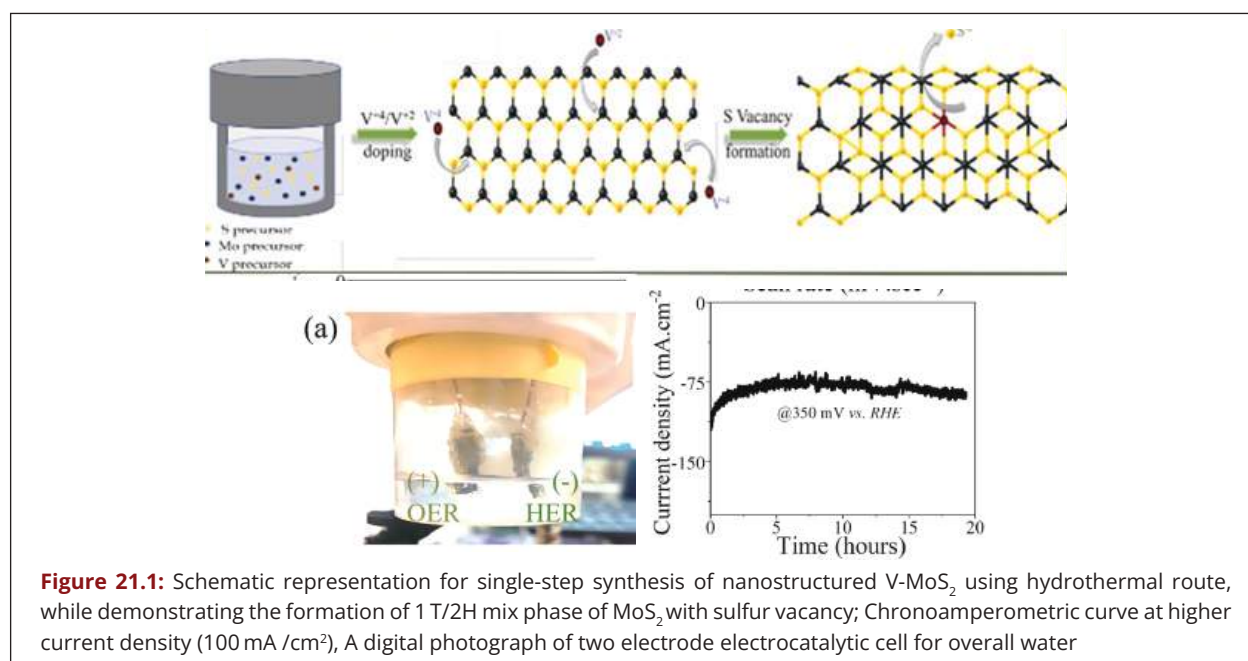


Reference: Jyoti Gupta, Dibakar Das, PH Borse, BV Sarada, "Single Step Synthesized V-doped Few Layered MoS₂ Nanosheets as an Efficient HER Cathode for Electrocatalytic Splitting of Saline Water", Journal of Alloys and Compounds, Vol. 1022, Art. 179738, 2025 <https://doi.org/10.1016/j.jallcom.2025.179738>

21. Development of Efficient, Cost-Effective, Transition-Metal-Doped 2D MoS₂ Nanosheet Electrocatalysts for Green Hydrogen Generation from Seawater

Contributors: B.V. Sarada, J. Gupta, and P.H.Borse

The development of cost-effective electrocatalysts is a key requirement for the generation and utilization of green hydrogen energy. In contrast to highly expensive platinum material, low-cost nano-sheets of 2D MoS₂ were designed by atomic doping of vanadium. Using a simple one-step hydrothermal process, V-doped MoS₂ nanosheets were engineered for high-efficiency hydrogen evolution in acidic, alkaline, and saline water. The co-doping of V(II)/V(IV) enhances the 1T metallic phase, creates sulfur vacancies, and boosts catalytic activity. The optimized catalyst achieved ultra-low overpotential (111 mV) and sustained hydrogen generation for 20+ hours. This electro-catalyst development by ARCI shows high potential for hydrogen generation from seawater in the near future.



Reference: Joyti Gupta, Dibakar Das, PH Borse, BV Sarada, "Single Step Synthesized V-doped Few Layered MoS₂ Nanosheets as an Efficient HER Cathode for Electrocatalytic Splitting of Saline Water", Journal of Alloys and Compounds, Vol. 1022, Art. 179738, 2025 <https://doi.org/10.1016/j.jallcom.2025.179738>

22. A New Low-Cost Intermetallic Boride for Thermoelectric Applications

Contributors: D. Sivaprahasam, R. Preyadarshini, and A. Kumar

AlFe_2B_2 is envisaged as a potential low-cost thermoelectric compound, never been experimentally investigated. The influence of selective doping on the structural and thermoelectric performance of AlFe_2B_2 -based intermetallic compounds was investigated in vacuum arc-melted samples. Substitution of 0.1 atomic fraction of Fe with transition and post-transition metals (Ag, Ni, Sb, Ga, and Ge) was performed to tune the microstructure, electronic transport, and thermal conductivity. X-ray diffraction and Rietveld refinement confirmed phase purity and revealed subtle changes in lattice parameters, indicating successful incorporation of dopants. The study found that each dopant uniquely influenced the electronic density of states and carrier mobility, resulting in varied Seebeck coefficients and electrical conductivities. Notably, Ga and Sb doping enhanced the power factor, while Ge doping significantly reduced the thermal conductivity due to increased phonon scattering. The optimized figure of merit (ZT) values, particularly for the Ga- and Ge-doped samples, mark a promising step towards viable thermoelectric materials operating in the mid-temperature range.

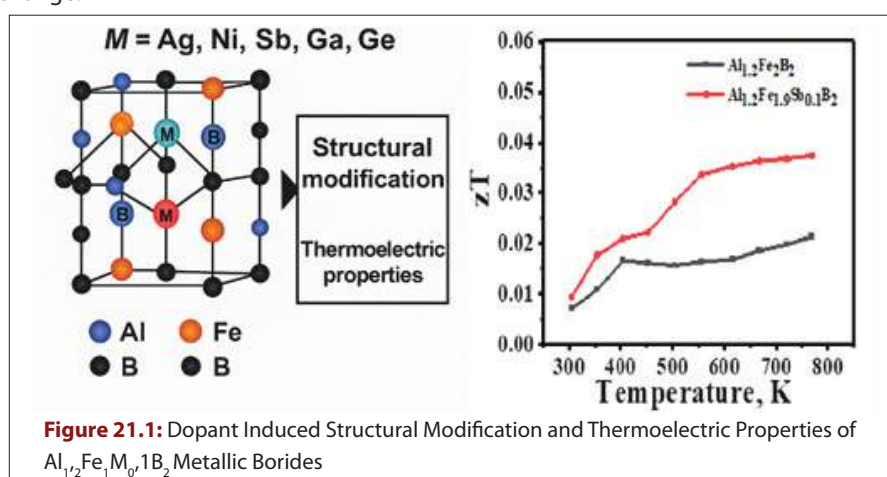


Figure 21.1: Dopant Induced Structural Modification and Thermoelectric Properties of $\text{Al}_{1/2}\text{Fe}_{1-M}0.1\text{B}_2$ Metallic Borides

Reference: D Sivaprahasam, R Preyadarshini, A Kumar, "Dopant-induced structural modifications and thermoelectric properties in $\text{Al}_{1.2}\text{Fe}_{1.9}\text{M}_{0.1}\text{B}_2$ intermetallic borides (M = Ag, Ni, Sb, Ga, Ge)", Applied Physics, Vol. 131, Art. 318, 2025 <https://doi.org/10.1007/s00339-025-08440-y>

23. Effect of pH on the Controlled Release of Benzotriazole from Halloysite Clay Nanotubes for Corrosion Protection of Mild Steel

Contributors: Aarti Gautam, Ramay Patra, K.R.C. Soma Raju, R. Subasri

Direct addition of a corrosion inhibitor such as benzotriazole (BTA) in sol-gel coatings can lead to its premature consumption over time. Hence, BTA was encapsulated into nanocontainers such as halloysite nanotubes (HNTs) before addition. Figure 23.1 shows an improved corrosion protection for BTA@HNT coatings. However, release of BTA from HNT was found to be pH-dependent, as shown in Figure (23.2). There was a sustained release at pH 10, as explained in Figure (2b) Our study showed that BTA-encapsulated HNT in sol-gel coating provides sustained corrosion protection under neutral and alkaline corrosive environments.

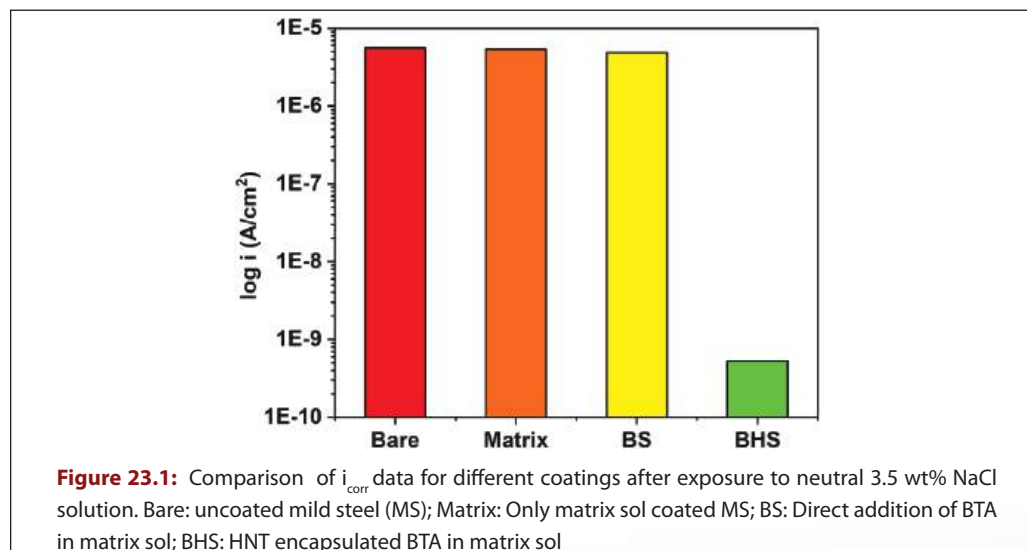
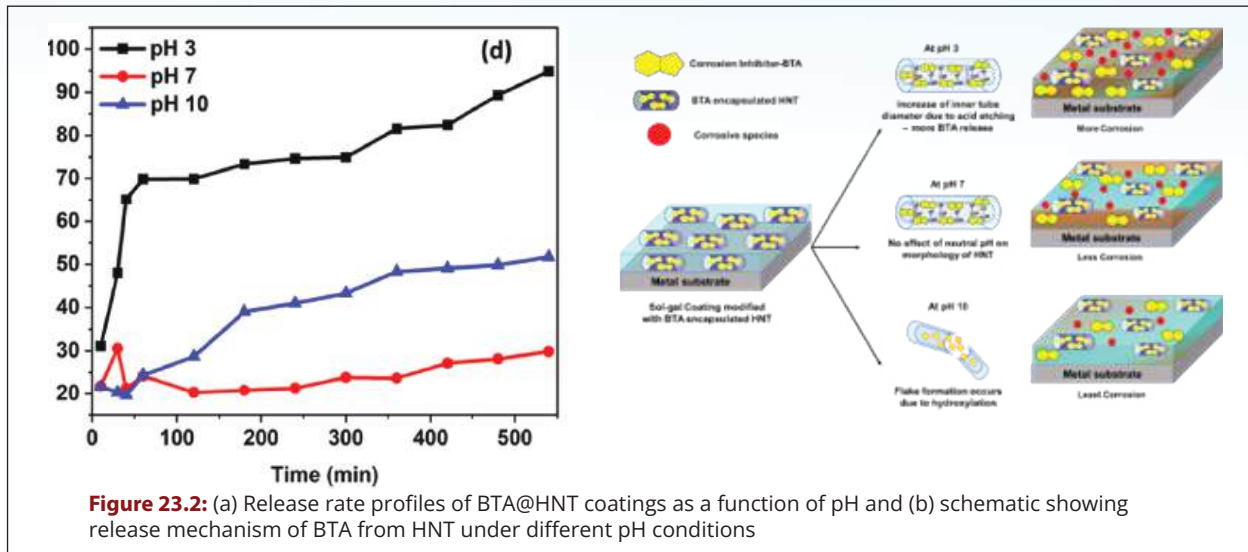


Figure 23.1: Comparison of i_{corr} data for different coatings after exposure to neutral 3.5 wt% NaCl solution. Bare: uncoated mild steel (MS); Matrix: Only matrix sol coated MS; BS: Direct addition of BTA in matrix sol; BHS: HNT encapsulated BTA in matrix sol



Reference: Aarti Gautam, Ramay Patra, KRCS Raju, KV Gobi, R Subasri, "Effect of pH on the Controlled Release of Benzotriazole from Halloysite Clay Nanotubes for Corrosion Protection of Mild Steel", *Ceramics International*, Vol. 50(22), p 45263-45277, 2024
<https://doi.org/10.1016/j.ceramint.2024.08.366>

24. Detect and Protect: Smart Dual-Functional Self-Indicating and Corrosion Inhibiting Coatings on Mild Steel

Contributors: R. Subasri, Ramay Patra, and M.M. Krishna

Smart self-indicating and corrosion-inhibiting coatings represent a breakthrough in corrosion management by enabling real-time detection and self-repair. In this study, two active fluorescent materials, fluorescein (FLUO) and 8-hydroxyquinoline (8HQ), were encapsulated within halloysite nanotubes (HNTs) and incorporated into a sol-gel matrix to develop a dual-functional smart coating on mild steel. 8HQ@HNT coating exhibited corrosion indication through blue fluorescence at the anodic site due to its sensitivity to metal ions. FLUO@HNT coating exhibited green fluorescence at cathodic regions and in addition, demonstrated superior corrosion inhibition, due to synergistic effect with HNT. These coatings can be promising for corrosion management.

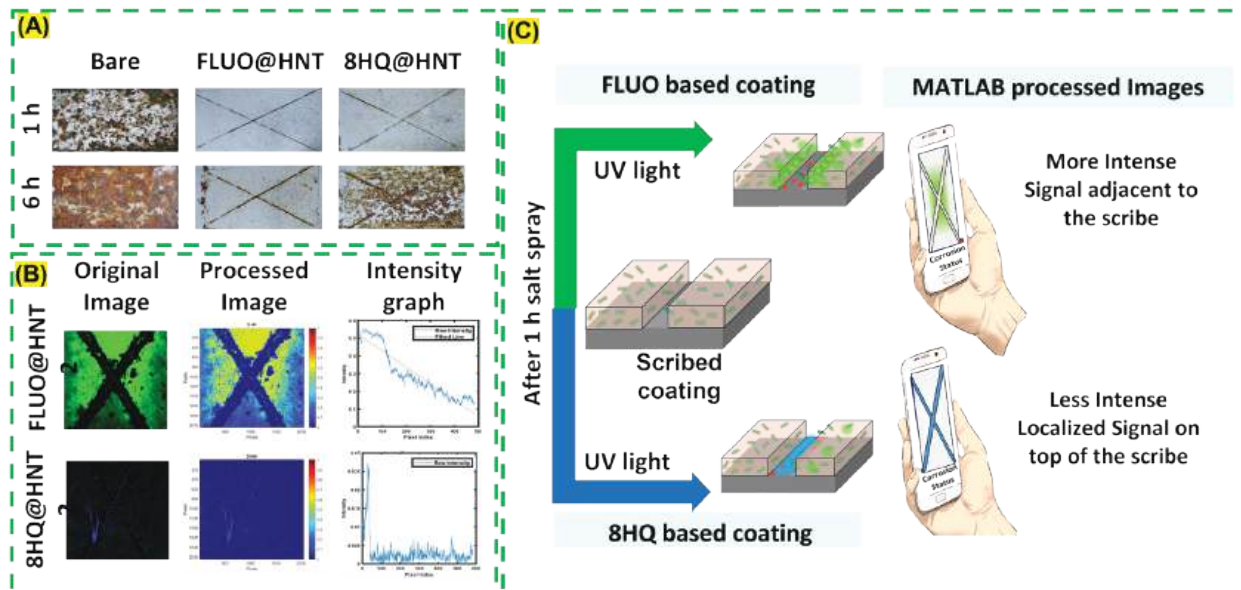


Figure 24.1: (A) Photographs of coating after different time durations of exposure to salt spray; (B) Confocal microscopic images of FLUO@HNT and 8HQ@HNT coating after 1 h of salt spray, followed by MATLAB image processing; (C) Schematic showing corrosion indication mechanism of FLUO and 8HQ

Reference: Ramay Patra, M M Krishna, KV Gobi, R Subasri, "Self-Indicating Coatings Using Fluorescent Indicators for Corrosion Detection in Mild Steel", *ACS Applied Engineering Materials*, Vol. 3(3), p 636-653, 2025
<https://doi.org/10.1021/acsaem.4c00779>

25. Spatial Microstructure in Cold-Sprayed Coatings: Influence of Material Properties

Contributors: Naveen Manhar Chavan, U.Vamshi, Akash Chavan, KV Girish, S Kumar, and JP Gautam

Due to the nature of the cold spray process, most materials sprayed are subjected to high strain and high strain rate deformation. Interestingly, this technique results in a strong gradient in the strain, strain rate, and temperature rise across an individual particle and multiple particles, with the maximum always near interfaces. The extent of this gradient depends mainly on the material being sprayed and process conditions. This gradient trickles down to the resultant final microstructure of the coatings or individual splats. This may manifest in shear localization, high-level grain refinement, defect density, and deformation twinning. In the present work, for the first time, the influence of material properties such as Stacking fault energy (SFE or γ) and Thermal diffusivity (α) on the final resultant microstructure has been rigorously studied with the former. The synergistic influence of these two properties has been studied extensively with the aid of Electron Back Scattered Diffraction (EBSD) and Focussed Ion Beam (FIB) across 7 materials with a wide variation in SFE and diffusivity. Silver, which has low SFE and high thermal diffusivity, shows a highly uniform and refined microstructure, and Nickel, with relatively high SFE and low thermal conductivity, shows localised and confined refinement, with other materials showing a mix of microstructures. An attempt was also made to estimate the fraction of recrystallized grains with material properties. The observed results also correlate well with the multi-particle simulation data, showing spatial temperature profiles across all the coatings.

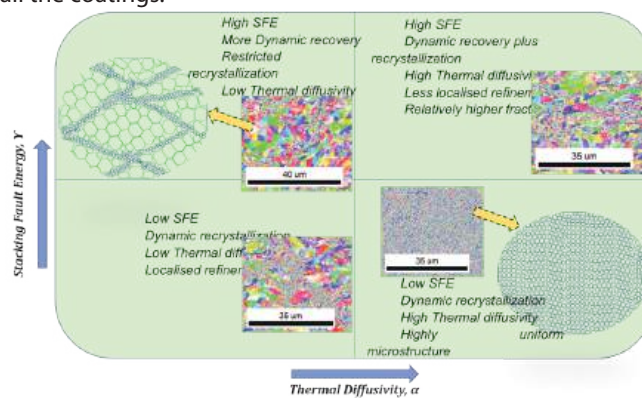


Figure 25.1: Schematic of the probable microstructure in cold sprayed coatings as a function of thermal diffusivity and stacking fault energy

Reference: Naveen M Chavan, U Vamshi, CA Naik, S Kumar, KV Girish, JP Gautam, "Spatial Microstructure in Cold Sprayed Coatings: Influence of Material Properties", Journal of Alloys and Compounds, Vol. 1021, Art. 179573, 2025

<https://doi.org/10.1016/j.jallcom.2025.179573>

26. An Insight into the Role of Boron Content and Heat Treatment on the Corrosion Behaviour of Ni–B Coatings

Contributors: B. Lavakumar, Nitin P Wasekar, and Srilakshmi

In this study, the influence of B content (0–4.69 at%) and heat treatment temperature (100–700°C) on the corrosion behaviour of electrodeposited Ni–B coatings has been investigated using electrochemical polarisation and impedance spectroscopy. The results indicate that there exists a critical boron content of ~ 0.8 at%, resulting in the best corrosion resistance irrespective of heat treatment temperature. These results were rationalised based on the characteristics of the oxide film (from depth-wise XPS analysis) and its semiconducting properties (from Mott–Schottky analysis). The role of grain boundaries and triple junctions on the corrosion behaviour has also been investigated.

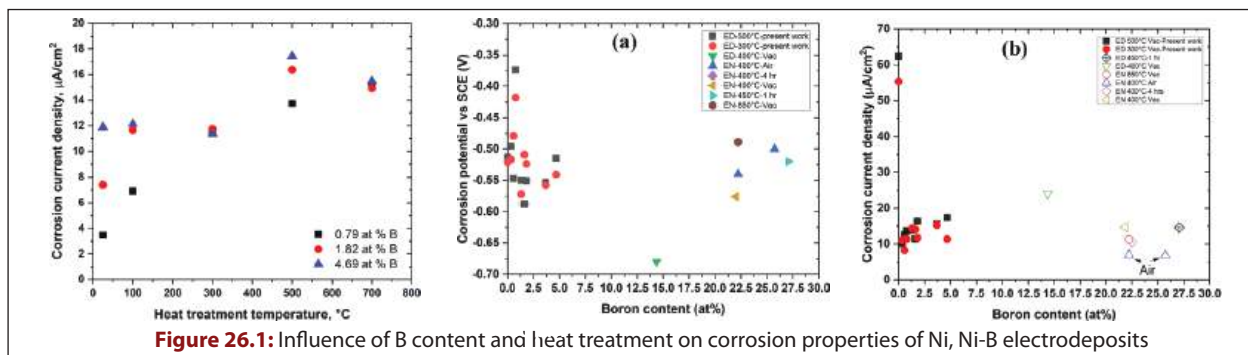


Figure 26.1: Influence of B content and heat treatment on corrosion properties of Ni, Ni-B electrodeposits

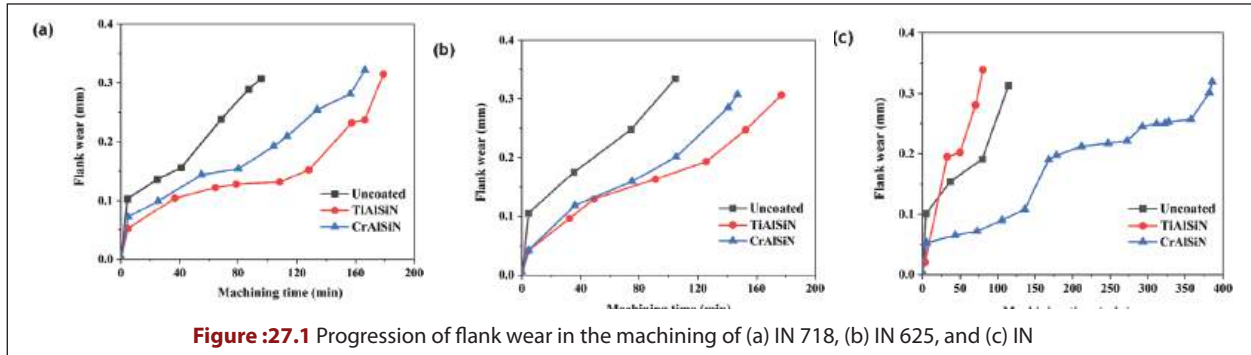
Reference: B Lava Kumar, Nitin P Wasekar, T S Srilakshmi, D Sivaprahasam, L Ramakrishna, DS Rao, "An Insight into the Role of Boron Content and Heat Treatment on the Corrosion Behaviour of Ni–B Coatings" Journal of Material Science, Vol. 59(24), p 11030-11056, 2024

<http://dx.doi.org/10.1007/s10853-024-09812-0>

27. Machining of Ni-Based Superalloys Using CAPVD Coated Carbide Tool

Contributors: N Tandekar, A Kumar, and K Valleti

This study shows that carbide tools coated with nanocomposite coatings (TiAlSiN & CrAlSiN) produced via CAPVD last longer when face milling IN 718, IN 625, and IN 617. TiAlSiN-coated tools milled IN 718, IN 625, and IN 617 with 179%, 164%, and 80% of the uncoated tool life, respectively. Similarly, the CrAlSiN-coated tool gave 155%, 150%, and 339% of the uncoated tool's life. The results of this investigation show that machining different alloys requires a selective coating. This study can assist strategic sectors in reducing super alloy machining tooling costs.



Reference: Nitin Tandekar, Aditya Kumar, Krishna Valleti, "Machining of Ni-based Superalloys using CAPVD Coated Carbide Tools", *Materials Today Communications*, Vol. 39, Art. 109101, 2024

<https://doi.org/10.1016/j.mtcomm.2024.109101>

28. Electrochemical Corrosion Behaviour of Thin and Thick WC-Co-Cr Coatings Deposited by HVAF Thermal Spray Technique

Contributors: D. Vijaya Lakshmi, P. Suresh Babu, Nitin P. Wasekar, G. Sivakumar, and M. J.N.V. Prasad

The deposition of high-performance thin WC-based cermet coatings (~50 μm thickness) using HVAF (High Velocity Air-Fuel) thermal spray technique is a viable alternative to hard chrome (HCr) plating to offer superior properties. To evaluate the corrosion resistance of thin WC-Co-Cr coatings and HCr coatings, salt spray tests were conducted following the ASTM B117 standard. The tests were carried out at exposure intervals of 96 h and 240 h.

After 240 h of exposure, the HCr specimens exhibited the formation of a greenish Cr₂O₃ layer on the surface, indicating oxidation. In contrast, the WC-Co-Cr coatings remained in an immune state, showing no visible signs of corrosion. Although a galvanic couple between the carbide and metallic matrix phases in the HVAF coatings was identified, no corrosion damage was observed, and the coatings remained intact. However, the HCr coatings showed signs of degradation, including spallation at multiple locations after 240h of exposure.

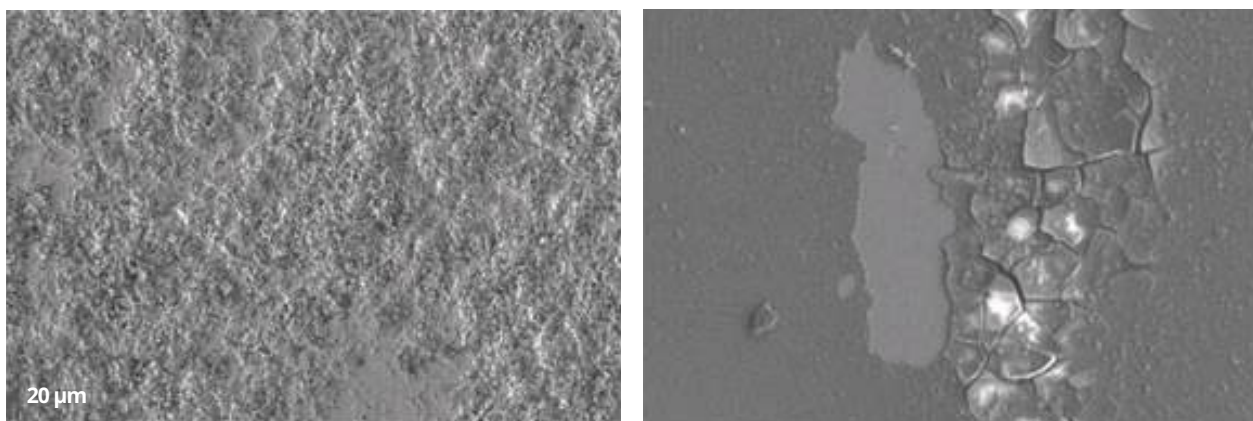


Figure 28.1: SEM micrographs of post salt sprayed specimens after 240 hrs of exposure: (a) thin (~50 μm) WC-Co-Cr coating and (b) hard chrome plated specimen showing spallation

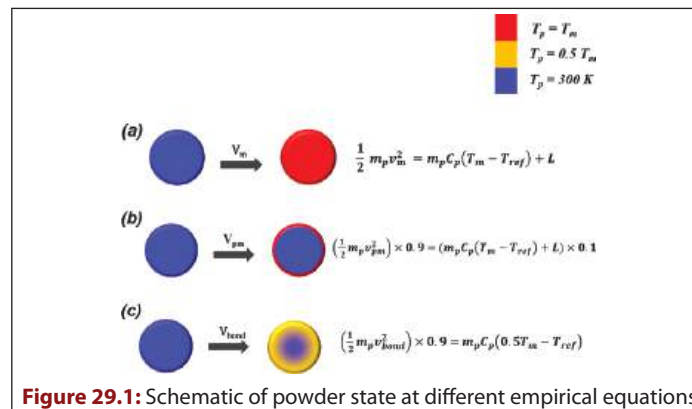
Reference: D Vijay Lakshmi, P Suresh Babu, Nitin P Wasekar, G Sivakumar, MJNV Prasad, "Electrochemical Corrosion Behavior of Thin and Thick WC-10Co-4Cr Coatings Deposited by HVAF Thermal Spray Technique", *Surface & Coatings Technology*, Vol.511, Art.132318, 2025

<https://doi.org/10.1016/j.surfcoat.2025.132318>

29. Assessing Critical Process Conditions for Bonding in Cold Spraying

Contributors: G Neelima Devi, S Kumar, and Naveen Manhar Chavan

The cold spray bonding mechanism is often correlated with adiabatic shear instability and jetting at inter-splat boundaries. In this work, the role of in-flight temperature on the deposition characteristics is synergistically addressed with the in-flight velocity of the impacting powders. The fraction of inter-splat bonding and the properties of the coatings are correlated as a function of the total energy of the powder upon impact rather than the in-flight velocity alone. The fraction of inter-splat bonding is used to obtain normalised electrical conductivity and normalised elastic modulus for a variety of materials ranging from low-melting-point zinc (Zn) to high-melting-point tungsten (W). The onset of deposition is characterized by the dimensionless parameter estimated by normalising the total energy of the impacting powder with the E_{bond} (critical energy). The data is correlated with the experimental results. For instance, the critical velocity (V_{cr}) and critical energy (E_{bond}) for bonding of copper are estimated to be 451 m/s and 27.25 μJ , respectively. One can tailor the process condition to deposit the metallic powder in cold spraying by selecting either the in-flight velocity or the in-flight temperature. The synergistic effect of velocity and temperature can be corroborated by the bonding state in cold-sprayed coatings.



Reference: G Neelima Devi, S Kumar, M Tarun Babu, G Vinay, Naveen M Chavan, A Venu Gopal, "Assessing Critical Process Condition for Bonding in Cold Spraying", *Surface & Coatings Technology*, Vol.470, Art. 129839, 2025
<https://doi.org/10.1016/j.surfcoat.2023.129839>

30. HVOF Sprayed Coatings for Tribological Applications

Contributors: G Sivakumar, M Swarna, RJ Alroy, A Kumar, and SM Shariff

Hard chrome coatings are traditionally used to enhance surface properties and restore dimensional accuracy of shafts due to their high hardness and excellent wear/corrosion resistance. However, environmental concerns, especially the release of carcinogenic hexavalent chromium (Cr^{6+}), have prompted the search for safer alternatives. High-Velocity Air Fuel (HVOF) spraying has emerged as a promising substitute, offering enhanced wear, corrosion, and oxidation resistance with higher deposition efficiency. In this study, four candidate materials were deposited as 1 mm thick coatings using HVOF. Among them, Tribaloy-400 demonstrated superior wear resistance, attributed to its intermetallic Laves phases that suppressed localized deformation and minimized material loss.



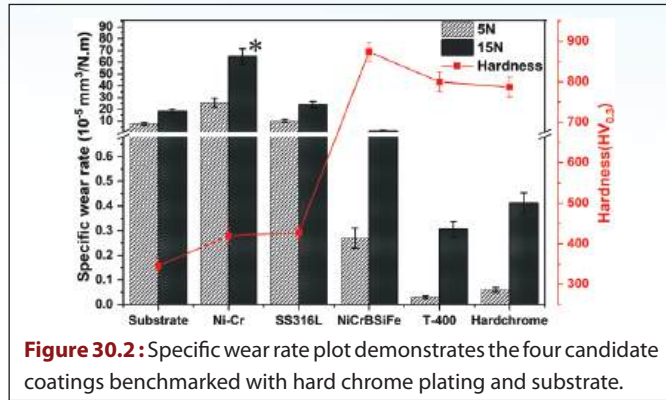


Figure 30.2: Specific wear rate plot demonstrates the four candidate coatings benchmarked with hard chrome plating and substrate.

Reference: M Swarna, G Sivakumar, RJ Alroy, A Kumar, SM Shariff, "High Velocity Air Fuel-sprayed Thick Composite Coatings for Sustainable Refurbishment of Engineering Components: A Viable Alternative to Hard Chrome Plating", Surface & Coatings Technology, Vol. 512, Art. 132410, 2025

<https://doi.org/10.1016/j.surfcoat.2025.132410>

31. Development of Fe-Based Biodegradable Alloys for Implant Applications Through Powder Bed Fusion Additive Manufacturing

Contributors: N. Hemanth Kumar, Kaliyan Hembram, Gyan Prakash Sahoo, Gururaj Telasang, B.V. Sarada, and R. Vijay

Biodegradable materials are gaining interest in environmental and biomedical fields, particularly for temporary implants like stents, bone fixators, and sutures. Unlike permanent implants such as SS 316L and Ti alloys, these materials naturally dissolve in the body, reducing the need for removal surgeries, minimizing patient risk and healthcare costs, though hypersensitivity remains a concern. Metals such as Mg, Fe, Mo, and Zn alloys are particularly promising due to their biocompatibility, safe degradation, and mechanical support. Iron-based alloys stand out for their excellent compatibility and strength; however, they have the drawback of lower degradation.

This study focuses on developing novel Fe-based biodegradable alloys and powders using vacuum induction melting and inert gas atomization, respectively, followed by laser powder bed fusion additive manufacturing (LPBF-AM), aiming for enhanced degradation, mechanical, and good biocompatibility properties. XRD analysis confirmed the presence of the austenitic phase, which is non-magnetic. Tensile testing (both vertical and horizontal samples) as per ASTM E21 and electrochemical testing were carried out to determine the mechanical properties and degradation rate. The best combination of mechanical and degradation properties was obtained: UTS (661 MPa), E (198 GPa), and elongation (29%), signifying that the samples are defect-free. Figure 31.1 shows the Tafel plot, which reveals the improved degradation rate of around 0.25 mm/year, demonstrating the advantage of the PBF-AM process. Biocompatibility test was performed as per ISO 10993-5; samples were incubated for 24 or 72 hours at 37 °C with 5% CO₂. MC3T3-C1 cells were treated with 100% and 10% extracts for 24 hours. Results showed 140% cell viability, confirming excellent biocompatibility and non-cytotoxicity. Figure (b) shows prototype STAs (more than 200 no's were built), which were additively manufactured with optimized designs featuring hollow structures for faster degradation, angled overhangs for minimal supports, and custom threads for easy insertion and strong pull-out resistance. The surface finishing of AM-built implants is being carried out by electropolishing.

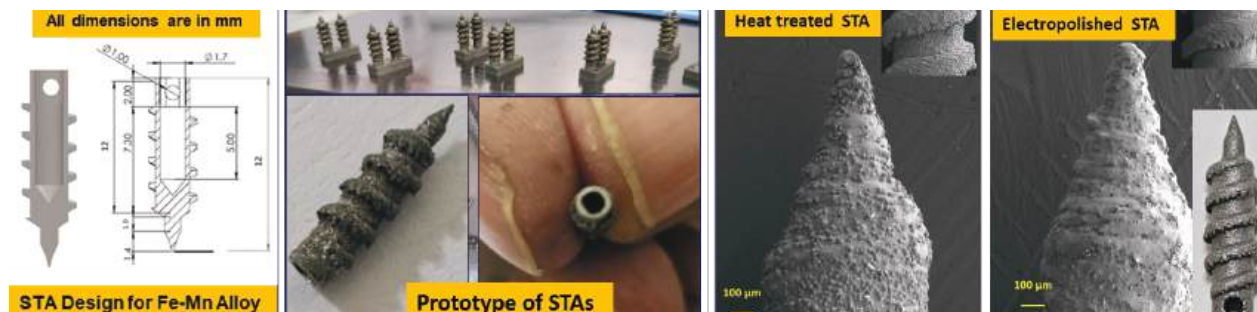
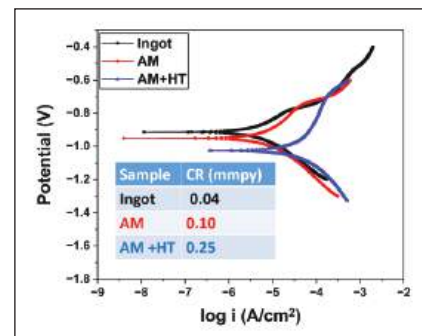


Figure 31.1: Corrosion Properties of Fe-Mn alloy BD samples and Pictures of STA built by AM process and SEM Images of heat-treated and electropolished STA

Reference: Fe-Mn based alloy composition and a method of fabricating biodegradable implants using the same, Provisional Indian Patent Filed No. 202541029825 dt 28-04-2025

32. Enhancing Enzymatic Production by Cryo-Milled α -Chitin

Contributors: S. Sudhakara Sarma, and TN Rao

α -Chitin is the most abundant naturally occurring biopolymer found in the exoskeletons of crustaceans and insects. Enzymatic hydrolysis of nano α chitin is used to produce chitooligosaccharides (COS), N-acetyl glucosamine (GlcNAc), and N, N'-diacetylchitobiose [(GlcNAc)₂]. N, N'-diacetylchitobiose has a higher commercial value in the food and medical fields. Nano-sized chitin enhances enzyme efficiency due to a higher surface area and improved substrate-enzyme interaction. However, the production of nano α -Chitin on a large scale is a challenging task. Cryo-milling offers a nano-technological solution to produce the nano α -Chitin on a large scale without a loss of functional groups and substrate breakdown. The nano α -Chitin was produced in scalable quantities at ARCI using cryo-milling with a particle size of less than 100 nm. The microstructure and performance of the nano α -Chitin are shown in Figures (a) and (b).

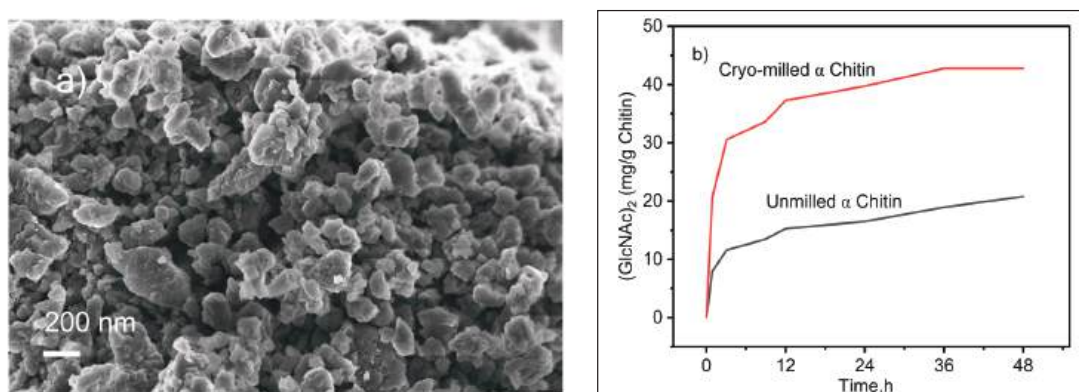


Figure 32.1: (a) Microstructure of the cryo-milled nano α -Chitin, (b) Performance of the cryo-milled nano α -Chitin in the production of (GlcNAc)₂

Reference: S Mukherjee, S Cord-Landwehr, T Swaroopa Rani, L Duhsaki, S Sudhakara Sarma, TN Rao, BM Moerschbacher, J Madhuprakash, "First Evidence of Cryo-milling Enhancing Enzymatic Production of Chitooligosaccharides from Chitin Biomass", Carbohydrate Polymers, Vol. 358, Art. 123509, 2025

<https://doi.org/10.1016/j.carbpol.2025.123509>

33. Novel In Situ Core-Shell-Based Fe-Ferrite SMCs for Low-Loss Motors

Contributors: Joydip Joardar, Malobika Karanjai, Sravan Kumar, Vajinder Singh, and Deepak Kumar

ARCI has been pursuing the development of Fe-based soft magnetic materials and composites (SMCs) for applications in low-loss motors and devices for DC and AC frequencies (50 Hz to 40 kHz). As part of these efforts, a core-shell type Fe-ferrite powders produced by controlled surface oxidation were consolidated to arrive at coupon-level products. The consolidated products were evaluated for structural and magnetic properties. DC properties @ 9000 A/m are: B_m (0.8 to 1.75 T); 800-2500 permeability with coercivity : <5 Oe, core-loss: 12 W/kg @ 50Hz. AC losses @15kHz @ B_m 20 mT is 70 W/kg, whereas @ 40kHz @20mT: 223 W/kg, comparable to literature values with much less shell thickness.

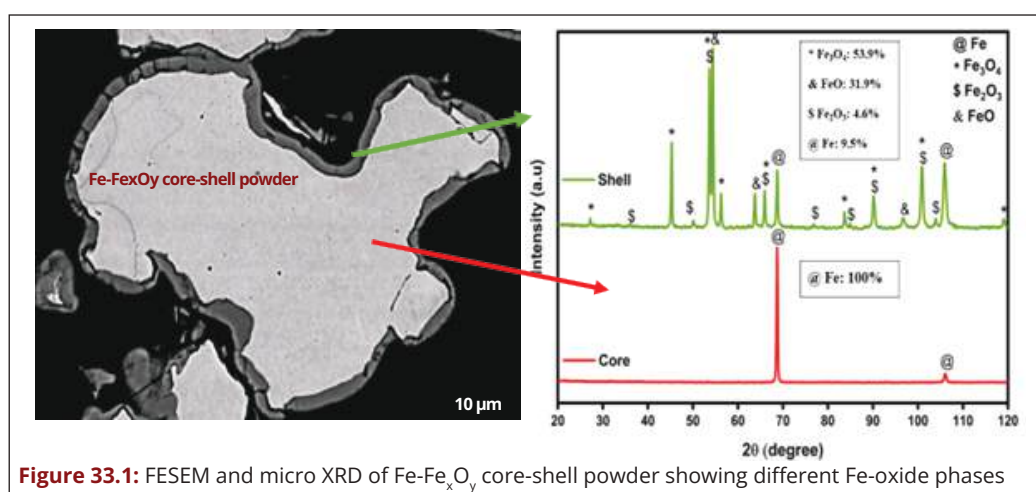


Figure 33.1: FESEM and micro XRD of Fe-Fe_xO_y core-shell powder showing different Fe-oxide phases

Reference: JS Kumar, Deepak Kumar, Vajinder Singh, Joydip Joardar, Malobika Karanjai, "Novel In-situ Core Shell Structured Fe-ferrite Soft Magnetic Composite Powder Processed by Controlled Oxidation", Advanced Powder Technology, Vol. 36(2), Art. 104779, 2025 <https://doi.org/10.1016/j.apt.2024.104779>

34. High-Temperature Oxidation Behaviour of $Nb_x(MoTaW)_{(1-x)}$ Refractory Multicomponent Alloys

Contributors: Anjali Kanchi, Vijayaraghavan Ganesan, and Ravi C. Gundakaram

Refractory multicomponent alloys offer the potential for use as better substitutes for certain superalloys in applications such as rocket engine nozzles and turbine blades. One of the important properties that needs to be studied at elevated temperatures is oxidation. In this work, we have synthesized alloys with compositions $Nb_x(MoTaW)_{(1-x)}$ ($x=0.25, 0.4, 0.55,$ and 0.7 at%) and carried out oxidation studies at 873 K, 973 K, and 1073 K for durations of up to nine hours. Alloys with lower Nb content showed better resistance to oxidation. Surface morphology of the alloys consists of cracks, bursts, and pores. The alloy with high Nb content showed greater spallation of the oxide layer, indicating lower oxidation resistance. High-resolution imaging showed the formation of nano-sized rod-shaped particles.

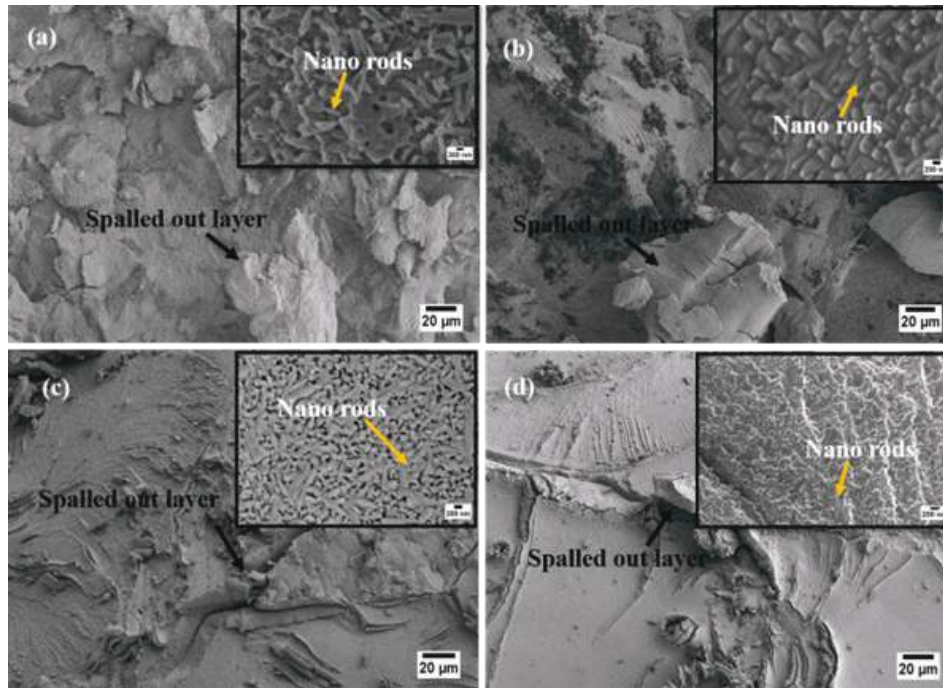


Figure 34.1: SEM images of a) Nb0.25, b) Nb0.4, c) Nb0.55, and d) Nb0.7 RMCAs that were oxidized at 1073 K for 9 h. The insets show high magnification in-lens images. The presence of nano-rods is indicated.

Reference: K Anjali, R Koteswararao, G Vijayaraghavan, G Ravi Chandra, "High-temperature Oxidation Behavior of $Nb_x(MoTaW)_{(1-x)}$ ($x=0.25, 0.4, 0.55,$ and 0.7) Refractory Multicomponent Alloys", *Intermetallics*, Vol.177, Art. 108604, 2024

<https://doi.org/10.1016/j.intermet.2024.108604>

35. Enhancing Tribological Performance of Gray Cast Iron by Laser Surface Texturing

Contributors: Ravi Bathe and D Nazeer Basha

This study demonstrates a significant enhancement in dry sliding tribological performance of gray cast iron through laser surface texturing (LST) using micro-grooves and micro-crosshatches. Employing a cost-effective nanosecond laser ($\lambda = 527$ nm), textured surfaces exhibited valley-like features and exposed graphite flakes that acted as solid lubricants. The optimized textures reduced the coefficient of friction by up to 92.6% and wear rate by 96.1% compared to untextured samples. These benefits stem from improved debris trapping, reduced contact area, and enhanced surface hardness due to rapid solidification effects.

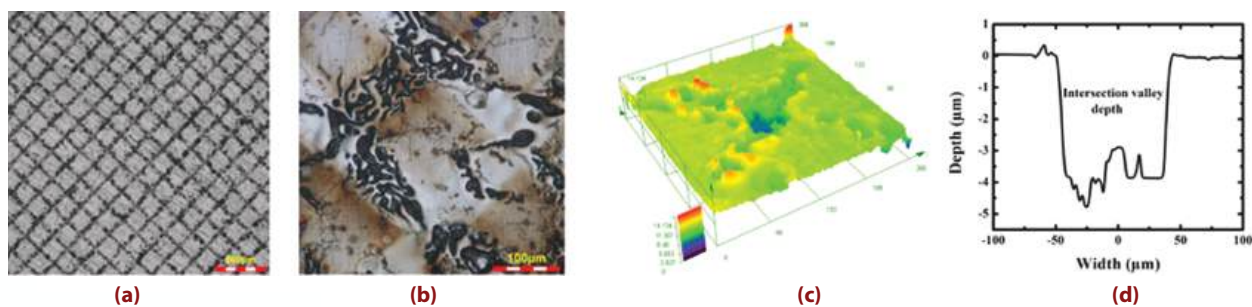
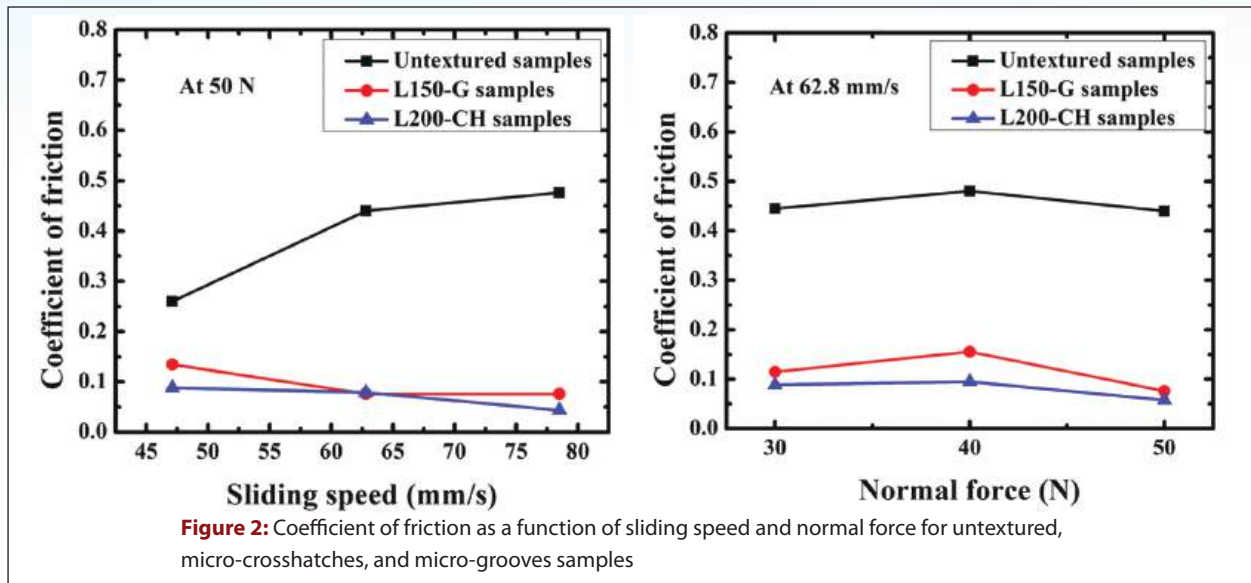


Figure 35.1: Morphology of the L200-CH sample (a) Micro-crosshatches, (b) single micro-crosshatch with opened graphite flakes, (c) 3D profile of single micro-crosshatch, and (d) intersection valley depth profile



Reference: D Nazeer Basha, GL Samuel, Ravi Bathe, "Enhancing Tribological Performance of Gray Cast Iron by Laser Surface Texturing of Micro-grooves and Micro-crosshatches", *Journal of Materials Engineering and Performance*, Vol.34(11), p 9878-9887, 2024

<https://doi.org/10.1007/s11665-024-09860-2>

36. Ultrafast Laser-Based Microchannel Fabrication on Stainless Steel

Contributors: Ravi Bathe and Dudekula Nazeer Basha

This study investigates the precise fabrication of microchannels in AISI 304 stainless steel using femtosecond laser micromachining. Two ablation regimes, gentle and strong, were identified, with an ablation threshold fluence of 0.16 J/cm^2 . Optimal conditions (100 mW laser power, 30 mm/s scan speed, $5 \mu\text{m}$ transverse overlap) yielded smooth, uniform channels suitable for biomedical and thermal applications. The vertical scan strategy and nitrogen shielding minimized surface defects and oxidation. These findings aid in engineering microscale fluidic and heat-exchange components with high precision and minimal thermal damage.

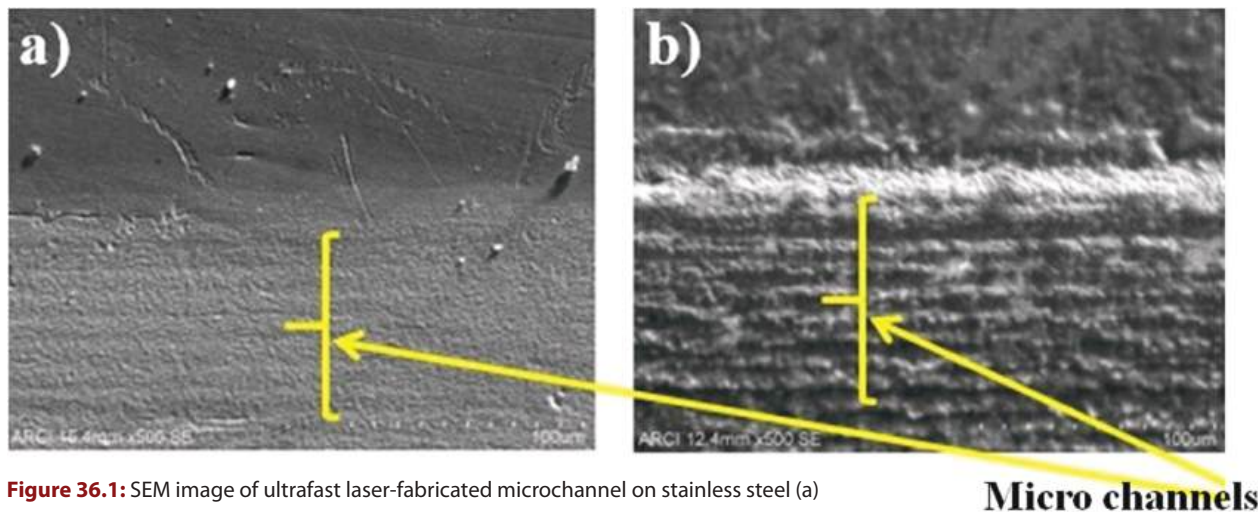


Figure 36.1: SEM image of ultrafast laser-fabricated microchannel on stainless steel (a) 100 mW, and (b) 1000 mW at 30 mm/s, $5 \mu\text{m}$ overlap

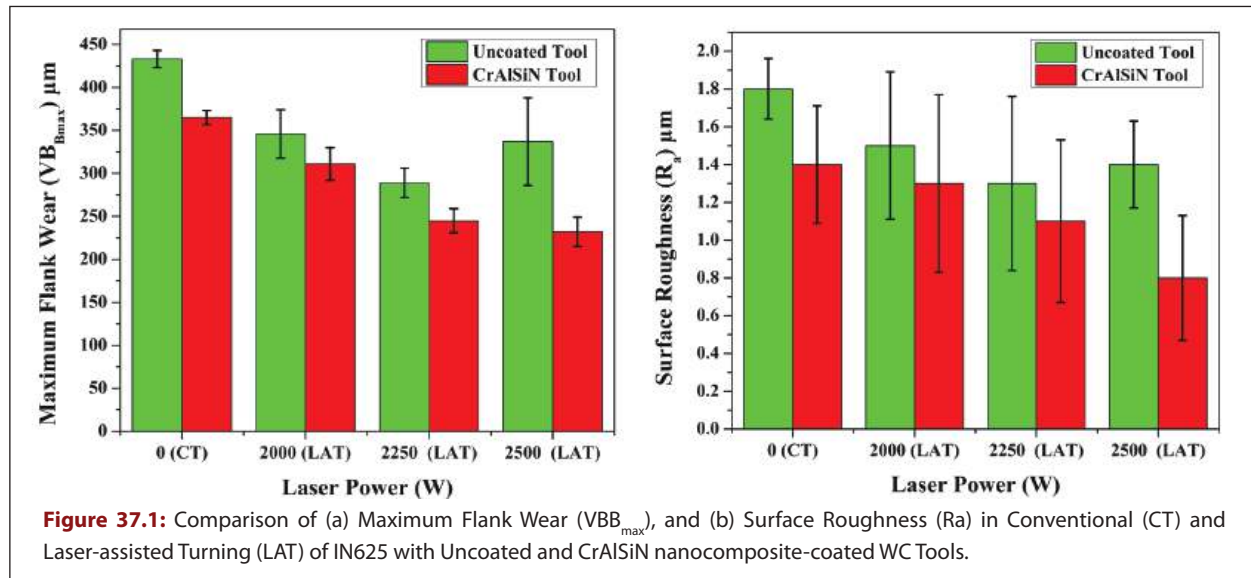
Reference: D Nazeer Basha, GL Samuel, Ravi Bathe, "Investigation of Ablation Threshold and Microchannel Fabrication on Stainless Steel using Ultrafast Laser", *Materials and Manufacturing Processes*, Vol. 40(2), p 231-241, 2025

<https://doi.org/10.1080/10426914.2024.2419090>

37. Laser-Assisted Turning of IN625 Superalloy Using CrAlSiN Nanocomposite Coatings

Contributors: Amarendhar Rao, Manish Tak, Krishna Valleti, and Ravi Bathe

Laser-Assisted Turning (LAT) of IN625 alloy using CrAlSiN nanocomposite-coated WC tools demonstrated substantial performance improvement over conventional turning. Optimized laser preheating (2250–2500 W) softened the workpiece above 850 °C, reducing cutting forces by up to 77%, flank wear by 46%, and surface roughness by 56%. The CrAlSiN coatings provided superior thermal stability and wear resistance, minimizing microchipping and adhesion-related tool failure. These advancements position LAT as a viable solution for machining difficult superalloys in the aerospace and power sectors.



Reference: Amarendhar Rao, Manish Tak, Narasimha Rao, Krishna Valleti, Ravi Bathe, "Investigations on Laser-assisted Turning of IN625 Alloy with Hot Hardness Approach using Uncoated and CrAlSiN Coated WC Tools", Proceedings of the Institution of Mechanical Engineers Part E-Journal of Process Mechanical Engineering, 2024

<https://doi.org/10.1177/09544089241279232>

38. Additive Manufacturing of AISI H13 Tool Steel with Enhanced Build Rates and Mechanical Properties

Contributors: D.M. Santhoshsarang, Gururaj Telasang, K. Divya, and Ravi Bathe

Using Powder Bed Fusion–Laser Beam Melting (PBF-LB/M), AISI H13 tool steel was successfully additively manufactured with optimized high-power (250–300 W) and high-speed (1000–1200 mm/s) parameters, achieving a build rate of up to 14 cm³/h and relative density >99.5%. The as-built microstructure featured fine lath martensite with minor retained austenite, yielding exceptional tensile strength (~2 GPa) and hardness (575 HV). Post-build heat treatment refined the microstructure into tempered martensite with dispersed carbides, improving ductility (16%). This work paves the way for commercial-scale fabrication of die-casting tools with conformal cooling.

Reference: DM Santhoshsarang, S Narayanaswamy, Gururaj Telasang, K Divya, Ravi Bathe, GL Samuel, "Additive Manufacturing of AISI H13 Tool Steel with Combinations of Higher Laser Power and Scan Speed: Microstructural and Mechanical Properties Insights", Journal of Materials Engineering and Performance, Vol. 34(16), p 17491-17502, 2025
<https://doi.org/10.1007/s11665-024-10467-w>

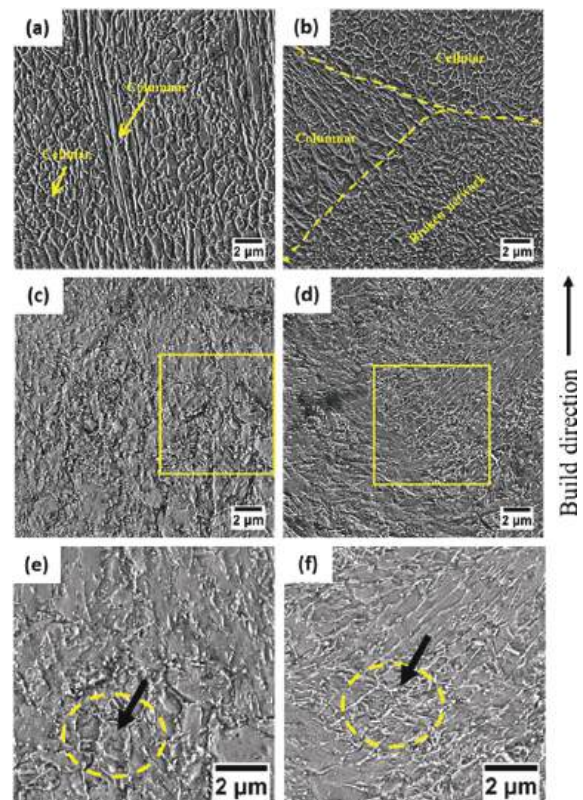


Figure 38.1: SEM micrographs of AM AISI H13 tool steel for different conditions (a) P1, (b) P2, (c) & (e) P1H and (d) & (f) P2-H

39. Joint Design Influence on Hybrid Laser Arc Welding of Maraging Steel (M250)

Contributors: L. Subashini and K.V. Phani Prabhakar

Hybrid laser arc welding (HLAW) was employed for single-pass joining of 10 mm thick M250 maraging steel using Y-groove joints with varying included angles (16°, 24°, 30°). Lower included angle (16°) joints exhibited reduced heat input (817 J/mm), minimal solute segregation, and lower reverted austenite (RA) content, enhancing weld toughness ($K_{Ic} = 77.5 \text{ MPa}\sqrt{\text{m}}$). As the heat input increased, RA content rose, reducing fracture toughness. A fine-grained laser fusion zone exhibited high strength but lower toughness due to closely spaced RA pools. Optimal parameter selection enabled strong, defect-free welds with improved mechanical performance.

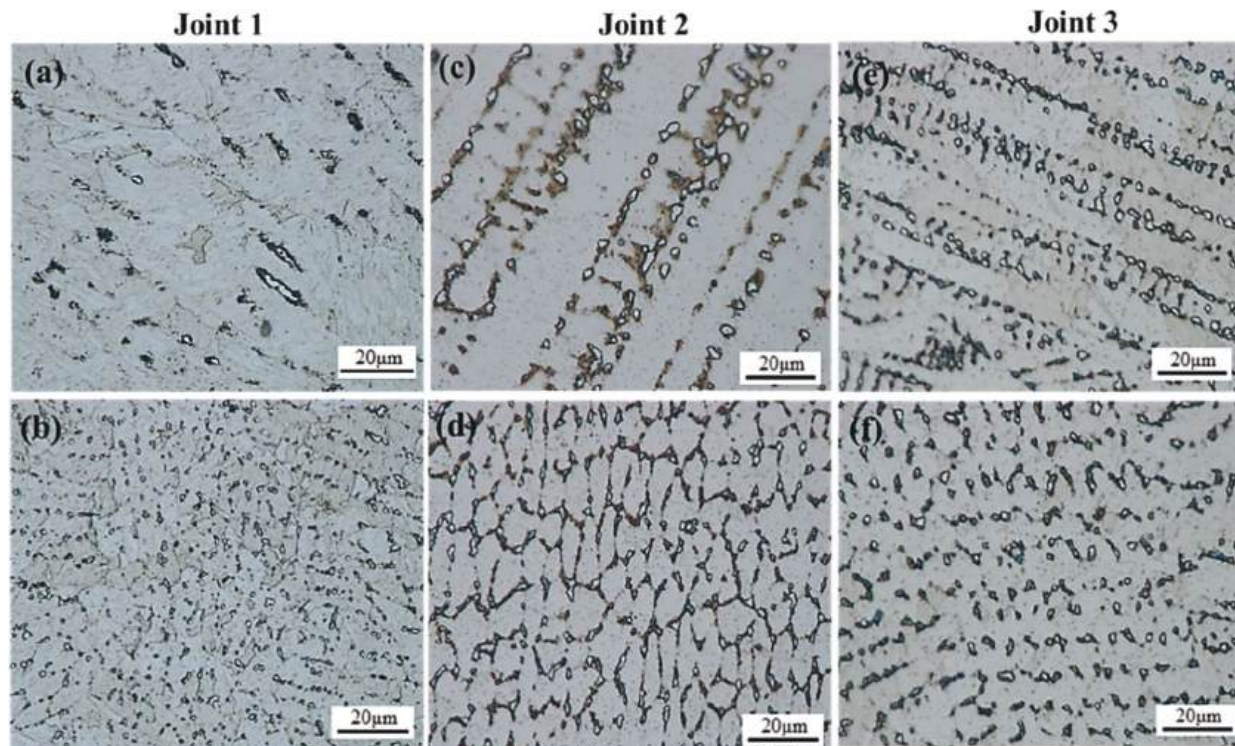


Figure 39.1: Aged fusion zone optical micrographs showing white pools of RA at inter-cellular or inter-dendritic regions: a, c, and e AFZ of joints 1, 2, and 3, respectively, and b, d, and f LFZ AFZ of joints 1, 2, and 3, respectively, at $\times 2220$ magnification

Reference: L Subashini, KVP Prabhakar, Swati Ghosh, "Joint Design Influence on Hybrid Laser arc Welding of Maraging Steel", Vol. 68(6), p 1611-1624, 2024

<https://doi.org/10.1007/s40194-024-01751-3>

40. Fabrication of Superhard Titanium Boride Coating on Titanium by High-Power Diode Laser Alloying with Amorphous Boron Preplacement

Contributors: S.M. Shariff

A Titanium boride (TiB/TiB_2) composite coating was successfully fabricated on commercially pure titanium using high-power diode laser alloying with amorphous boron preplacement. The rapid heating and self-quenching process induced in-situ crystallization of boron and formation of hard TiB dendrites and TiB_2 phases. The resulting coating showed heterogeneous microstructures, extreme surface hardness ($\sim 4700 \text{ HV}$), and a four-fold improvement in wear resistance. Phase formation was confirmed via XRD and thermodynamic calculations ($\Delta G \approx -250 \text{ kJ/mol}$; activation energy $\approx 140 \text{ kJ/mol}$), confirming spontaneous Self-propagating High-temperature Synthesis (SHS)-like reactions during alloying.

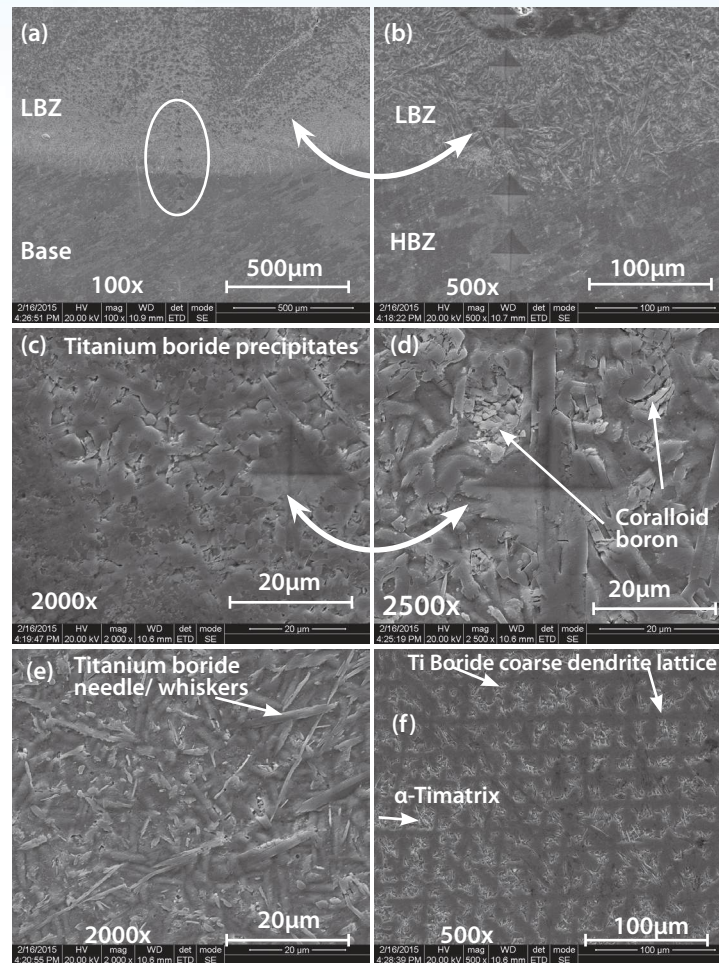


Figure 40.1: SEM micrographs of borided titanium cross section formed by the laser alloying of amorphous boron preplacement with titanium: (a) thick coating at 3 k W (b) fine dendrites in region close to the interface, (d, e) fine dendrites and thick boride precipitates, (e) titanium boride and martensite and (f) coarse dendrites at the heat affected zone region.

Reference: K Monisha, SM Shariff, A Sekar, R Raju, J Manonmani, J Senthilvelan, "Titanium Boride Coating by High Power Diode Laser Alloying of Amorphous Boron with Titanium and its Surface Property Investigations", *Optics and Laser Technology*, Vol. 170, Art. 110159, 2024

<https://doi.org/10.1016/j.optlastec.2023.110159>

41. Influence of Optical Inhomogeneities on Electrical Performance of LAS Glass-Ceramics at Elevated Temperatures

Contributors: Papiya Biswas, M. Buchi Suresh, Prasenjit Barick, Dulal Chandra Jana, and Bhaskar Prasad Saha

Lithium aluminosilicate (LAS) glass-ceramics are valued for their low thermal expansion, high thermal stability, and optical clarity, making them suitable for aerospace, high-energy optics, and precision applications. In this study, LAS glass-ceramics were fabricated using the melt casting method and investigated for the effect of striae, i.e., localized optical inhomogeneities, on their dielectric and electrical properties at elevated temperatures. Two types of samples were prepared: one with striae (LAS-WS) and another striae-free (LAS-WoS), distinguished by stress birefringence levels above and below 10 nm/cm, respectively. Both samples underwent identical heat treatment to induce β -spodumene crystallization. Dielectric measurements revealed a frequency-dependent behaviour in both samples, with the dielectric constant decreasing from 400 at low frequencies to 10 at 1.2 MHz. While LAS-WS exhibited a slightly higher dielectric constant at low frequencies, the high-frequency behaviour remained largely unaffected by striae. AC conductivity and impedance spectroscopy indicated that electrical conduction is dominated by ion migration and grain boundary effects, which becomes more pronounced with increasing temperature. The ionic conductivity increased from $\sim 2 \times 10^{-3}$ S/cm at 300°C to $\sim 7 \times 10^{-3}$ S/cm at 700°C, with both samples showing comparable activation energies (~ 0.63 eV), implying thermally activated conduction. Although striae slightly altered the dielectric response at lower frequencies, the overall impact on high-temperature conductivity and dielectric performance was minimal. These findings suggest that LAS glass-ceramics, even with moderate striae, maintain reliable electrical properties suitable for high-temperature applications, affirming their potential use in optoelectronics, precision instruments, and thermal insulation systems.

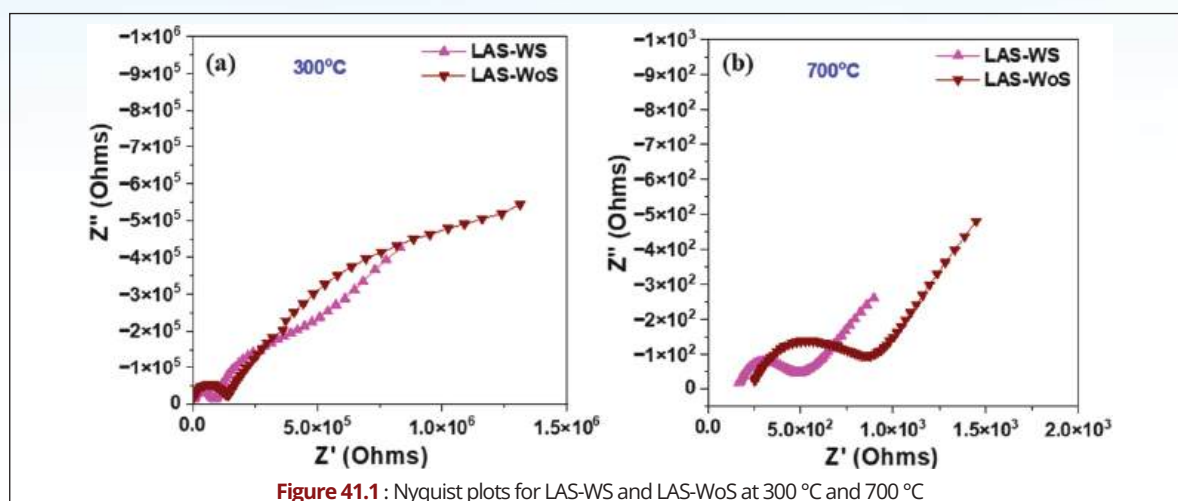


Figure 41.1 : Nyquist plots for LAS-WS and LAS-WoS at 300 °C and 700 °C

Reference: M Buchi Suresh, Papiya Biswas, DC Jana, C Venkateswaran, MK Gupta, BP Saha, Roy Johnson, "Effect of Striae on the High Temperature Dielectric and Electrical Properties of Lithium Aluminosilicate Glass-ceramics", *Ceramics International*, Vol. 50(17), p 30393-30401, 2024

<https://doi.org/10.1016/j.ceramint.2024.05.335>

42. Effect of Zn and Gd Dopants in the Ceria Matrix as an Ionic Conducting Electrolyte for LT-SOFC Applications

Contributors: M Buchi Suresh and B P Saha

Solid oxide fuel cells, or SOFCs, have drawn worldwide attention from the research community due to their remarkable conversion efficiency, low emissions, and versatility in terms of fuels. Since yttria-stabilized zirconia (8YSZ) electrolytes are used in conventional SOFCs, high operating temperatures (800-1000°C) are necessary. However, problems like interfacial reactions and thermal incompatibility occur at such temperatures. To address this challenge, an alternative solid electrolyte is necessary with better conductivity at lower temperatures, which can replace 8YSZ. This study focuses on zinc-doped ceria (ZDC) and gadolinium-doped ceria (GDC) to explore their potential for improved performance. In this work, the co-precipitation-hydrothermal method was used to obtain low-cost $Gd_xCe_{1-x}O_2$ (GDC) and $Zn_xCe_{1-x}O_2$ (ZDC) composites (NC). The ZDC and GDC composites were further characterized using XRD, TEM, and EIS (Electrochemical Impedance Spectroscopy). The XRD analysis revealed that the ZDC and the GDC samples showed the formation of a single cubic fluorite structure. FTIR spectra confirmed the formation of ZDC and GDC composites. Furthermore, XPS data confirmed the oxidation states of Zn^{2+} , Ce^{4+} , and Ce^{3+} along with the different oxygen species. The conductivity increased with the temperature for the ZDC samples, with the highest conductivity value exhibited by the ZDC30 composite. Furthermore, the activation energy decreases by increasing the dopant, which implies a tunable ionic conduction mechanism. The ionic conductivity calculated for ZDC electrolytes at two distinct temperatures was 0.146 and 0.141 S/cm for 500°C and 600°C, respectively. These findings provide new insights into optimizing ceria-based electrolytes, offering a promising pathway for next-generation energy materials.

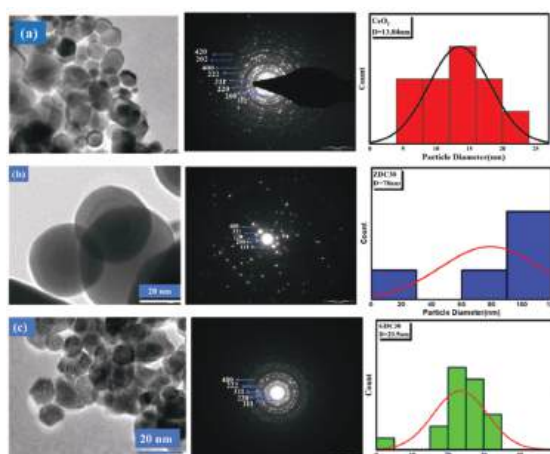


Figure 42.1: TEM images with SAED patterns of CeO_2 , ZDC, and GDC nanocomposites

Reference: N Kavita, Buchi Suresh, P Sharma, "An Experimental Insight into the Zn and Gd Dopants Impact on CeO_2 Electrolyte for LT-SOFC Applications", *International Journal of Hydrogen Energy*, Vol. 117, p 168-175, 2025

<https://doi.org/10.1016/j.ijhydene.2025.03.175>

43. Enhanced UV-NIR Detection in Si Photodetectors Using Core-Shell Quantum Dots

Contributors: PH Borse and B Kumar Swamy Reddy

Photodetection is the most important aspect of life in our modern-day life, for various commercial and defence applications. A broadband, high-responsivity Si photodetector was developed via solution-processed integration of CdZnS/ZnS core-shell and CsPbBr₃ perovskite Quantum Dots (QDs). CdZnS/ZnS QD-sensitized devices demonstrated superior performance with responsivity up to 391 mA/W, detectivity of 1.37×10^{13} Jones, and stable operation across 300–1100 nm. Enhancements were attributed to spectral downshifting, anti-reflection, and space charge effects. The fabrication approach is CMOS-compatible and scalable for future optoelectronic and machine vision applications.

Quantum dot integrated Si photo-detectors find tremendous applications in communication, remote sensing, safety and security, process control-automation, environmental sensing, astronomy, defence, etc.

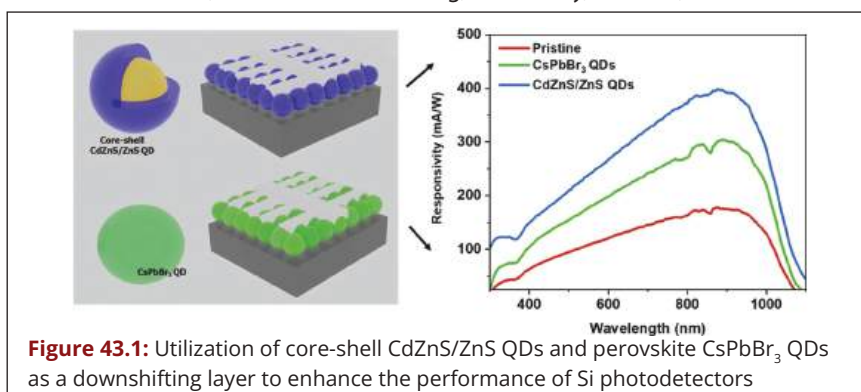


Figure 43.1: Utilization of core-shell CdZnS/ZnS QDs and perovskite CsPbBr₃ QDs as a downshifting layer to enhance the performance of Si photodetectors

It reveals that apart from the downshifting effect of QDs, the anti-reflective properties of the QD layers and the formation of a space charge region at the Si-QD interface also contributed to the enhancement

Reference: B Kumar Swamy Reddy, MF Abdelbar, W Jevasuwan, Z Qinqiang, PH Borse, S Badhulika, N Fukata, "Enhancing Silicon Photodetector Performance through Spectral Downshifting using Core-shell CdZnS/ZnS and Perovskite CsPbBr₃ Quantum Dots", Nano Energy, Vol. 128, Art. 109832, 2024

<https://doi.org/10.1016/j.nanoen.2024.109832>

44. Economic Fabrication of Fast, Solution-Processed Self-Biased Photodetector Based on Cu₂SnS₃ / TiO₂ Nanorod Heterojunctions

Contributors: P.H.Borse, V. Ganapathy, and B. Kumar Swamy Reddy

A broader range UV-VIS-NIR Photodetector is a crucial component in modern-day IOT devices, as they find various applications in cyber-physical space for interfacing the Cyber to Real space domain components, especially in photo-integrated devices. Photo-detector device converts the UV, Visible, and NIR light photons into related electrical output. A novel zero-bias photodetector based on a solution-processed Cu₂SnS₃ (CTS)/TiO₂ nanorod p-n heterostructure was developed. The device integrates TiO₂ nanorods (hydrothermally grown) with CTS (chemical bath deposited), forming a conformable junction for efficient charge transport. It demonstrates high responsivity (50 mA/W at 0V), low dark current (477 nA), excellent ON/OFF ratio (33), and fast response (~40 ms), making it promising for environmental monitoring, portable electronics, and medical diagnostics. This photodetector prototype portrays a high and viable scope towards commercialization.

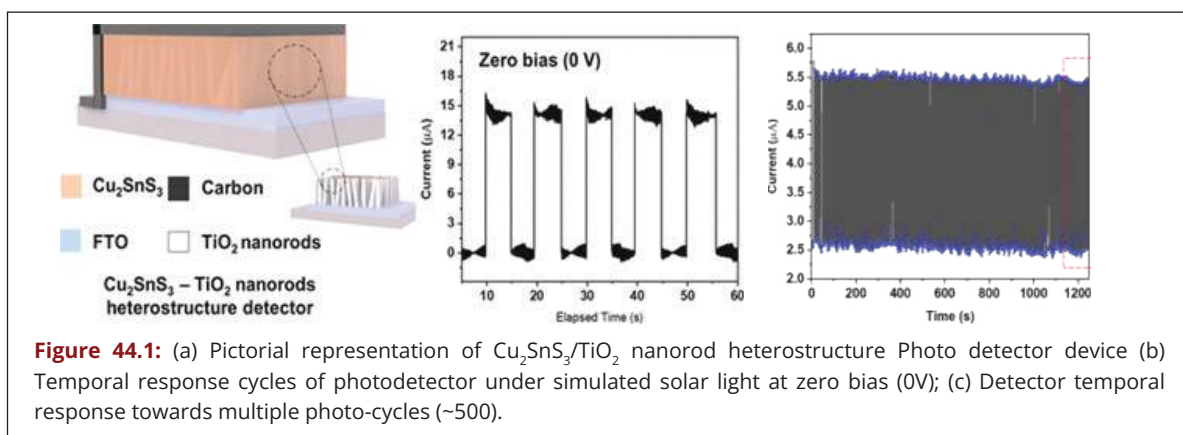


Figure 44.1: (a) Pictorial representation of Cu₂SnS₃/TiO₂ nanorod heterostructure Photo detector device (b) Temporal response cycles of photodetector under simulated solar light at zero bias (0V); (c) Detector temporal response towards multiple photo-cycles (~500).

Reference: B Kumar Swamy Reddy, V Ganapathy, S Badhulika, PH Borse, "Self-Powered Photodetectors Based on Cu₂SnS₃/TiO₂ Nanorod Heterojunctions", ACS Applied Nano Materials, Vol. 8(8), p 3825-3838, 2025

<https://doi.org/10.1021/acsnm.4c06425>



FACILITIES CREATED DURING 2024-25



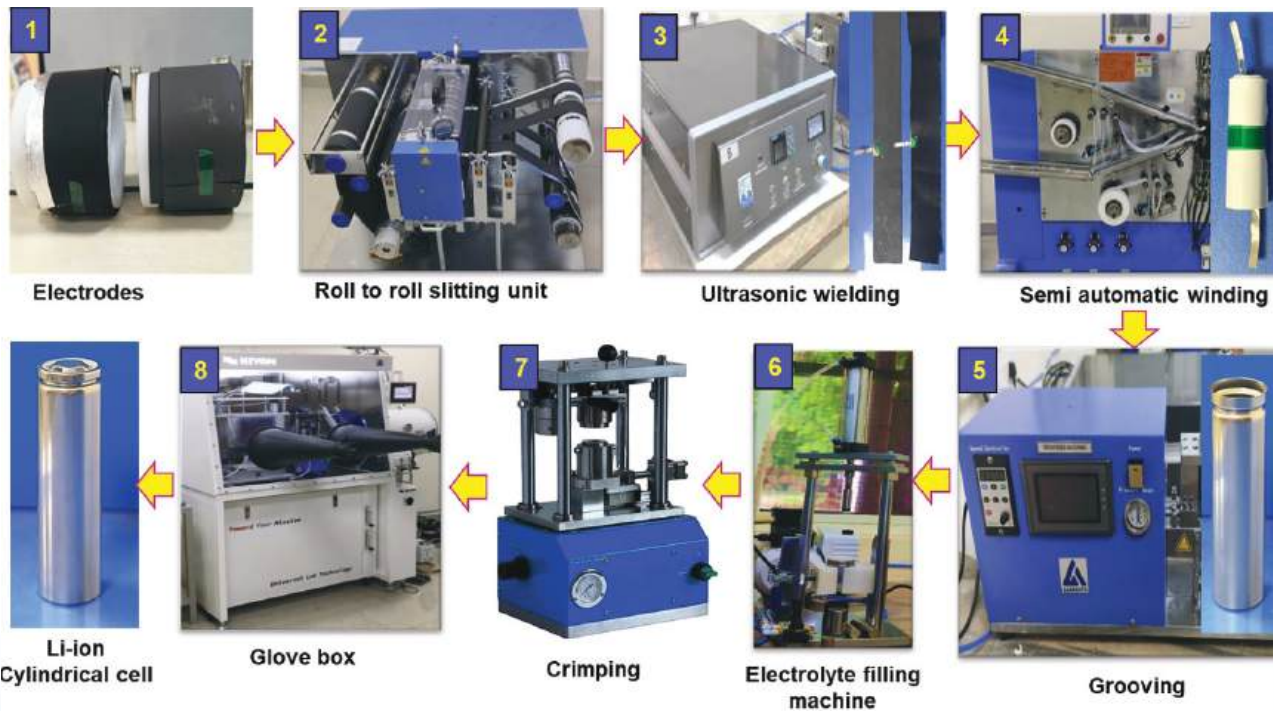
Li-ion Pouch Cell Line

The Li-ion pouch cell line comprises of slurry mixer, slot-die coating, vacuum oven, electrode die cutting, stacking, ultrasonic welding, pouch case forming, top/side sealing, electrolyte filling, vacuum sealing, final sealing, four port glove box, and hot flat press. The fabrication of pouch cell is performed in a dry room with controlled humidity conditions (10 % RH and 1% RH). Li-ion pouch cell line was established under SERB- IRHPA project and it was commissioned in November 2024.



Li-ion Cylindrical-Cell Line

The augmented cylindrical line comprises of slitting, winding, ultrasonic welding, grooving, glove box, electrolyte filling, and crimping. Further, high energy attrition milling unit was also installed and commissioned for the up scaling of process at lab scale level to produce maximum of 20 kg electrode materials. Augmentation of cylindrical line was established under Technology Research Centre (Phase-1) and was commissioned in November 2024.



Grooving and Crimping Machine for the Fabrication of LIB Cylindrical Cells

These machines are used for fabricating lithium-ion cylindrical cells (up to 5 Ah). After winding, the jelly roll is inserted into the can which is often Nickel-plated mild steel. The negative tab of the jelly roll is attached to this. Thus, the can serves as the negative terminal. A groove is made at the top of the can for properly placing the top lid assembly that serves as the positive terminal. The positive tab is welded to this assembly. After the addition of calculated amount of electrolyte by vacuum filling, the top lid assembly is positioned over the groove and the whole assembly is sealed by crimping. The cell is subjected to formation and other cycling studies. The crimping is subjected to Helium leak detection test. The leak rate which should be less than 1×10^{-6} atm-cc/sec as per international standards. Commonly used cell formats viz. 18650, 21700, 26650, 32700 are manufactured like this. This process is quite cost-effective compared to the laser welding and hence widely used for the Lithium-ion cell fabrication.



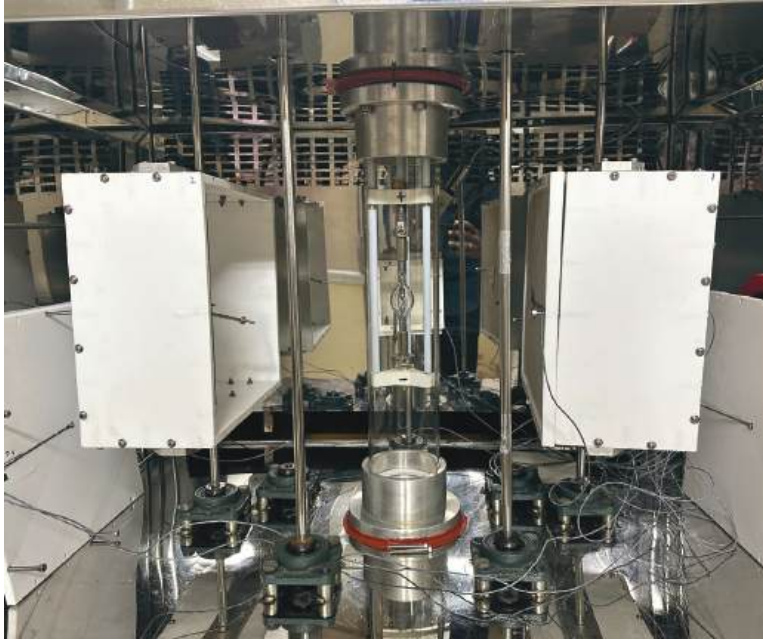
Automated Fuel Cell Assembly Line

The automated fuel cell assembly line will enable the fabrication of various PEM fuel cell components such as Gas Diffusion Layer (GDL), Catalyst Coated Membrane (CCM), Membrane Electrode Assembly (MEA) and stack, marking a significant step towards self-reliance in PEM fuel cell manufacturing. This setup will be a cost-effective solution and facilitate the feasibility studies to fabricate customized fuel cells and further advancing India's clean energy ecosystem.



Environmental Chamber with Solar Simulator

This indigenously developed and custom fabricated environmental chamber with solar simulator (ipgi instruments make) can measure thermal insulation performance of sheet like samples in the real-life conditions such as summer, winter, day and night. The system has a temperature range from 10°C to 80°C, and humidity range from 10% to 95 % RH. It also includes solar simulation capability with 500 W Xe lamp.



Plasma Spray Torch

The 11MB Metco internal diameter (ID) plasma spray torch is a compact and highly specialized thermal spray system designed for coating complex and confined internal surfaces, with the capability to operate effectively in components with internal diameters as small as 50 mm and a stand-off distance (SOD) of just 20 mm. Its right-angled nozzle design and short SOD make it ideally suited for accessing hard-to-reach internal geometries, such as curved surfaces and cavities found in additively manufactured parts. The torch delivers high thermal energy density, allowing for efficient melting and deposition of a wide range of coating materials, including ceramic, metallic, and cermet powders.



Screen Printer

The facility is an electric high-precision and high-efficiency flat screen printing machine. It is controlled by a frequency conversion motor, featuring a fast response speed and accurate starting and stopping positions. The printing is balanced and stable, with low vibration, high precision, and accurate multi-color overprinting. The printing accuracy is $\pm 0.02\text{mm}$, and the operating speed can reach 1500 times per hour. It is safe and easy to operate greatly improving the production efficiency. It is used to process the cathode and cathode functional layer thin films on half cells of SOFC. This facility is controlled with air compressor and the thickness as well as printing speed can be altered as per the requirement.



Batch-type Tape Caster

The equipment is used to process thin layers of tapes of Solid Oxide Fuel Cell (SOFC) components such as anode, anode functional layer and electrolyte. The facility is controlled with humidity at 50% and a temperature of 22-23°C to process the tapes.



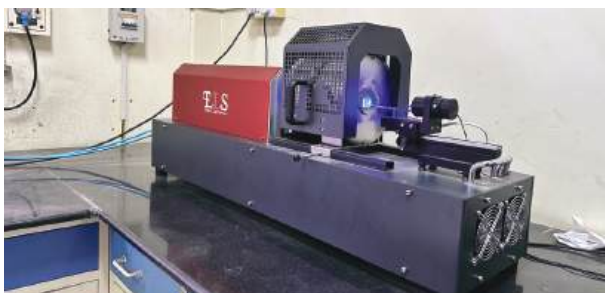
Contour Measuring System

The system is provided with key operating functions to enable fast, accurate and easy measurements. The main function of the system is to measure the flatness of all types of blanks/plates/discs especially to estimate the flatness of the half cells made with SOFC components.



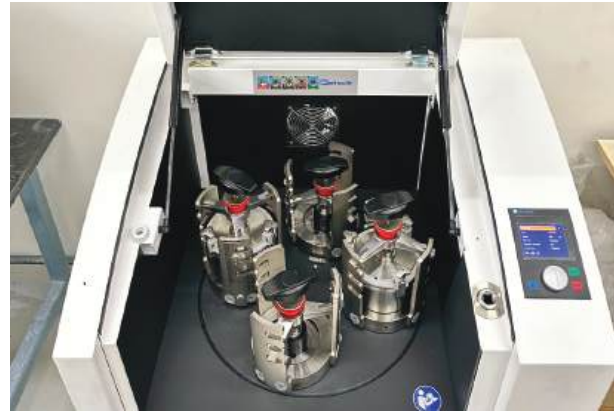
Heating Stage Microscope

The instrument is provided with LED screen and also can be connected to the desktop or laptop to see the images and can capture the surface structures. It helps to identify defects such as cracks, bubbles, inclusions etc. on the surface and bulk of glass-ceramic and SOFC samples



Planetary Ball Mill

It is suitable for grinding and mixing both dry and wet powder samples uniformly especially composite materials such as Mixed Ionic and Electronic Conductors (MIEC) with high degree of fineness and also to reproduce the same. The machine is provided with four grinding stations and is suitable for long term and continuous operation. The machine is powerful and quick grinding to nano fineness with comfortable operation and easy cleaning.



Stereo Zoom Microscope

The instrument is provided with LED screen and also can be connected to the desktop or laptop to see the images and can capture the surface structures. It helps to identify defects such as cracks, bubbles, inclusions etc. on the surface and bulk of glass-ceramic and SOFC samples



Thermal Conductivity Meter

Thermal conductivity quantifies a material's capacity to transfer heat. It is a critical property for researchers designing materials having high thermal conductivity. The facility (Thermtest THW L1) helps in knowing a material's thermal conductivity and predicts how efficiently heat will move through it. It can be used for both solids and liquids and has an operation temperature ranging from - 40°C to 300°C



Spray Pyrolyzer

Facility is used to synthesize nano powders of cathode and electrolyte materials with different formulations through combustion process. It operates upto temperatures of 500°C and has capacity to feed solution upto 10 ltrs. per hour. The spray chamber is of stainless steel - AISI 316 and is insulated by ceramic wool and outer jacket (SS-AISI 304). The main cyclone and an extra second cyclone, for finer particles, are made of AISI 316 stainless steel. It also contains two-fluid nozzle made of titanium and an anti-blocking device. It is used for atomization and the judicious rate of precursor composition, its surface tension, density and composition of feed solution can produce spray pyrolyzed product of specialized quality.



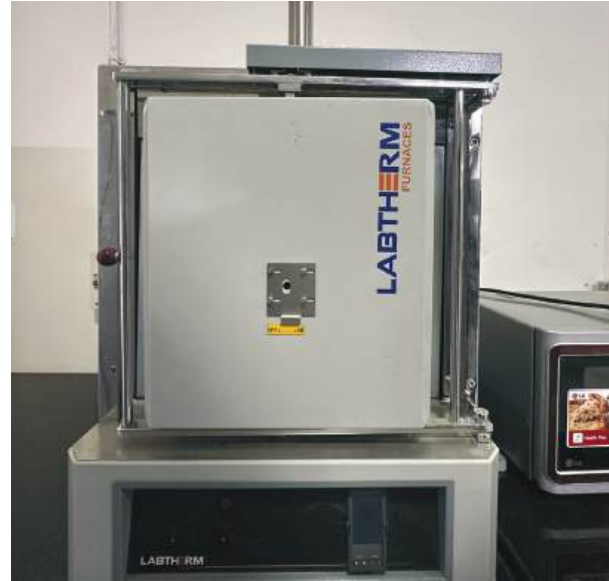
Hydraulic Press with Hot plates

The facility has a capacity load upto 75 tons and can reach temperatures upto 150°C. It is mainly a compaction press and is used to compact the green laminates of anode, anode functional layer and electrolyte in a controlled temperature atmosphere.



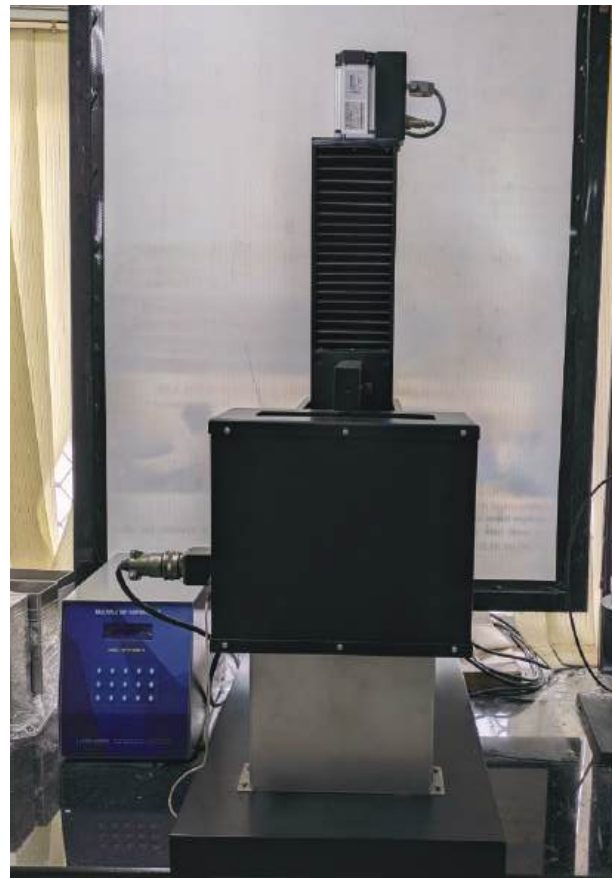
High Temperature Muffle Furnace

This is used to sinter half cells, single cells and substrates of SOFC. The furnaces are provided with good insulation for fast cooling and to maintain the uniform temperature in the hot zone. Heating elements made of MoSi₂ of different sizes are used to efficiently heat the furnace upto 1750°C with skin temperature of 40-50°C.



Multiple Dip-Coater with Infr-Red (IR) Drier

A Multiple Dip-Coater with Infrared (IR) Drier (Holmarc make) is a sophisticated laboratory instrument designed for applying uniform thin film coatings onto substrates using the dip-coating technique, with the added efficiency and precision of integrated infrared drying.



ASTM C177 based Thermal Insulation Testing Set-up

This custom fabricated and indigenously developed equipment can measure thermal insulation performance of samples based on steady state unidirectional heat flow. It is used for sample size of 30 x 30 cm with thickness of 05-25 mm. The temperature range of the set-up is from 50°C to 500°C with temperature accuracy of plus or minus 1°C. It has temperature uniformity of $\pm 2^\circ\text{C}$



Drying Reactor

This indigenously developed and custom fabricated equipment is multi-purpose vessel for carrying out drying process of wet materials as well as it can be used for upscaling of materials produced by chemical synthesis. The system has a capacity of 30 liters, with a temperature range from room temperature to 150°C. The system also has provision for suction pump, stirrer, gas purging, and condenser



Dielectric Constant Measurement Setup

A dielectric constant measurement setup determines a material's ability to store electrical energy in an electric field, represented as the ratio of capacitance with the material to that in a vacuum. The present facility has been procured from Siva instruments and helps in measurement of dielectric constant for both solids and liquids. The instrument can be operated at temperatures ranging from room temperature to 300°C.





EVENTS, DATA & STATISTICS



Major Events

Jayanthi Celebrations

Dr. B.R. Ambedkar, Dr. Babu Jagjivan Ram and Mahatma Jyothirao Phule Jayanthi celebrations were held at ARCI on April 14, 2024. Dr. Kaliyan Hembram, President of ARCI SC/ST Employees Welfare Association, welcomed the gathering. The Director and Associate Directors, ARCI and members of ARCI SC/ST Employees Welfare Association paid rich floral tributes. The immense contributions made by Dr. Ambedkar, Dr. Babu Jagjivan Ram and Mahatma Jyothirao Phule towards the upliftment of downtrodden and women were highlighted during the celebrations.



National Technology Day

ARCI celebrated National Technology Day-2024 on May 10, 2024 with great pride, commemorating India's remarkable journey in science and technology. The event began with a welcome address by Dr. M Buchi Suresh, followed by a short documentary showcasing India's technological advancements and ARCI's contributions. Dr. P.K. Jain, Chairman of the Technology Day Committee-2024, highlighted the latest technological achievements in the country and discussed the significant role technology plays in our daily lives and its impact on shaping the future. The chief guest, Dr. Sateesh Reddy, President of AeSI, Former Secretary, Dept. of Defence R&D and Chairman DRDO & Former Scientific Advisor to Raksha Mantri, shared invaluable insights on igniting young minds, from school to start-up to contribute to the Defence of the country. Dr. R Vijay, Director of ARCI, emphasized the continuous evolution of technologies and their impact on society. He has also stressed the importance of developing indigenous technologies and the critical role of scientists in this process, which is very much needed for the country. Shri. D.S. Rao, Associate Director, shared his experiences developing various technologies at ARCI. The event concluded with a vote of thanks by Dr. Papiya Biswas. This celebration inspired young minds and reinforced the importance of innovation, critical thinking and sustainable development in today's world.



First Aid & CPR Training Program

The First Aid & CPR Training Program was conducted on May 29, 2024, with enthusiastic participation from approximately 60 participants. The training focused on essential life-saving techniques, covering the following key topics:

1. Vital Organs of Life
2. Primary Survey
3. CPR & Recovery Position
4. Medical Shock
5. Heart Attack
6. Severe Bleeding
7. Severe Burn & Injuries

The programme provided valuable hands-on training, equipping participants with crucial first-aid skills to respond effectively in emergencies.



Third Dr. G. Padmanabham Memorial Lecture

The third Dr. Padmanabham Memorial Lecture was held on June 05, 2024, at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad. This event honoured the memory of Dr. G. Padmanabham, whose pioneering contributions significantly shaped the scientific direction and institutional growth of ARCI.

This year's lecture was delivered by Prof. B.S. Murthy, Director of the Indian Institute of Technology (IIT)



Hyderabad, a leading expert in the field of materials science. Prof. Murthy's engaging talk on the "Role of Innovations & Collaborations towards Viksit Bharat" highlighted recent innovations and future perspectives in materials research, drawing broad appreciation from the audience. The event was conducted in hybrid format, enabling greater inclusion and interaction among ARCI's scientific community. The lecture concluded with a lively discussion session and closing remarks that paid tribute to Dr. Padmanabham's enduring legacy and contributions to advancing ARCI's mission. The memorial lecture continues to serve as an inspiring platform to celebrate the scientific excellence and honor the life and work of a visionary leader.

International Day of Yoga 2024

The tenth International Day of Yoga (IDY), themed "Yoga for Self and Society", was organized by the welfare committee of ARCI at the Hyderabad campus on June 21, 2024.

Mr. Ajay Rasoju and his team from Gandhi Gyan Mandir Yoga Kendra, Hyderabad, conducted the yoga training session. The event commenced with an address by Director Dr. R Vijay and Associate Director Dr. PK Jain. Participants practiced the Surya Namaskar, Pranayama, and various other asanas under the guidance of the yoga instructors. The event concluded with a vote of thanks from Dr R. Subasri, Chairman of the Welfare Committee. All participants received a cap featuring the IDY logo and a complimentary nutritious breakfast with ragi idlis, malt, and bananas.



Group photo of Welfare committee with Director, ARCI and Yoga Instructors

Independence Day Celebrations

ARCI Chennai celebrated the 78th Independence Day on August 15, 2024. The celebrations commenced with the participation of all employees, scientists, and Heads at ARCI Chennai.



Important Meetings

ARCI Governing Council was newly constituted with Prof. Ashutosh Sharma, Institute Chair Professor, IIT, Kanpur, President, Indian National Science Academy & Chairman, Life Sciences Research Board, DRDO, as Chairman. The 70th Governing Council meeting of ARCI under his chairmanship was held on April 09, 2024 at ARCI, Hyderabad.

The 71st Governing Council meeting of ARCI, Chaired by Prof. Ashutosh Sharma was held on September 13, 2024 at ARCI, Hyderabad



Chairman and Members of the Governing Council during the 71st Governing Council Meeting held on September 13, 2024

The National Advisory Committee (NAC) of Technical Research Centre on "Alternative Energy Materials & Systems (ARCI-TRC-AEM&S) Phase II", Chaired by Prof. Ashutosh Sharma was held on September 14, 2024 at ARCI, Hyderabad

National Space Day Celebrations

National Space Day is celebrated to mark the historic landing of Chandrayaan-3's Vikram Lander on the Moon's South Pole on August 23, 2023. National Space Day is also celebrated to promote space exploration, inspire the next generation of scientists and engineers, and highlight the significant influence of space research on everyday life. ARCI celebrated National Space Day from 21 to 22 August 2024. On 21st August, the Program was started with a welcome address by the Chairman of the Committee, Dr. P.K. Jain, and remarks by the Director, Dr. R Vijay & Associate Director Mr. DS Rao of ARCI, and a senior scientist from NRSC. On this day, 9th & 10th class students at nearby schools actively participated in the competitions on space-related models and drawing/painting, as well as quizzes. The National Remote Sensing Centre also showcased its mobile vehicle, Space on Wheels, to exhibit highlights of India's space mission, which is to inspire and encourage young minds. This day was also memorable for arranging a mass plantation by the students, faculty, and employees. On the second day, i.e., 22nd August, the Program was inaugurated by the Director, Associate Directors, and the Chief guest, Dr. YVN Krishnamurthy, Former Director, NRSC, Hyderabad, and Professor, IISST, Thiruvananthapuram. They have given their opening remarks and highlighted the importance of Space Day. The chief guest has delivered an inspiring talk on "Touching Lives While Touching the Moon: Indian Space Saga". The Program ended with concluding remarks and a group photo.



ARCI Wins 3rd Prize for Swachhta Hi Seva & Special Campaign 4.0



ARCI, Hyderabad, along with its Centers of Excellence in Chennai and Liaison Office in Gurugram, has been honored with the 3rd Prize for its outstanding participation in the "Swachhta Hi Seva & Special Campaign 4.0," which took place from September 17, 2024 to October 31, 2024.

The campaign focused on promoting cleanliness and environmental awareness through various impactful activities, including:

1. Formation of a dedicated committee
2. Display of banners at prominent locations
3. 360° Digital Advocacy
4. Administering the Swachhta pledge
5. Creation of selfie points
6. Waste management awareness programs
7. Slogan and drawing competitions for school children
8. Mass cleaning drives
9. PPE distribution for housekeeping workers
10. Conducting medical examinations
11. "Ek Ped Maa Ke Naam" – Mass tree plantation program
12. Waste-to-wealth initiatives
13. Walkathon for awareness
14. Installation of ARCI-developed "Green Dispo" incinerators for hygienic disposal of menstrual pads in girls' high schools

This achievement highlights ARCI's commitment to sustainability and public welfare.

Annual Medical Check-up

The Annual Medical Check-up (AMC) programme for ARCI's employees for the year 2024 was organised during September 24-25, 2024. Employees were categorized under two age groups, i.e., below 45 years and 45 years & above, and prescribed medical tests were carried out for them. Apart from prescribed medical tests, special tests such as 2D Echo, "Prostate Specific Antigen test" for male employees, "Ferritin" and "Mammography" tests for female employees aged 45 years and above were also conducted. AMCs were organized for ARCI's Chennai and Gurugram employees.



Employees undergoing Annual Medical Check-up

Official Language (Hindi) Implementation

The Official Language Implementation Committee (OLIC) under the Chairmanship of Dr. R. Vijay, Director, has successfully implemented and progressively Promoted the use of Hindi at ARCI. ARCI conducted a quarterly OLIC meeting to review the progressive use of Hindi at ARCI. The minutes of the meeting were sent to DST and Quarterly reports on Hindi works were sent to DST, Department of Official Language (D.O.L), Regional Implementation Office (South), Bengaluru with a copy to Town Official Language Implementation Committee (TOLIC-3) and by online to D.O.L. Ministry of Home Affairs, Govt. of India for review. During the year, ARCI achieved the target set by the D.O.L., Ministry of Home Affairs, Govt of India, regarding proper and progressive implementation of the official language.

Hindi Saptah Celebrations

ARCI celebrated "Hindi Saptah" from September 18-27, 2024 (5 days). Competitions such as essay writing, poetry, debate, typing, translation, one-minute reel/video, quiz competitions, etc., were conducted in which employees and students participated enthusiastically. Dr. Nitin P. Wasekar, Vice-Chairman, Official Language Implementation Committee, gave the welcome speech and introduced the chief guest. Shri A. Srinivas, Member Secretary, OLIC, administered the 'Official Language Pledge' and presented the report on the achievements of the official language implementation-related work in ARCI. In his address, Dr. R Vijay, Director ARCI, appreciated the Hindi initiative at ARCI and highlighted the employees' enthusiasm in working with the language. He also congratulated everyone for their contributions and encouraged them to continue their commitment to the development of Hindi. He urged all the scientists to establish a connection between their research endeavors and the use of official language. Associate Directors Shri. D. Srinivas Rao and Dr. P.K. Jain also addressed the attendees wished all the officers/employees on Hindi Diwas, and encouraged them to work in Hindi. The Chief Guest for the programme, Engr. Ashok Kumar Khatua, Chief Engineer, Central Public Works Department, Hyderabad, boosted everyone's morale with his inspiring and remarkable thoughts and praised the Hindi work being done by ARCI. Employees and Research students actively participated in the Hindi Saptah celebrations, which concluded on September 27, 2024. Various competitions were also conducted during Hindi Saptah celebrations at ARCI's offices in Chennai and Gurugram. Prizes were awarded to all the winners.



Release of SRUJAN Magazine

As part of its commitment to promoting and implementing the Official Language, ARCI has taken the initiative to publish an annual in-house magazine titled 'Srujan' in Hindi. Through this magazine, ARCI endeavours to convey information to the general public about the technological research and developmental activities undertaken at ARCI for the development of the nation. The 8th edition of the annual Hindi magazine "SRUJAN" was released on March 28, 2025 during the Technical Hindi Workshop.



Along with the regular Rajbhasha lectures in the quarterly workshops, ARCI Scientists/research students were encouraged to deliver lectures in Hindi on scientific & technical topics. During the Technical workshops, Ms. N. Aruna, Technical Officer "C", ARCI, Ms. Haritha Sikala, SRF, Shri. Narendra Kumar Bhakta, Ms. K. Swati, Sr. Analyst, delivered informative lectures on 'Role of E&G at ARCI', 'Introduction of Nano Indentation', 'GeM E Market Place', and 'Introduction of IPR' respectively.

A cash incentive scheme has been established to encourage the employees to carry out their day-to-day official work in Hindi. During the year, 15 employees received cash awards for their efforts in using Hindi for their official tasks. Additionally, there is a Cash award for the articles submitted by employees, research students, and other staff, in regional languages or Hindi, which are published in the Annual Hindi Magazine "SRUJAN". As part of Human Resource Development, each year a student is trained in the implementation of the Official Language through a "Post Graduate Training Programme".

Health Talk

As a part of a continuous effort to keep the staff members, and research students abreast of the latest health-related issues, the welfare committee arranged a health talk. A talk on "Effects of Chemicals on the Respiratory System" was delivered on October 23, 2024, by Dr. Divya, Pulmonologist, Kamineni Hospitals & Consultant ARCI.



Vigilance Awareness Week

Vigilance Awareness Week 2024, under the theme "Culture of Integrity for Nation's Prosperity", was observed at ARCI from October 28 to November 03, 2024. As part of the celebrations, the Director and Chief Vigilance Officer administered the Integrity Pledge at 11:00 AM on October 28, 2024. In his address to ARCI staff, the Director emphasized the importance of collective participation in preventing and fighting against corruption, and highlighted the need to raise public awareness about its existence, causes, severity, and the threat it poses to society.

On October 29, 2024, a lecture titled "Integrity Pact in Purchase Contracts" was presented by Shri. Manas Naik, Senior Purchase and Stores Officer, NRSC, Hyderabad, for the benefit of ARCI staff. In line with this year's theme, Mr. Ch. Narender Dev, Additional Superintendent of Police from CBI ACB, Hyderabad, delivered a Vigilance Awareness Talk on October 30, 2024.



Rashtriya Ekta Diwas

To reinforce ARCI's commitment to preserve and strengthen the security, unity, and integrity of our country and commemorate the birth anniversary of Shri Sardar Vallabhbhai Patel, the architect of national integration of independent India, "Rashtriya Ekta Diwas" (National Unity Day) was observed on October 31, 2024. Since the day fell on a festival holiday, the staff members and research students took the pledge from their homes.

Samvidhan Diwas/ Constitution Day

On November 26, 2024, all the employees, project staff, research students, and trainees actively participated in Samvidhan Diwas/Constitution Day Celebrations. On this occasion, they read the Preamble of the Constitution, in Hindi and English, respectively, at their Centres of Excellence/Centres/Sections. Informative messages about the constitution/rare photographs were displayed on the digital boards.

28th Annual Day Celebrations

ARCI Hyderabad commemorated its 28th Annual Day on December 27, 2024. The celebration was conducted in a subdued manner as a mark of respect for the late former Prime Minister, Dr. Manmohan Singh.

The event commenced with a welcome address by Dr. Sanjay R Dhage, Chairman of the Annual Day Celebration Committee.

In his central address, Dr. R. Vijay, Director of ARCI, provided an insightful overview of ARCI's progress over the past year, highlighting innovative research, technological advancements, and noteworthy achievements. He emphasized that these accomplishments are a testament to workforce's talent, perseverance, and dedication. Dr. Vijay further encouraged the attendees by underscoring ARCI's immense potential as a premier research institution.

In his address, Dr. P.K. Jain, Associate Director, ARCI, highlighted the importance of the Annual Day, stating that it is not merely a customary celebration but a profound acknowledgment of the relentless efforts, commitment, and passion that drive ARCI's mission and vision.

A special event segment was dedicated to recognizing individuals who have contributed significantly to ARCI over the years. Employees who completed 25 years of distinguished service at ARCI were honoured and presented with mementos to appreciate their unwavering commitment and exceptional contributions. Twelve PhD scholars, who completed their Doctorate degrees in 2024, were recognized and awarded mementos as a token of recognition for their academic excellence and research contributions.

In light of the passing of former Prime Minister Dr. Manmohan Singh the planned cultural programme was cancelled. Instead, the event concluded solemnly, reflecting on the legacy of Dr. Manmohan Singh and his contributions to the nation.



ARCI Chennai Annual Day

ARCI Chennai Annual Day was celebrated on February 07, 2025. On this occasion, Dr. R Vijay, Director, Mr. D Srinivasa Rao, Associate Director, and Dr. PK Jain, Associate Director addressed the employees and their families. This was followed by the team-building activities.



Republic Day Celebrations

ARCI celebrated Republic Day on January 26, 2025, with great enthusiasm. Dr. R. Vijay, Director hoisted the National Flag, and the celebration featured a spectacular parade by the security personnel, showcasing discipline and patriotism. Mr. D. Ramesh, SF & SO, welcomed the gathering. Dr. R Vijay, the Director, and Shri. DS Rao, Associate Director, addressed the gathering, and highlighted the significance of the occasion.



National Science Day

On the occasion of National Science Day (February 28, 2025), an enlightening and inspiring talk titled "Hydrogen as an Energy Carrier" was delivered by Prof. S. Srinivasa Murthy, a Visiting Faculty at the Interdisciplinary Centre for Energy Research, IISc Bengaluru, and former Professor of Mechanical Engineering at IIT Madras.

The session attracted a vibrant and enthusiastic audience of young and aspiring researchers and scientists. Prof. Murthy shared deep insights into the evolving role of hydrogen in the global energy landscape, highlighting its potential as a sustainable and efficient energy carrier.

The talk aligned closely with this year's National Science Day theme: "Empowering Indian Youth for Global Leadership in Science and Innovation for Viksit Bharat", inspiring participants to contribute to India's journey towards a technologically advanced and energy-secure future.



National Safety Day/Week 2025

ARCI celebrated the National Safety Day/Week during March 04-05, 2025. The event aimed to emphasize workplace safety through various activities, including safety pledges, lectures, demonstrations, and interactive sessions.

As part of the celebrations, safety slogan competitions were organised for employees, students, and outsourced staff, with the winners being awarded during the event. On March 04, 2025, safety pledges were administered across ARCI's centres in Hyderabad, Chennai, and Gurugram. Additionally, a safety lecture was delivered to students from a government school, followed by a fire safety demonstration.

The main event on March 05, 2025, commenced with a welcome address by Dr. L. Rama Krishna, Chairman, Safety Committee, who highlighted the lessons learnt from the Bhopal Gas tragedy and stressed the importance of adopting chemical safety as a daily habit for all employees.

In his address, Dr. R. Vijay, Director, ARCI, urged everyone to remain committed to safety, including road safety, by adhering to proper procedures and best practices. Mr. D. S. Rao, Associate Director, discussed defensive driving safety precautions, while Dr. P. K. Jain, Associate Director, emphasised the role of emotional intelligence in raising safety awareness.

Mr. D. Ramesh, Security Fire & Safety Officer, presented an overview of ARCI's safety initiatives and activities. The keynote lecture on Chemical and Electrical Safety was delivered by Mr. P. V. Vidyadhara Rao, CEO, ESD Control Systems, Hyderabad. He demonstrated the impact of static electricity and its proper discharge. He shared valuable safety practices through real-world case studies from various industries.

The event concluded with a vote of thanks by Shri Manish Tak. Employees and students participated enthusiastically, reinforcing ARCI's commitment to workplace safety.



Internal Committee (IC)

ARCI Internal Committees (ICs) conduct their activities throughout the year on two campuses, one in Hyderabad and the other in Chennai. Both AICCs are actively involved in propagating the purpose of their formation to ensure that there is no sexual harassment of women in the workplace.

During the year, AICC Hyderabad arranged the placement of a physically secure She-Box at the main security gate for individuals without access to the internet. All relevant contact details of the Internal Committee members, including the external member, were displayed at ARCI's security gate and entrance.

Internal Committee, ARCI, Hyderabad organised the International Women's Day at ARCI on March 11, 2025, in line with the International Women's Day theme 2025 'Accelerate Action' and UN theme 2025 'For ALL women and girls: Rights. Equality. Empowerment. Accelerate the empowerment.' The day was celebrated with great enthusiasm at ARCI by one and all. Mrs Mangala Mani Nalli, Ex-Senior Scientist- National Remote Sensing Centre and the 'Polar Woman', graced the occasion as Chief Guest along with Dr. Mrs Mamatha Raghuveer, Director-Tharuni, NGO, as Guest of Honour. Celebrations of the day began as Mr. Manish Tak, Scientist-E and member of IC, welcomed all the guests and ARClans. On behalf of IC, Dr. Malobika Karanjai, Presiding Officer, delivered the welcome address and an inaugural speech, stressing the importance of gender equality and self-awareness among women. She highlighted the existing



disparities in pay and leadership opportunities, as well as the lack of awareness regarding women's health and its long-term impact across the world and highlighted the growing importance of the right stress-mitigation measures while striving for professional growth for long-term sustenance and productivity in the workplace. She also showcased the increasing number of women's participation in ARCI across all spheres, and while thanking the Director of ARCI for providing a conducive atmosphere, she also informed the audience of the measures being taken at ARCI for facilitating younger women to ease their early career start in pursuing STEM. Her words reaffirmed ARCI's dedication to fostering a supportive and inclusive workplace where women can thrive with a proper work-life balance. And IC's full dedication to the cause of the betterment of women in the workplace.

Associate Directors Shri D.S. Rao and Dr. P.K. Jain also greeted all the women on campus. They extended their good wishes, addressing the gathering with a focus on increasing the participation of women in all spheres of life, in accordance with the proactive actions taken at ARCI and those to be taken during the year.

Dr. R. Vijay, Director of ARCI, extended his greetings during the celebration of International Women's Day and addressed the gathering online. He highlighted the organisation's commitment to women's empowerment. He emphasised ARCI's proactive approach in bridging the gender gap by ensuring an unbiased, inclusive work environment and enforcing a strict zero-tolerance policy toward discrimination. He further underscored the dual responsibility of empowering women and fostering societal awareness to support their growth, reinforcing that progress is achieved collectively.

Dr. Mamata Raghuveer Achanta, Founder of Tharuni NGO and Guest of Honour for the occasion, addressed the audience with her work on insights into social initiatives aimed at the development of children and women. She emphasised the importance of unity and community support as catalysts for women's empowerment, underscoring their role in nurturing a progressive society and welcomed one and all for collective responsibility.

The Chief Guest, Ms. Mangala Mani Nalli, a former Scientist of NRSC-ISRO and fondly known as the "Polar Woman," captivated the audience with her inspiring journey. She shared her experiences of perseverance, including the rigorous selection process for the Antarctic mission and the unique challenges of maintaining a ground station in -90°C for 403 days, being the only person in the mission to serve the country at such a long stretch in the harsh climate. Through a captivating video showcasing her on-site experiences, she encouraged young researchers to dream big and push the boundaries in their careers while taking proper care of their physical and mental health.

On behalf of ARCI, IC felicitated its 'women achievers of the year' for being recognised at the state national or international level. This year, the special invitees included superannuated colleagues who interacted with younger



colleagues and shared their experiences of balancing work-life schedules healthily. The IWD celebrations concluded with Mrs. Rajalaxmi delivering the ceremonial vote of thanks to everyone and playing the national anthem.

On October 8, 2024, Mrs. N. Nirmala, Secretary, ICC, conducted an interactive session with women employees of ARCI in accordance with the POSH ACT 2013 to create awareness and to prevent any incidents. The "Sexual Harassment at Workplace Prevention Week" was conducted by ICC as per the directives of MOWCD, New Delhi, at ARCI- Hyderabad and Chennai (offline at Hyderabad and online for Chennai- ARCI). During the week, IC initiated the launch and integration of the She-Box portal by onboarding all ICC members for smooth and streamlined complaint handling. The programme ended with a vote of thanks.

On December 13, 2024, ARCI conducted a sensitisation workshop with two lectures for contract staff, researchers, and trainees. Dr. Malobika Karanjai, IC – Presiding Officer Dr. Malobika Karanjai, Presiding Officer, welcomed the gathering, stressing compliance and continuous awareness to prevent workplace harassment during the week .

Director Dr. R. Vijay addressed the gathering, emphasizing zero tolerance of any misconduct and stressing strict compliance with the POSH ACT 2013 by one and all to foster growth and a productive work environment. Associate Directors Shri D. Srinivas Rao & Dr. P.K. Jain also addressed the gathering.

Senior Scientist Mrs. Priya Anish Mathews delivered a talk on "Sexual Awareness: Dos & Don'ts", using interactive presentations and case studies in multilingual mode using Hindi, English and local language

Dr. Neha Hebalkar, Senior Scientist and resource personnel, highlighted key POSH Act provisions through case studies and video discussions. A total of 137 staff attended the workshop.

Mrs. Padma Priya PV delivered a motivational speech at the Women's Day celebration. She talked about her journey as a CEO in her start-up, MERKEL HAPTIC SYSTEMS PRIVATE LIMITED, incubated at IIT-M. She elaborated on its mission of enhancing the Extended Reality (XR) experiences by incorporating Haptic Technologies.



Annual Sports Day

The Annual Sports 2024–25, KHELO ARCI, commenced with the inauguration on March 12, 2025 by Director, Dr. R Vijay, and continued for two months. Customized T-shirts featuring the event logo and tagline were distributed to all participants, symbolizing camaraderie and an inclusive spirit at ARCI. This year's events witnessed an enthusiastic response, with nearly 200 participants, including employees and students, achieving an impressive 60% participation rate. A total of 15 sporting events spanning individual and team categories were conducted. Notably, the relay race and women's throwball were introduced, adding to the vibrancy and inclusivity of the Program. First-aid support was available at the venue throughout the events to ensure the safety and well-being of participants. The celebrations concluded with a prize distribution by Director, Dr. R Vijay, and Associate Director, Dr. P K Jain, where winners and runners-up were felicitated.



Conferences/Workshops/Seminars organized by ARCI

Recent Advancements and Applications of High Temperature Materials: Processing, Manufacturing & Diagnostics (RAATEM 2024)

The workshop titled 'Recent Advancements and Applications of High Temperature Materials: Processing, Manufacturing & Diagnostics (RAATEM 2024)' was held from July 15-16, 2024, at ARCI, Hyderabad. This notable event was funded by the Department of Science and Technology (DST) and focused on the latest advancements and applications of high-temperature materials, with an emphasis on processing, manufacturing, and diagnostics. This event was part of the broader initiative under the National Centre for Development of Advanced Materials and Manufacturing (NCCORD) Processes for Clean Coal Technologies for Thermal Power Plant applications, established by DST at ARCI. The NCCORD consortium comprises various academic and R&D organisations, including IIT Madras, NIT Warangal, NIT Andhra Pradesh, CSIR-NML and BHEL-WRI, with ARCI serving as a nodal centre. The centre's research on the development of enabling processing and fabrication technologies, including coating, welding, machining and new materials for the High-Performance Power Generating Systems (HPPGS) in coal-based Advanced Ultra Super Critical (AUSC) technology.



The primary objectives of the workshop were: Dissemination of newly developed technologies and industrial solutions, promotion of collaborations between industries and consortium partners in advanced materials and manufacturing technologies and facilitating the adoption of advanced high-temperature material technologies in Indian industries, particularly in sectors such as thermal power plants, aerospace, and energy systems.

One-Day Workshop on Biodegradable Implants: Materials and Processes

A one-day workshop on "Biodegradable Implants: Materials and Processes (BIMP-2024)" was organized by International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) on September 17, 2024, to bring together leading scientists, academicians, researchers, clinicians and industry personnel to exchange ideas and share their experiences related to all aspects of biomedical implants and devices with a particular focus on biodegradable materials and processes.



The workshop was supported by Indo-German Science and Technology Centre (IGSTC) as a part of the (2+2) collaborative project focused on "Development of Biodegradable Alloys and AM Processes for Soft Tissue Anchors" along with WIPRO 3D (India), Charite University (Germany) and KCS Europe (Germany).

Experts representing various relevant stakeholders discussed the importance of translational research on biomedical implants in India, emphasising the need for synergy between fundamental research and technology development in collaboration with clinicians.

The workshop witnessed a huge enthusiasm from researchers, medical doctors, technologists, industrialists and students, with the active participation of about 120 delegates.

7th Hydrogen Workshop on Fostering Start-up Ecosystem for Commercialisation of Hydrogen Technologies on October 08, 2024

The aim and objective of this workshop were to encourage, develop and promote hydrogen energy and fuel cell and their applications within the country. Prof. Mohammed Rihan, DG, National Institute of Solar Energy (NISE), was the chief guest and Dr. G.A. Pathanjali, MD, High Energy Batteries, was the guest of honour. Invited lectures from various stalwarts across industries, academia & start-ups were spread over the day. Fruitful discussions ensued during the Q&A sessions. The participants and the speakers appreciated the organisation's collective efforts to bring everyone together on a single platform. The workshop attracted 67 research scholars from 20 institutes, 10 industry participants, 12 faculty and scientists and 40 representatives from ARCI.



Workshop on Improving Battery Energy Storage Systems (BESS)

ARCI and the National Institute of Solar Energy (NISE), New Delhi, have jointly organised a two-day workshop on 'Improving Battery Energy Storage Systems (BESS)' on December 4-5, 2024, at Hyderabad. The workshop is supported by German National Metrology Institute, Physikalisch-Technische-Bundesanstalt (PTB), Germany. The purpose of the workshop was to discuss the safety, quality, and sustainability requirements for Battery Energy Storage Systems (BESS).

Stakeholders representing academics, R&D institutes, and industries gathered to discuss the contributions of

quality infrastructure and standards and regulations. The workshop witnessed enthusiastic participation, particularly during the breakout sessions where participants shared their insights and engaged in panel discussions.



Human Resource Development

ARCI-IIT Fellowship Programme

ARCI continues to sponsor fellowship programmes at the Indian Institute of Technology (IITH) – Hyderabad. As part of the ARCI-IIT Fellowship Programme, ARCI supports the doctoral study of talented students, selected as ARCI Fellows, to work in areas of immediate interest to ARCI under the expert guidance of an identified IIT faculty member. ARCI's support includes a stipend, procurement of consumables and essential equipment. After successful completion of the programme, the ARCI Fellow is awarded a Ph.D. degree by the IITH.

The status of the project being undertaken is as follows

Project	Collaborating Institute	Name of the Fellow	Date of admission	Status
Development of a More Efficient Cathode Matrix from Hard Carbon as a Sulfur Host for Lithium-Sulfur Battery	IIT-Hyderabad	Sony K. Cherian	18.12.2020	Ongoing

Recognition of ARCI as an External Centre for Carrying Out Ph.D. Research

Indian Academic Institutions/Universities

Apart from the above, the following Indian academic institutes recognised ARCI as an External Centre for carrying out Ph.D. Research. Accordingly, interested ARCI employees, Project Scientists and Research Fellows are encouraged to register for a master's degree (M.S./M.Tech.) and Ph.D. (as per university norms) at the Institute/University:

01.	Indian Institute of Technology	Bombay
02.	Indian Institute of Technology	Kharagpur
03.	Indian Institute of Technology	Kanpur
04.	Indian Institute of Technology	Madras
05.	Indian Institute of Technology	Hyderabad
06.	Indian Institute of Technology	Bhilai
07.	National Institute of Technology	Warangal
08.	National Institute of Technology	Tiruchirappalli
09.	National Institute of Technology	Surathkal
10.	National Institute of Technology	Calicut
11.	University of Hyderabad	Hyderabad

List of Project Scientists/ Research Fellows who Completed Ph.D. during the year 2024-25

Sl. No.	Name of the Project Scientist/ Fellow	Topic	Ph.D. Registered at	Degree Awarded on
1.	P. Raju	Investigations on the Applicability of Pressure Slip Casting and 3D Printing for Alumina (Al ₂ O ₃) and Aluminium Titanate (Al ₂ TiO ₅) Systems.	NIT, Warangal	03.10.2023
2.	Rahul Jude Alroy	Structure-Property Correlation Studies on High Velocity Air-Fuel Sprayed Cr ₃ C ₂ -25NiCr Coatings for High Temperature Wear-Resistant Applications.	IIT, Madras	19.04.2024
3.	Priyadarshini R	Investigation of the Phase Formation, Microstructure and Thermoelectric Properties of Zinc Antimonides and Magnesium Silicides.	NIT, Trichy	03.08.2024
4.	Aarti Gautam	Self-Healing Corrosion Protection Coatings based on Corrosion Inhibitor Encapsulated Nanocontainers for Mild Steel.	NIT, Warangal	20.08.2024
5.	Narendra Chundi	Development of Anti-Soiling Coatings and their Evaluation for Applications in Photovoltaic Modules.	IIT, Bombay	23.08.2024
6.	K. Reshma Dileep	Interfacial Engineering for Improved Stability and Performance in HTM and Metal Cathode-free Perovskite Solar Cells.	IIT, Bombay	23.08.2024
7.	Manchala Venkatesh	Development of High-Specific Capacity Electrode Materials for Sodium-Ion Battery Application.	IIT, Madras	09.10.2024
8.	N. Ravi Kiran	Novel and Sustainable Production, Characterization and Testing of Various Nanocarbons as Excellent Additives in Lubricants.	University of Hyderabad, Hyderabad	10.10.2024
9.	Vijayaragavan G	Coercivity Enhancement in Sm-Fe-N and Nd-Fe-B Permanent Magnets by Microstructure and Grain Boundary Engineering.	IIT, Madras	05.01.2025

Post Doctoral Fellows, Research Scholars, Senior/ Junior Research Fellows, Post Graduate/ Graduate Trainees and M.Tech. / B.Tech. / M.Sc. Project Students joined during the Year at ARCI.

DST Inspire Faculty	-
DST Women	01
Post Doctoral Fellows/Research Scholars	03
Junior Research Fellows	08
Senior Research Fellow	01
Post Graduate Trainees	05
Graduate and Diploma Trainees	18
M. Tech. Project Students	22
B. Tech. / M.Sc./ Diploma Projects Students	45
Summer Research Interns	28

Project Scientist/Research Fellows whose Ph.D. is Ongoing List of Project Scientists (as per date of Ph.D. registration)

Sl. No	Name of the Student Mr./ Ms.	Ph. D. Topic	Ph.D. Registered at
01.	Kumari Konda	Electrochemical Performance of various Cathode Materials using Half and Full Cell	Indian Institute of Technology, Bombay
02.	S. Ramakrishnan	Metallic Flow Field Plates for Low-Temperature Proton Exchange Membrane Fuel Cell	Indian Institute of Technology, Kanpur

Research Fellows whose Ph.D. is Ongoing (as per date of Ph.D. registration)

Sl. No	Name of the Student (Mr./ Ms.)	Ph. D. Topic	Ph.D. Registered at
1.	A. B. Aravind	Development of Materials for Aluminium Air Batteries.	National Institute of Technology, Tiruchirappalli
2.	D. Nazeer Basha	Laser Surface Texturing of Automotive Engine Components using Ultrafast Laser.	Indian Institute of Technology, Madras
3.	K. Sriram	Development of Non-Noble Electro Catalyst for Alkaline Electrolyser Application.	Indian Institute of Technology, Madras
4.	D. M. Santosharang	Design and Modelling of Residual Stresses of Additive Manufacturing	Indian Institute of Technology, Madras
5.	B. Amarendhar Rao	Laser Assisted Machining of Nickel based Super Alloys	National Institute of Technology, Warangal
6.	Kanchi Anjali	Mechanical and Microstructural Behaviour of Refractory High Entropy Alloy	University of Hyderabad, Hyderabad
7.	Guduru Neelima Devi	Cold Spray Deposition of Nickel-based Alloys	National Institute of Technology, Warangal
8.	Harita Seekala	Measuring the Size and Rate Dependence of Strength at Small Scales	Indian Institute of Technology, Madras
9.	Kumar Swamy Reddy. B	Solution – Processed Photo Detector	Indian Institute of Technology, Hyderabad
10.	Rentala Jayasree	Development of Functionally Graded Materials for Bio Applications	Indian Institute of Technology, Kharagpur
11.	D. Vijaya Lakshmi	A Comprehensive Study on High Velocity Thermal Sprayed Thin Coatings for Wear and Corrosion Resistant Applications	Indian Institute of Technology, Bombay
12.	Baswanta Sainath Patil	Additive Manufacturing of 15-5 PH Stainless Steel	Indian Institute of Technology, Hyderabad
13.	P.Sankar Ganesh	Development of Laser Surface Re-Engineering Process on Automotive Structural Steels for Improved Forming and Manufacturability	Indian Institute of Technology, Hyderabad
14.	Chandra Gowthami	Synthesis, Characterisation and Validation of Modified Electrode Materials for Battery Applications	National Institute of Technology, Warangal
15.	Ramay Patra	Corrosion Sensing and Self-Healing Smart Nano Composite Coatings	National Institute of Technology, Warangal
16.	Madugula Swarna	Process development with Analysis of Laser Post-Processing for improved Mechanical Properties in DED Manufactured Super Alloy Component.	National Institute of Technology, Warangal
17.	Ch. Phani Nookarajendra	Micro Arc Oxidation on Valve Metals	Indian Institute of Technology, Madras
18.	Shivangi Tewatia	Cathode Materials for Lithium Sulphur Batteries	Indian Institute of Technology, Madras

Sl. No	Name of the Student (Mr./ Ms.)	Ph. D. Topic	Ph.D. Registered at
19.	Sivakanali	High Voltage Cathode Material and Solid Polymer Electrolyte for Lithium Ion Battery Applications	Indian Institute of Technology, Madras
20.	Yuva Keerthana	Development of Anode Material for High Performance Sodium Ion Batteries	Indian Institute of Technology, Hyderabad
21.	Amgothu Chinna Mathru Naik	Development of an Composite Polymer Electrolyte (CPEs) for all Solid State Lithium-Ion batteries (ASSLIBs)	Indian Institute of Technology, Madras
22.	Priya Indulkar	Rare Earth Corrosion Inhibitor based Corrosion Protection Coating for Metals/Alloys	National Institute of Technology, Warangal
23.	Pragyan Paramita Sahoo	Fabrication of Cost-Effective new Transparent Conducting Material by Inkjet Printing for touch Sensing Application	National Institute of Technology, Warangal
24.	M. Praveen	Design, Development and Demonstration of Nanocomposite Phase Change Material (NPCM) based Thermal Energy Storage System for Economic and Efficient Thermal Energy Storage Applications	Indian Institute of Technology, Hyderabad
25.	Khadambari B	Development of Next Generation High Voltage Spinel Battery Materials	Indian Institute of Technology, Kharagpur
26.	Thumula Akhil	Microstructure Property Correlation of Additively Manufactured Ti-Alloy	National Institute of Technology, Warangal
27.	Jessy Rebecca Angeline C	Anion Exchange Membrane Fuel Cell	Indian Institute of Technology, Madras
28.	Preyadarshini R	Thermoelectric Material for Waste Heat Recovery	Indian Institute of Technology, Madras
29.	D. Lakshmi Priya	Comparative Evolution of Aqueous and Organic based tape casting Process for the Fabrication of Anode-supported IT-SOFC	National Institute of Technology, Warangal
30.	Azarudeen N	Green Hydrogen Generation	National Institute of Technology, Warangal
31.	J. Sravan Kumar	Development of MAX/MXene Phase Materials for Electromagnetic Radiation (Microwave) Absorption	Indian Institute of Technology, Madras
32.	Rajesh R	Development of Nanomaterials for Direct Absorption in Solar Thermal Conversion Systems	National Institute of Technology, Warangal
33.	Vetri Mani A	Indoor Perovskite Solar Cell	Indian Institute of Technology, Hyderabad
34.	Monica M	Carbon Functionalization using Amine Groups	National Institute of Technology, Trichy
35.	Muraliraj A	PEM Fuel Cell Electrode Engineering	National Institute of Technology, Trichy
36.	Mahima Ammu Rajan	Development of Rechargeable Aluminium Ion Batteries (AIBs) for Mobility and Storage Applications	Indian Institute of Technology, Madras
37.	B. Joel Bhaskar	Structure and Electrochemical Property Correlation of Dual Ion Transition Metal Phosphate Cathode	Indian Institute of Technology, Madras

Sl. No	Name of the Student (Mr./ Ms.)	Ph. D. Topic	Ph.D. Registered at
38.	Kandala Bhavani	Processing, Microstructures and Performance of High Entropy and Multi Component Doped YAG Based Thermal Barrier Coatings	Indian Institute of Technology, Bombay
39.	IVRV Harika	Titanate Based Glass Ceramics for Energy Storage Applications	University of Hyderabad, Hyderabad
40.	Bura Kavya	Multiscale Mechanical characterization of Additively Manufactured Structural Components	University of Hyderabad, Hyderabad
41.	Challarapu Bhavani	High Entropy Alloys and Electrodeposition	University of Hyderabad, Hyderabad
42.	N. Hemanth Kumar	Development of Novel Fe-Mn based Biodegradable Alloys for STA Applications	National Institute of Technology, Warangal
43.	Navagana Jaya Surya	Aerogel-MOF Composites for Thermal Insulation and Gas Adsorption Applications	National Institute of Technology, Warangal
44.	B. Rishikesh	Development of Novel Magnesium based Biodegradable Alloys for STA Applications	Indian Institute of Technology, Bombay
45.	Teja Karanam	Development of PAN-Based Carbon Fibre	University of Hyderabad, Hyderabad

Visits by Students and Faculty to ARCI

- 25 B.Sc. Students and Faculty from Padmavathi Degree College for Women, Warangal visited ARCI on April 18, 2024.
- 32 B.Sc. Students and Faculty from Government Degree College for Women, Nalgonda visited ARCI on April 19, 2024.
- 40 B. Tech Students and Faculty from Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad visited ARCI on April 25, 2024.
- 33 Ph.D-M.Tech Students and Faculty from the Indian Institute of Technology, Hyderabad, visited ARCI on May 24, 2024.
- 08 Faculty from various Government Colleges participating in ESCI's program on "Coating & Paint Technology" visited ARCI on June 5, 2024.
- 10 B.Tech., M.Tech., Ph.D. Students and Faculty from SKN Sinhgad College of Engineering, Pandharpur, Maharashtra visited ARCI on June 10, 2024.
- 05 Faculty from School of Applied Sciences and Humanities, Vignan's Foundation for Science, Technology & Research University, Guntur visited ARCI on July 19, 2024.
- 25 Faculty from Bharat Institute of Engineering and Technology, Hyderabad visited ARCI on August 9, 2024.
- 40 B.Sc. Students and Faculty from Government Degree College, Kodangal visited ARCI on September 26, 2024.
- 62 B. Tech. Students and Faculty from National Institute of Technology, Warangal visited ARCI on October 4, 2024.
- 35 B. Tech. Students and Faculty from Methodist College of Engineering and Technology, Hyderabad visited ARCI on November 22, 2024.
- 26 Scientist and Professors from various Government Departments who participated in ASCI programme on "Science Administration Research Management (SARM)" visited ARCI on December 12, 2024.

13. 41 B.Tech Students and Faculty from Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad visited ARCI on December 20, 2024.
14. 52 B. Tech Students and Faculty from National Institute of Technology, Warangal visited ARCI on January 10, 2025.
15. 18 Scientist and Professors from various Government Departments who participated in ASCI programme on "Research Collaborations and Technology Transfers" visited ARCI on January 16, 2025.
16. 11 Technical Officers from various Government Departments who participated in ESCI programme on "Laser Welding Technology" visited ARCI on January 23, 2025.
17. 50 B. Tech. Students and Faculty from National Institute of Technology, Warangal visited ARCI on January 24, 2025.
18. 22 B. Tech. Students and Faculty from SRM Institute of Science and Technology, Chennai visited ARCI on February 21, 2025.
19. 30 B.Tech. Students and Faculty from JB Institute of Engineering and Technology, Hyderabad visited ARCI on February 25, 2025.
20. 160 School Students and Teachers from Zilla Parishad High School, Hyderabad visited ARCI on March 4, 2025 and March 6, 2025 respectively.
21. 75 B.Sc. Students and Teachers from Telangana Social Welfare Residential Degree College for Women, Hyderabad visited ARCI on March 13, 2025.
22. 45 M.Tech. Students and Faculty from National Institute of Technology, Warangal visited ARCI on March 20, 2025.
23. 90 B.Tech. and M.Tech. Students and Faculty from Jawaharlal Nehru Technological University, Hyderabad visited ARCI on March 28, 2025.

Summer Research Internship Programme 2024-25

Students from IIT's, NIT's, IIIT's, Central Universities and various other state and private universities from all over the country were short-listed for availing Summer Research Internship Programme (SRIP) at ARCI, Hyderabad and Chennai Centres for the year 2024. 28 students, who were selected, have attended the programme from May 16, 2024 for a minimum period of 45 days to a maximum period of 60 days. The selected students initially underwent a week-long orientation course at various Centres of Excellence so as to get familiar with the activities being carried out at ARCI. Each student was guided by a scientist to carry out a mini project. The students were issued certificates on successful completion of the programme.

Appointment of Director

Dr. R. Vijay has assumed the charge of the post of Director ARCI w.e.f. May 06, 2024.

Regular Appointment

ARCI has added the following employees to its fold to take up varied responsibilities:

Sl.No.	Employee Name	Designation	Date of Joining
01.	Mr. Deepak Kumar	Technician "A"	01/04/2024
02.	Mr. Padval Rajesh	Technical Assistant "A"	16/04/2024
03.	Mr. Bhukya Vijay	Technical Assistant "A"	24/04/2024
04.	Mr. Golu Kumar Jha	Technical Assistant "A"	26/04/2024
05.	Mr. Rayikindi Ganesh	Assistant "A"	27/02/2025
06.	Mr. Sai Kumar Kandhukuri	Assistant "A"	17/03/2025

Promotions

ARCI has been following its existing assessment and promotion policy since the year 2000-01. As per the policy, assessments were carried out for all the eligible employees and the following were promoted during the years 2024-25:

Sl. No.	Name of the Promotees	Effective Date	Promotion for the post	
			From	To
01.	Dr. Joydip Joardar	10.04.2024	Scientist "F"	Scientist "G"
02.	Mr. M.A. Fazal Hussain	20.05.2024	Driver "B" (MACP)	Driver "C"
03.	Mr. Ravi Singh	16.08.2024	Officer "A"	Officer "B"
04.	Mr. A. Balraj	16.08.2024	Assistant "A"	Assistant "B"
05.	Mr. Gaje Singh	01.10.2024	Technician "A"	Technician "B"
06.	Dr. G. Sivakumar	01.10.2024	Scientist "F"	Scientist "G"
07.	Dr. Ravi Nathuram Bathe	01.10.2024	Scientist "F"	Scientist "G"
08.	Dr. Papiya Biswas	01.10.2024	Scientist "E"	Scientist "F"
09.	Dr. Easwarmoorthi Ramasamy	01.10.2024	Scientist "E"	Scientist "F"
10.	Ms. S. Nirmala	01.10.2024	Scientist "E"	Scientist "F"
11.	Ms. N. Aruna	01.10.2024	Technical Officer "B"	Technical Officer "C"
12.	Mr. R. Anbarasu	01.10.2024	Technical Officer "B"	Technical Officer "C"
13.	Mr. D. Krishna Sagar	01.10.2024	Technician "E"	Technician "F"
14.	Mr. K.V.B. Vasantha Rayudu	01.10.2024	Technician "E"	Technician "F"
15.	Mr. G. Venkata Rao	01.10.2024	Technician "E"	Technician "F"
16.	Mr. K. Satyanarayana Reddy	01.10.2024	Technician "D"	Technician "E"
17.	Mr. D.P. Surya Prakash Rao	01.10.2024	Technician "D"	Technician "E"
18.	Mr. I. Prabhu	01.10.2024	Technician "C"	Technician "D"
19.	Mr. Ch. Jangaiah	01.10.2024	Technician "C"	Technician "D"

Superannuation

Sl.No.	Employee Name	Designation held	Date of Superannuation
01.	Dr. Tata Narasinga Rao	Director	06/05/2024
02.	Ms. Uma Venkateshwaran	Technical Officer "E"	31/07/2024
03.	Mr. M. Srihari	Technical Officer "C"	31/08/2024
04.	Mr. Jamalpur Bansilal	Junior Assistant (MACP-II)	30/09/2024
05.	Mr. C. Karunakar	Technical Officer "C"	31/12/2024
06.	Mr. Debajyoti Sen	Technical Officer "E"	28/02/2025

Resignations

Sl.	Employee Name	Designation held	Date of Superannuation
01.	Dr. Balaji Padya	Scientist "E"	25/09/2024
02.	Mr. P. Prasad Babu	Assistant "A"	11/12/2024

Obituary

Sl.	Employee Name	Designation held	Date of Superannuation
01.	Mr. B. Subramanyeswara Rao	Technician "E"	04/04/2024
02.	Mr. G. Venkat Reddy	Technician "E"	27/10/2024
03.	Mr. Kurra Venkata Ramana	Technician "D"	05/02/2025

Reservations and Concessions

The Reservations and Concessions for SCs/STs/OBCs/EWS and persons with disabilities are followed as per Government of India orders from time to time. At, ARCI, the overall representation of employees under Scheduled Caste (SC) is 20%, Scheduled Tribe (ST) is 6.21%, Other Backward Class (OBC) is 29.66%, and that of persons with disabilities is 2,76% as on March 31, 2025.

Faculty Internship Programme

Under Faculty Internship Programme, teaching faculty from Engineering colleges who are interested to be associated with research work, to carry out part of their research work or wanted to become familiar with latest R&D activities and facilities are permitted to work for a period of 2 to 8 weeks during their vacation.

Outreach Programme under Scientific Social Responsibility

Some of the Scientists on voluntary basis have visited nearby government schools and delivered motivational talks/science talks for the benefit of the school students. On invitation by reputed government/private engineering colleges, ARCI scientists delivered lectures in the area of their specializations and shared their research experiences with the faculty and students.

Indian and Foreign Visitors for Technical Discussion

1. Mr. Rajesh Dobriyal, General Manager-Sales, M/s KG Projects & Equipment Marketing Co. Pvt Ltd, New Delhi visited on May 03, 2024
2. Mr. Martin, Service Engineer, M/s AIP, USA visited during August 26-30, 2024
3. Dr. Ing. Franziska Schmidt, Head, Dental Materials Science and Biomaterials Research, Charite University visited on September 17, 2024
4. Mr. Frank Murken, Head, Thermal Process Technology Division, M/s Nabertherm, GmbH, Germany visited on September 26, 2024
5. Mr. Aseem Naik, Director-Technology, and Mr. Srinivas, Area Manager, M/s KG Projects & Equipment Marketing Co. Pvt Ltd, New Delhi visited on September 26, 2024
6. Dr. Marianito T. Margarito, Supervising Science Research Specialist, Mar Christian O. Que, Senior Science Research Specialist and Alvin Kim M. Collera, Science Research Specialist II, project partners from ITDI, Philippines visited during October 21-25, 2024
7. Mr. David Garrard, Director(APAC), Xiris Automation Inc., Canada visited during November 20-22, 2024
8. Mr. Andrey Golinye, Director, Dr. Konstantin Ivanovskikh, Deputy Director-Research & Innovation, Giredmet-ROSATOM, Moscow, Russia, Mrs. Natalia Samakhvalova Senior Staff and Mr. Vijay Joshi, Deputy CEO, ROSATOM South Asia, Mumbai visited on January 27, 2025
9. Mr. Hiroyuki Ohnishi, Chairman and Ms Sofia Mateem, Engineer, Technology Seed Incubation Co. Ltd, Kyoto, Japan visited on February 3, 2025
10. Mr. Grodent Baptiste, Export Sales Manager, M/s DCX Chrome Groupe Delachaux, Marly, France visited on March 12, 2025

Foreign Visits by ARCI Personnel

1. Mr. K V Phani Prabhakar, Mrs. S Nirmala, and Mr. E Anbu Rasu visited Türkiye during March 13-14, 2025, for Training on the Functionality of the Integrated 10kW fiber Laser and GMAW-based Robotic Laser Hybrid.
2. Dr. Ravi Bathe and Mr. Manish Tak visited the Philippines from March 17-22, 2025, for technical discussion regarding the collaborative research project on "Development, Characterization, and Performance Evaluation of Polymer-Coated and Uncoated Aluminium and Titanium Alloy Powder for Selective Laser Sintering, Selective Laser Melting, and Electron Beam Melting".

Papers Presented at Foreign Conferences / Symposia

1. Dr. Nitin P Wasekar presented a paper on "Compositionally Modulated Ni-W Multilayers to Alleviate Residual Stresses in Coatings for Superior Wear Resistance" at the 'International Conference on Surface, Interfaces and Coatings Technologies-SICT 2024', organized by Science, Engineering, Technology Conferences Organization, Vienna, Austria, during April 17-19, 2024
2. Ms G Neelima Devi (Dr. S Kumar) presented a paper on "Significance of In-flight Powder Energy for Inter-splat Bonding in Cold Sprayed Coatings" at the '11 RIPT-2024 Les Rencontres Internationales De La Projection Thermique' organized by Forschungszentrum Julich, Germany, during June 05-07, 2024
3. Dr. M Buchi Suresh presented paper on "Development and Performance Evaluation of Honeycomb based and Planar based Anode Supported Intermediate Temperature Solid Oxide Fuel Cell for Power Generation" at the '14th International Conference on Ceramic Materials and Components for Energy and Environmental Systems' organized by AK Congress, Budapest, Hungary, during August 18-22, 2024

Papers Presented at Indian Conferences / Symposia

1. Mr. Abhishek (Dr. R Balaji) presented a paper on "Simulation Studies on Development of CCS System for CO₂ Produced from PEM Based Electrochemical Methanol Reformer (ECMR)" at the 'International Conference on Sustainable Research in Energy and Environment (SREE)-2024' organized by National Institute of Technology, Jalandhar, Punjab, during April 05-06, 2024
2. Dr. G Ravi Chandra presented a paper on "Multiscale Characterization of 18-Cr Oxide Dispersion Strengthened Steels" at the 'International Conference on Electron Microscopy and the XLII Annual Meeting of the Electron Microscope Society of India (EMSI-2024)' organized by Indian Institute of Technology (IIT), Mumbai, during May 14-18, 2024
3. Dr. K Suresh presented a paper on "Microstructure of Additively Manufacture 15-5 PH Stainless Steel" at the 'International Conference on Electron Microscopy and the XLII Annual Meeting of the Electron Microscope Society of India (EMSI-2024)' organized by Indian Institute of Technology (IIT), Mumbai, during May 14-18, 2024
4. Dr. P Barick presented a paper on "A Comparative Evaluation Between Densification, Microstructure and Mechanical Properties of Spark Plasma Sintered and Hot-Pressed SiC" at the 'National Symposium on Sintering (NSS-24)' organized by IIT-Patna, Bihar, during May 16-18, 2024
5. Dr. Maheswari (Dr. K Ramya) presented a paper on "Utilization of Recovered Graphite from End of Life Batteries for Energy Applications" at the 'National Conference on Recent Trends in Materials Science and Technology' organized by IIST, Thiruvananthapuram, during June 25-27, 2024
6. Dr. P Suresh Babu presented a paper on "Creep Behaviour of Dispersion Strengthened Iron Aluminide (Fe₃Al)" at the 'International Conference on Creep and Fracture of Engineering Materials and Structures' organized by Indian Institute of Science (IISc), Bangalore, during July 28-August 02, 2024
7. Mr. Ramay Patra (Dr. R Subasri) made a poster presentation on "Bioinspired Corrosion Sensing and Self-Healing Nanocomposite Coatings" at the '13th Edition of Bengaluru INDIA NANO' jointly organized by Department of Science & Technology (DST), Government of Karnataka, Karnataka Science & Technology Promotion Society (KSTePS), and Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, during August 1-3, 2024
8. Dr. D Prabhu presented a paper on "High Coercivity Fe-B Magnets for EV Applications by Grain Boundary Engineering" at the 'International Conference of Science and Technology and Applications of Rare Earths (ICSTAR-2024)' jointly organized by the Rare Earth Association of India and The Indian Institute of Metals, Trivandrum Chapter, Thiruvananthapuram, during August 21-23, 2024

9. Mr. KRC Soma Raju presented a paper on "Rare-earth Corrosion Inhibitor-based Paints for Corrosion Protection of Low Carbon Steels" at the 'International Conference on Electrochemical Science and Technology-2024 (ICONEST-2024)' jointly organized by Electrochemical Society of India and CSIR-National Physical Laboratory, New Delhi, during September 18-20, 2024
10. Mr. Ramay Patra (Dr. R Subasri) presented a paper on "Smart Sol-Gel Coatings: Thymol Blue and Phenolphthalein for Enhanced Corrosion Sensing and Protection on Mild Steel" at the 'International Conference on Electrochemical Science and Technology (ICONEST 2024)' jointly organized by Electrochemical Society of India and CSIR- National Physical Laboratory, New Delhi, during September 18-20, 2024
11. Ms. Priya Indulkar (Dr. R Subasri) made a poster presentation on "Investigation on Corrosion Inhibition of Rare Earth Elements based Sol-gel Coatings for Mild Steel Protection" at the 'International Conference on Electrochemical Science and Technology (ICONEST 2024)' jointly organized by Electrochemical Society of India and CSIR- National Physical Laboratory, New Delhi, during September 18-20, 2024
12. Ms. Yuvakeerthana (Dr. B V Sarada) made a poster presentation on "Development of Hard Carbon as an Anode Materials for their use in Na Ion Batteries" at the '18th National Frontiers of Engineering Symposium and Innovation in Manufacturing Devices related to Energy Storage', organized by NIT Warangal, during November 16-17, 2024
13. Ms. Sivakanali (Dr. S Anandan) made a poster presentation on "Cobalt and Nickel Free Advanced High Voltage Cathode (LiMn1-xFexPO4) Material for High Energy Lithium ion Battery Applications" at the '18th National Frontiers of Engineering Symposium and Innovation in Manufacturing Devices related to Energy Storage', organized by NIT Warangal, during November 16-17, 2024
14. Mr. Jaya Surya (Dr. Neha Hebalkar) made a poster presentation on "Investigating the Correlation Between Porous Structure with High Temperature Thermal Insulation Performance in Silica Aerogel Made by Ambient Pressure Drying" at the '78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)', organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
15. Dr. Gururaj Telasang presented a paper on "Powder bed Fusion Laser Beam Melting of High Speed Tool Steel" at the '78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)', organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
16. Dr. KS Athira presented a paper on "Effect of High Temperature Substrate Plate during Powder Bed Fusion Laser Beam Melting of Titanium Alloy" at the '78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)', organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
17. Ms R Jayashree (Dr. Dibyendu Chakravarthy) presented a paper on "Exploring the Feasibility of Fabricating Functionally Graded Metal Ceramic Components by Spark Plasma Sintering for Dental Implants" at the '78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)', organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
18. Mr. J Sruvan Kumar (Dr. Malobika Karanjai) presented a paper on "Study on Magnetic Properties of Core Shell Fe-Fe₃O₄ PM Processed Magnetic Composites" at the 78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)' organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
19. B. Amarendhar Rao (Dr. Ravi Bathe) presented a paper on "Tool-life Studies in Laser-assisted Turning of IN625 Alloy with Uncoated and CrAlSiN Nanocomposite Coated Tungsten Carbide Inserts" at the 78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)' organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
20. Dr. K Murugan presented a paper on "Development of Slurry / Paste based Coating for High Temperature Thermal Protection" at the 78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM 2024)' organized by Indian Institute of Metals, Bengaluru, during November 20-22, 2024
21. Dr. P. Barick presented a paper on "Silicon Carbide: Processing Properties and Critical Applications" at the 'International Conference on Frontier in Ceramic Materials (ICFCM)' organized by IIT-BHU, Varanasi, Uttar Pradesh, during December 16-18, 2024
22. Ms. N Aruna presented a paper on "Enhancing PVD Process Control through LabVIEW Automation" at the '2nd International Conference on Recent Trends in Microelectronics, Automation, Computing and Communications Systems (ICMACC-24)', jointly organized by IEEE and VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad, on December 20, 2024

23. Dr. P Barick presented a paper on “Lithium Aluminosilicate Low-Expansion Glass-Ceramic – Composition Effect on Salient Properties Crystallization Mechanism” at ‘Viswa Bangla Convention Center’ organized by CSIR-CGCRI, Kolkata, during January 20-24, 2025
24. Dr. Priji C presented a paper on “Study of Impact of Defects on Fuel Cell Performance during Automated Manufacture: DAE-BRNS” at the ‘Conference on Electrochemistry for Industry Health and Environment (EIHE-2025)’ jointly organized by DAE Convention Center and Bhabha Atomic Research Centre, Mumbai, during January 21-25, 2025
25. Dr. Bhanu Prakash (Dr. D C Jana) made a poster presentation on “C/C-SiC-ZrC Based Ceramic Composites through ZrSi₂ Reactive Infiltration” at the ‘National Conference & Research to Business (R2B)’ organized by Indian Ceramic Society, Hyderabad, on January 24, 2025
26. Mr. G Praneeth Raj (Dr. M Buchi Suresh) presented a poster on “Combustion Synthesis of LSCF and BSCF Nano Powders for Solid Oxide Fuel Cell Cathodes” at the ‘National Conference & Research to Business (R2B) meet’ organized by Indian Ceramic Society, Hyderabad, on January 24, 2025
27. Dr. Pandu Ramavath presented a paper on “Processing and Applications of Advanced Ceramic Materials” at the ‘2nd International Conference on Advanced Materials and Computational Methods in Mechanical Engineering (ICAMCMME-2025)’ jointly organized by Poornima College of Engineering, Jaipur and Vasavi College of Engineering, Hyderabad, during February 14-15, 2025
28. Ms. MS Archana (Dr. Joydip Joardar) presented a paper on “On Consolidation of Mechanically Activated Cr₂AiC based Composites” at the ‘International Conference on Powder Metallurgy & Particulate Materials (PM 25) and 50th Annual Technical Meeting of PMAI’, organized by Powder Metallurgy Association of India (PMAI), Mumbai, during February 19-21, 2025
29. S Sudhakara Sarma presented a paper on “Nanostructured Materials Processing by Cryo-milling”, at the ‘International Conference on Powder Metallurgy & Particulate Materials (PM 25) and 50th Annual Technical Meeting of PMAI’ organized by Powder Metallurgy Association of India (PMAI), Mumbai, during February 19-21, 2025
30. Dr. Sanjay R. Dhage presented a paper on “Inkjet Printing of Graphene and Carbon Nanotubes for Advanced Applications” at the ‘National Workshop on Advanced Carbon Materials for Next Generation Energy Solutions (NWCM025)’ organized by Indian Institute of Petroleum (CSIR-IIP), Dehradun, during February 20-21, 2025
31. Mr. Teja Karnam (Dr. Sanjay R. Dhage) made a poster presentation on “Metal Foils Reinforced Exfoliated Graphite Composites for Advanced Engineering Applications” at the ‘National Workshop on Advanced Carbon Materials for Next Generation Energy Solutions (NWCM025)’ organized by Indian Institute of Petroleum (CSIR-IIP), Dehradun, during February 20-21, 2025
32. Ms. Ambathi Mary Suvarna Preethi (Dr. Sanjay R. Dhage) made a poster presentation on “Single Step Treatment to Improve the Quality of MWCNT’s for Application in Electronic and Sensor” at the ‘National Workshop on Advanced Carbon Materials for Next Generation Energy Solutions (NWCM025), organized by Indian Institute of Petroleum (CSIR-IIP), Dehradun, during February 20-21, 2025
33. Dr. N Ravi Kiran (Dr. PK Jain) presented a paper on “A Novel Green Process of Making Multi/ Few Layers Graphene and their Applications” at the ‘National Workshop on Advanced Carbon Materials for Next Generation Energy Solutions (NWCM025); organized by Indian Institute of Petroleum (CSIR-IIP), Dehradun, during February 20-21, 2025
34. Ms. M Swarna (Dr. G Siva Kumar) presented a paper on “Sustainable Refurbishment of through HVOF Sprayed Thick Composites Coatings to replace Hard Chrome Plating for Cylindrical Shafts” at the ‘2nd National Thermal Spray Conference and Expo (NTSC)’ jointly organized by The Indian Thermal Spray Association and CSIR Institute of Minerals and Materials Technology (IMMT), Bhubaneswar, during February 21-23, 2025
35. Dr. KS Athira presented a paper on “Powder Bed Fusion by Laser Beam Melting of BZL 12Y Super Alloy: Process Optimization, Microstructure Analysis and Mechanical Properties” at the ‘2 Day National Conference on Challenges in Welding and Additive Manufacturing (NCWAM 2025); organized by BITS, Hyderabad, during February 27-28, 2025
36. Ms. T Navya (Dr. Ravi Bathe) presented a paper on “Laser Powder Bed Fusion of Ti-6Al-4V: A Study of Post-build Heat Treatment and Substrate Plate Heating Effects” at the ‘2 Day National Conference on Challenges in Welding and Additive Manufacturing (NCWAM 2025); organized by BITS, Hyderabad, during February 27-28, 2025
37. Dr. K Suresh presented a paper on “SAXS for Materials Engineering: Probing Nanoscale Chemical Heterogeneity in Structural Alloys” at the ‘International Conference on Multinational Materials for Societal Applications (ICMMSA-2025); organized by Osmania University, Hyderabad, during March 26-28, 2025

38. Dr. Sanjay R Dhage presented a paper on "Thin Film Materials for Efficient Solar Energy Conversion" at the 'International Conference on Multinational Materials for Societal Applications (ICMMSA-2025)', organized by Osmania University, Hyderabad, during March 26-28, 2025
39. Ms. C Prashanthi (Dr. K Suresh) presented a paper on "Effect of Hatch Width Overlap on Microstructural Evolution in Laser Powder Bed Fusion of 15-5 PH Steel" at the 'International Conference on Multinational Materials for Societal Applications (ICMMSA-2025)', organized by Osmania University, Hyderabad, during March 26-28, 2025
40. Ms. Shailaja Saxena (Dr. PH Borse) presented a paper on "Comparative Electrochemical Study of Nickel based Composite for Alkaline Electrolyser Application" at the 'International Conference on Multinational Materials for Societal Applications (ICMMSA-2025)', organized by Osmania University, Hyderabad, during March 26-28, 2025
41. Mr. Teja Karnam (Dr. Sanjay R. Dhage) presented a paper on "Enhanced Electrical, Thermal, Mechanical Properties of Exfoliated Graphite-Metal Sheets for Advanced Engineering Applications" at the 'International Conference on Multifunctional Materials for Societal Application (ICMMSA-2025)', organized by Osmania University Hyderabad, during March 26-28, 2025
42. Ms. Pragyan P Sahoo (Dr. Sanjay R. Dhage) presented a paper on "Al:ZnO Transparent Conductive Oxide with Controlled Morphology for Opto-electronic Application" at the 'International Conference on Multifunctional Materials for Societal Application (ICMMSA-2025)', organized by Osmania University Hyderabad, during March 26-28, 2025
43. Mr. B Kumar Swamy Reddy (Dr. P H Borse) presented a paper on "Performance Evaluation of Photovoltaic/Thermal (PV/T) System: A Study of Flow Characteristics Using 3D Transient Thermal Analysis" at the 'International Conference on Multifunctional Materials for Societal Applications (ICMMSA-2025)', organised by Osmania University, Hyderabad, during March 26-28, 2025

Lectures Delivered by ARCI Personnel

1. Dr. B V Sarada delivered an invited lecture on "Energy Storage Devices for Electric Vehicles" at the 'Workshop on E-Mobility and its Challenges for Sustainability' organized by Geetanjali Institute of Engineering and Technology, Hyderabad, during April 02-06, 2024
2. Dr. P H Borse delivered a key note lecture on "Rare Earth-based Functional Materials for Optoelectronic Applications" at the '3rd International Conference on Technologies as Properties of Rare-earth Metals and Related Materials (RAREMET-2025)' organized by Giredmet, Moscow, Russia, during April 03-05, 2024 (Online)
3. Dr. R Balaji delivered an invited lecture on "Electrochemical Reformer - An Advanced Method for Hydrogen Generation" at the 'National Conference on Sustainable Energy Conversion and Storage: Functional Materials, Systems, and Applications (NCSECS 2024)' organized by CHRIST University, Bangalore, during April 18-20, 2024
4. Dr. B V Sarada delivered a Keynote lecture on "Power Electronic Technologies for Energy Storage Applications" at the 'Tech Resonance workshop' organized by Avanti Group of Institutions, Hyderabad, during April 19-20, 2024
5. Dr. V Ganapathy delivered an invited talk on "Surface Engineering of Photoelectrodes for Highly Efficient and Stable Perovskite Solar Cells" at the '3rd International Conference on Advanced Nanomaterials for Energy, Environment and Healthcare Applications (ANEH-2024)' organized by GTIN Institution, Dindigul, Tamil Nadu, during April 21-23, 2024
6. Dr. P H Borse delivered an invited talk on "Fabrication of Nanostructured Photo-sensor for Energy Applications" at the '5 Day National Research Development Program-Pathways to Discovery and Innovation: Nurturing Research for Tomorrow (PDINR-2024)', organized by P R Govt. College, Kakinada, Andhra Pradesh, during April 25-30, 2024
7. Dr. Raman Vedarajan delivered an invited lecture on "Unlocking Value: Recycling Precious Components in End-of-Life Polymer Electrolyte Membrane Fuel Cells" at the '23rd National Convention of Electrochemist' jointly organized by SRM Institute of Science and Technology and Society for Advancement of Electrochemical Science and Technology (SAEST), Chennai, on May 01, 2024
8. Dr. Sanjay Bhardwaj delivered an invited lecture on "Industrial Collaborations and Technology Transfer" at S.N. Bose National Centre for Basic Sciences, Kolkata, on May 02, 2024
9. Dr. Mani Karthik delivered an invited talk on "Advanced Energy Materials and Prototype Systems for Energy Conversion, Storage and Utilization" organized by Centre for Research and Development, K.S. Rangasamy College of Technology, Tiruchengode, Namakkal, Tamil Nadu, on May 02, 2024

10. Dr. V Ganapathy delivered an invited talk on “Evolution of Perovskite Solar Cells: Advantage and Challenges, Advanced Energy Materials for Next-Generation Solar Cells” organized by IITDM Jabalpur, Madhya Pradesh, on May 02, 2024
11. Dr. D Prabhu delivered an invited lecture on “Microstructurally Engineered Heavy Rare Earth Free/ Lean Permanent Magnets” at the ‘International Conference on Electron Microscopy (EMSI-2024)’, organized by Indian Institute of Technology (IIT), Mumbai during May 16-18, 2024
12. Dr. Sanjay Bhardwaj delivered an invited lecture on “Translational Research” for Ph.D. & M.Tech. students and faculty from IIT Hyderabad at ARCI, Hyderabad, on May 24, 2024
13. Dr. R Subasri delivered an invited talk on “Surface Engineering for Prevention of Corrosion and Material Degradation” at the ‘Continuing Professional Development Program on Coating and Paint Technology’, organized by Engineering Staff College of India, Hyderabad, on June 03, 2024
14. Dr. Srinivasan Ananadan delivered an invited lecture on “Indigenous Materials for Li-ion Battery Applications: Demonstration of Lab Innovations to Semi-Pilot Scale Production” at the ‘Summer Training Program in Physics (STP-2024)’ organized by the Academy of Sciences, Chennai, on June 04, 2024
15. Dr. Srinivasan Ananadan delivered an invited lecture on “Design, Fabrication and Demonstration of Indigenous Supercapacitor for EV Applications” at the ‘Summer Training Program in Physics (STP-2024)’ organized by the Academy of Sciences, Chennai, on June 06, 2024
16. Dr. R Vijay delivered an invited lecture on “Lithium Summit: Demand & Supply Dynamics” organized by T-Hub, Hyderabad, on June 07, 2024
17. Dr. Sanjay Bhardwaj delivered an invited lecture on “Academia – R & D – Industry Collaboration” for faculty members of SKN Singhad College of Engineering, Pandharpur, Solapur, Maharashtra, on June 10, 2024
18. Dr. Sanjay Bhardwaj delivered an invited lecture on “Research Collaborations” at the ‘DST Sponcered Science Administration Research Management (SARM)’ Programee organized by Administrative Staff College of India (ASCI), Hyderabad, on December 12, 2024
19. Dr. Raman Vedarajan delivered an invited lecture on “Materials in PEM Fuel Cells” organized by Sathyabhama University, Chennai, on June 15, 2024
20. Dr. MB Sahana delivered an invited lecture on “Introduction to the Rietveld Refinement” organized by Indian Institute of Technology (IIT), Chennai on June 15, 2024
21. Dr. R Vijay delivered a keynote lecture on “Materials, Supply Chain and Equipment Manufacturing” at ‘Unlocking Battery Innovation: Stakeholder Meeting on Rapid Prototyping Centre’ jointly organized by India Energy Storage Alliance (IESA), DST and IIT Tirupati, on June 18, 2024
22. Dr. R Balaji delivered an invited lecture on “Electrolysis – Carbon-free Hydrogen Production Method” at the ‘One Day Industrial Conclave One Week One Theme - Energy (Conventional and Non-Conventional) and Energy Devices (EED) [OWOT-EED] Campaign’ organized by CSIR – CECRI, Karaikudi, Tamil Nadu, on June 27, 2024
23. Dr. B V Sarada delivered an invited lecture on “Nanostructured Electrode Materials for High-Performance Energy Storage Devices” at the ‘International Conference on Emerging Multifunctional Materials and Devices for Sustainable Technologies (IEMDST-2024)’ organized by NIT Warangal, during July 4-5, 2024
24. Dr. R Balaji delivered an invited lecture on “Development of indigenous & Durable Components for PEM Fuel Cell” at the ‘International Conference on Emerging Multifunctional Materials and Devices for Sustainable Technologies (IEMDST-2024)’ organized by NIT, Warangal, during July 4-5, 2024
25. Dr. Srinivasan Ananadan delivered an invited lecture on “Materials for Energy Storage Applications: Lab Innovations to Semi-Pilot Scale Demonstration,” at the ‘International Conference on Emerging Multifunctional Materials and Devices for Sustainable Technologies (IEMDST-2024)’ organized by NIT Warangal, during July 4-5, 2024
26. Dr. Srinivasan Ananadan delivered an invited lecture on “Development of Indigenous Materials for Energy Storage Applications: Translations of Lab Innovations to Semi-Pilot Scale Production” at ‘Military College of Electronics and Mechanical Engineering’, Secunderabad, on July 12, 2024

27. Dr. M Buchi Suresh delivered an invited talk on "An Energy Efficient Clean & Green Technology for the Generation of Power and Hydrogen – Component Screening through Characterization Tool" at the 'Faculty Development Program on Advances in Material Characterization and Data Processing' organized by Anurag University, Hyderabad, on July 19, 2024
28. Dr. P H Borse delivered an invited talk on "Sensors Advancements in Climate Change and Possible Future" at the '1st National Scientists Round Table Conference (NSRTC-2024) for Viksit Bharat-2047' organized by MIT-WPI, Pune, during July 19-21, 2024
29. Dr. P H Borse delivered an invited talk on "Advancements in Green Hydrogen via Light, Electricity, and Chemical Induce Water Splitting" at the 'National Conference on India's Hydrogen National Mission: Recent Developments and Future Prospects' organized by Indian Institute of Information Technology, Design & Manufacturing (IIITDM), Kurnool, Andhra Pradesh, during July 22-24, 2024 (Online)
30. Dr. P Suresh Babu delivered an invited talk on "Creep Behavior of Oxide Dispersion Strengthened Iron Aluminide (Fe₃Al)" at the '16th International Conference on Creep and Fracture of Engineering Materials and Structures (CREEP 2024)' organized by Indian Institute of Science(IISc), Bangalore, during July 28 –August 02, 2024
31. Dr. Mani Karthik delivered an invited talk on "Development of Advanced Materials and Prototype Systems for Energy Conversion and Storage" at the 'Five-day Online Faculty Development Programme on Advancements in Materials Science Research' organized by PSGR Krishnammal College for Women, Coimbatore, during July 29 - August 02, 2024
32. Ms. Priya Anish Mathews delivered a guest lecture on "Idea to IPR: Generate, Invent and Safeguard" organized by Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, Hyderabad on August 02, 2024
33. Dr. R Balaji delivered an invited lecture on "PEM Fuel Cell and its Environmental Impact" at the 'Faculty Development Programme on Energy Storage Devices' organized by SRMIST, Chennai, on August 8, 2024
34. Dr. Raman Vedarajan delivered an invited lecture on "Recycling of Precious Components in PEM fuel Cells" organized by ANEH – GTN, Dindigul, Tamil Nadu, on August 21, 2024
35. Ms. Priya Anish Mathews delivered a guest lecture on "Anticipation, Opposition IP Transformation" organized by RBVRR, Hyderabad on August 23, 2024
36. Dr. S Sakthivel delivered an invited lecture on "Cost-efficient Absorber Tubes for Medium and High-temperature Concentrated Solar Thermal (CST)-based Industrial Process Heat Application" at the '2nd International Symposium on Renewable Energy Technologies: Energizing the Future (ISRET-2024)' organized by IIT Chennai, on August 28, 2024
37. Dr. B V Sarada delivered a keynote lecture on "Additive Manufactured Bio-Medical Implants and Advanced Biocompatible Coatings" at the 'Conference on Medical Materials and Devices' organized by AMTZ and ASM International at Mumbai during September 04-06, 2024
38. Dr. R Subasri delivered a keynote lecture on "Bioinspired Nanostructured/Nanocomposite Coatings for Corrosion Protection" at the '3rd International Conference on Electrochemical Science and Technology (ICONEST-2024)' jointly organized by Electrochemical Society of India (ECSI) and National Physical Laboratory (NPL), New Delhi, during September 18-20, 2024
39. Dr. Srinivasan Anandan delivered an invited lecture on "Reinforcing Indian Mission Towards Indigenous Energy Storage Materials: Lab to Semi-Pilot Scale Demonstration" at the '3rd International Conference on Electrochemical Science and Technology (ICONEST-2024)' jointly organized by Electrochemical Society of India (ECSI) and National Physical Laboratory (NPL) New Delhi, during September 18-20, 2024
40. Dr. K Ramya delivered an invited lecture on "Achieving PEMFCs full Potential through Materials Development and Diagnostics" at the '3rd International Conference on Electrochemical Science & Technology (ICONEST-2024)' jointly organized by Electrochemical Society of India (ECSI) and National Physical Laboratory (NPL) New Delhi, during September 18-20, 2024
41. Dr. V Ganapathy delivered an invited talk on "Renewable Energy: Environmentally Benign and Never Depletes" at the 'National Conference on Emerging Energy Storage System' organized by Karpagam Academy of Higher Education, Coimbatore, Tamil Nadu, on September 24, 2024

42. Dr. R Subasri delivered a lecture on "Bioinspired Nanostructured/Nanocomposite Coatings for Diverse Applications", at the 'Asian Advanced Materials Congress' organized by International Association of Advanced Materials, Jodhpur, on September 26, 2024 (Online)
43. Dr. R Vijay delivered an invited lecture on "Development of Powders for Additive Manufacturing" at 'Engineers Conclave-2024' organized by Indian National Academy of Engineering (INAE) at the Defence Research and Development Laboratory (DRDL) Hyderabad, during September 26-27, 2024
44. Dr. Bijoy Kumar Das delivered an invited lecture on "Large Scale Design of High Performance Cathode Materials for Sustainable Sodium-ion Batteries" at the '1st National Meeting on Sodium (-Ion) Batteries' organized by IIT Bombay, during October 4-6, 2024
45. Dr. V Ganapathy delivered an invited talk on "Renewable Energy: Solar Cells" at the 'Refresher Course on Materials Science and Nano Technology' organized by Pondicherry University, Puducherry, during October 15-28, 2024
46. Dr. V Ganapathy delivered an invited talk on "Perovskite Solar Cells: Advantages and Challenges" at the 'Refresher Course on Materials Science and Nano Technology' organized by Pondicherry University, Puducherry, during October 15-28, 2024
47. Dr. R Vijay delivered a lecture on "Ushering into a Self-dependent India in Energy Storage Materials: Bridging the Gap Between Lab to Pilot Scale Manufacturing @ARCI" at 'Indo-French Symposium 2024' organized by BITS-Pilani, Hyderabad, Supported by CEFIPRA during October 24-26, 2024
48. Dr. R Balaji delivered an invited lecture on "Advancements in Hydrogen Fuel Cell Environmental Implications" at the 'ATAL Faculty Development Programme on Electrical Vehicles and Hydrogen Fuel Cell Vehicles' organized by RVS College of Engineering, Coimbatore, on November 8, 2024
49. Dr. Srinivasan Anandan delivered an invited lecture on "Strengthening India Mission Towards Self-reliance in Energy Storage (Li-ion Battery & Supercapacitor) Lab to Semi-Pilot Scale Demonstration" at the '4th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Bio-medical Applications (INEEBA 2024)' organized by Vinayaka Mission Research Foundation, Salem, on November 09, 2024
50. Dr. M Buchi Suresh delivered an invited talk on "Impact of Student Education for Future Society" on the occasion of 'Children's Day' organized by Narayana Techno School, Hyderabad, on November 14, 2024
51. Dr. S Sakthivel delivered an invited lecture on "Functional Materials and Coatings for Solar Thermal and PV Applications" at the 'Workshop on Materials and Coatings for Flexible Electronics' organized by Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur, during November 18-22, 2024
52. Dr. Malobika Karanjai delivered a lecture on "Magnetic Properties of Core-shell based Fe-Fe₃O₄ PM Processed Soft Magnetic Composites" at the 'International Symposium on Transformation Technologies in Materials and Manufacturing' organized by Indian Institute of Metals (IIM), Bengaluru, during November 20-22, 2024
53. Dr. R Vijay delivered a plenary lecture on "Ushering into a Self-dependent India in Energy Storage Materials: Bridging the Gap between Lab to Pilot Scale Manufacturing @ARCI" at 'CORCON – 2024' organized by The Association for Materials Protection and Performance (AMPP) India Chapter, Chennai, on November 24, 2024
54. Dr. Mani Karthik delivered an invited talk on "Advanced Materials for Energy Storage Devices and Technologies" organized by PSG College of Technology, Coimbatore, on November 30, 2024
55. Dr. Srinivasan Anandan delivered an invited lecture on "Requirements of the National and International Markets of BESS Produced in India – Focus on Safety, Quality, and Sustainability Requirements," at the 'Workshop on Improving Quality Infrastructure for Battery Energy Storage Systems' organized by Physikalisch-Technische Bundesanstalt (PTB), Germany, National Institute of Solar Energy (NISE) and ARCI, Hyderabad, on December 04, 2024
56. Dr. R Balaji delivered an invited lecture on "Advanced Electrolysis Method for Hydrogen Generation" at the 'ATAL Faculty Development Programme on Fuel Cell Technologies for Hybrid and Electric Vehicles' organized by MVGR College, Vizianagaram, Andhra Pradesh, on December 6, 2024 (virtual)
57. Dr. R Vijay delivered the inaugural lecture on "Activities on Hydrogen @ARCI" at the 'International Workshop on Hydrogen Energy: Production, Storage, and Utilization' organized by IIT Tirupati, on December 09, 2024
58. Dr. S Sakthivel delivered an invited lecture on "Functional Materials and Coating for Energy Conversion and Hydrogen Generation" at the 'National Workshop on Green Hydrogen: Technology to Application' organized by Pondicherry University, Puducherry, on December 10, 2024

59. Dr. R Balaji delivered an invited lecture on “Key Measures in Realising Hydrogen Mission in India” at the ‘National Workshop on Green Hydrogen: Technology to Application’ organized by Pondicherry University, Puducherry, on December 10, 2024
60. Dr. R Balaji delivered an invited lecture on “PEMFC for Stationary and Transport Applications” at the ‘ATAL Faculty Development Programme on Hydrogen Fuel Cell and Electric Vehicle’ organized by BS Abdul Rahman College, Chennai, on December 11, 2024 (virtual)
61. Dr. R Balaji delivered an invited lecture on “Hydrogen as an Energy Carrier” at the ‘ATAL Faculty Development Programme on Advances in Energy Storage & Sustainable Technologies’ organized by Vellammal College of Engineering, Chennai, on December 12, 2024 (virtual)
62. Dr. Dibyendu Chakravarty delivered a talk on “Tungsten Tungsten-fibre Composites for High Temperature Applications by SPS” at the ‘5th Indo-Austrian Symposium on Materials Engineering (IASME 2024)’ organized by IIT Kharapur, during December 12-13, 2024
63. Dr. Srinivasan Ananadan delivered an invited lecture on “Advancing India’s Journey Toward Self-Reliance in Energy Storage Materials: Lab to Semi-Pilot Scale Demonstration of Li-ion Batteries and Supercapacitors,” at the ‘International Conference on Smart Materials for Green Energy & Environmental Sustainability (SMaGEES 2024)’ organized by B S Abdur Rahman Institute of Science and Technology, Chennai, on December 12, 2024
64. Dr. B V Sarada delivered an invited lecture on “Materials and Processes for Energy Storage Applications” at the ‘Chemistry for a Sustainable Future: International Symposium on Bridging Science and Society’ organized by Sri Satya Sai Institute of Higher Learning, Puttaparthi, Andhra Pradesh, during December 13-14, 2024
65. Dr. Papiya Biswas delivered an invited talk on “Processing of Optically Transparent Lithium Aluminium Silicate Glass-Ceramics and Study of Mechanical Properties” at the ‘International Conference on Frontier in Ceramic Materials (ICFCM 2024)’ organized by IIT-BHU, Varanasi, Uttar Pradesh, during December 16-18, 2024
66. Dr. Dibyendu Chakravarty delivered a talk on “Engineering Functionally Graded Metal Ceramic Composites for Dental Implants using Novel SPS Technique” at the ‘International Conference on Frontier in Ceramic Materials (ICFCM 2024)’ organized by IIT-BHU, Varanasi, during December 16-18, 2024
67. Dr. Prasenjit Barick delivered a talk on “Silicon Carbide Processing, Properties and Critical Applications” organized by IIT-BHU, Varanasi during December 16-18, 2024
68. Mr. Manish Tak delivered an invited talk on “Role of Additive Manufacturing Applications in Sustainable Materials” organized by Gokaraju Rangraju Institute of Engineering and Technology (GRIET), Hyderabad, on December 17, 2024
69. Dr. Debdyuti Mukherjee delivered an invited lecture on “Designing Next Generation Sustainable Energy Conversion and Storage Systems Using Two-Dimensional Organic-Inorganic Layered Hybrid Catalysts and Highly Conducting Ionomer Membranes” at the ‘61st Annual Convention of Chemists (ACC-2024)’ organized by Indian Chemical Society, Kolkata, during December 19-21, 2024
70. Dr. Neha Hebalkar delivered an invited lecture on “Innovative Nanomaterials: Applications and Technologies” at the ‘ATAL Faculty Development Program’ organized by Department of Biomedical Engineering, Osmania University, Hyderabad, on January 06, 2025
71. Dr. Kaliyan Hembram delivered an invited lecture on “Next Generation Biodegradable (BD) Alloy Implants by Additive Manufacturing: Powder to Product” at the ‘ATAL Faculty Development Program’ organized by Department of Biomedical Engineering, Osmania University, Hyderabad, on January 06-11, 2025
72. Dr. Sanjay Bhardwaj delivered an invited lecture on “Technology Assessment using TRLs” at the ‘Technology Development, Assessment, and Transfer’ organized by DST–Technology Enabling Centre, University of Hyderabad (UoH), Hyderabad, during January 09-10, 2025
73. Dr. Sanjay Bhardwaj delivered an invited lecture on “Research Collaborations” for DST sponsored Foundation Training Programme organized by Administrative Staff College of India (ASCI), Hyderabad, on January 16, 2025
74. Dr R Subasri delivered an invited talk on “Sol-Gel Derived Nanocomposite Coatings on Glass for Diverse Applications” at the ‘27th International Congress on Glass (ICG-2025)’ organized by CGCRI, Kolkata, during January 20-24, 2025
75. Dr. Ravi Bathe delivered an expert talk on “Laser Processing of Materials” organized by Engineering Staff College of India (ESCI), Hyderabad, on January 23, 2025

76. Mr. KV Phani Prabhakar delivered an expert talk on "Laser Welding" organized by Engineering Staff College of India (ESCI), Hyderabad, on January 23, 2025
77. Dr. Mani Karthik delivered an invited talk on "Advanced Materials for Energy Storage Devices and Technologies" at the 'International Conference on Advanced Materials for Sustainable Technologies' organized by Centre for Advanced Materials and Technologies (CAMAST), PSGR Krishnammal College for Women, Coimbatore, during January 23-24, 2025
78. Dr. B P Saha delivered an invited talk on "Design Criticality and Processing Aspects of High Precision Space Mirror Substrate" at the 'National Conference and Research to Business (R2B) Meet on Materials that Matter for Whiteware and Technical Ceramics' jointly organized by American Ceramic Society and Indian Ceramic Society Hyderabad, on January 24, 2025
79. Dr. Raman Vedarajan delivered an invited lecture on "Functionalization of Carbon for Electro Catalyst in Fuel Cell Applications" at the 'International Conference on Energy Conversion and Storage 25 (ICEMS25)' organized by IIT, Chennai, on January 28, 2025
80. Dr. R Balaji delivered an invited lecture on "Hydrogen Energy-based Mobility and Backup Power Applications" at the 'ATAL Faculty Development Programme on Innovative Solutions for Smart Cities: Enhancing Mobility and Urban Sustainability' organized by Takshashila University, Tindivanam, Tamil Nadu, on February 3, 2025 (Virtual)
81. Dr. R Balaji delivered an invited lecture on "Hydrogen Production through Electrolysis" at the 'ATAL Faculty Development Programme on Hydrogen (H₂) Generation from Renewable Energy Technologies' organized by Institute of Energy Studies, Anna University, Chennai, on February 3, 2025
82. Dr. K Ramya delivered an invited lecture on "PEMFC – Overview and Applications" at the 'ATAL Faculty Development Programme on Hydrogen (H₂) Generation from Renewable Energy' organized by Institute of Energy Studies, Anna University, Chennai, during February 3-7, 2025
83. Dr. Debdyuti Mukherjee delivered an invited lecture on "Designing Next Generation Sustainable Energy Conversion and Storage Systems Using Two-Dimensional Organic-Inorganic Layered Hybrid Catalysts" at the 'International Conference on Emerging Materials for Energy and Sustainability Energy and Sustainability (EMES-2025)' organized by VIT, Chennai, during February 6-8, 2025
84. Dr. Srinivasan Ananadan delivered an invited lecture on "Development of Sustainable Indigenous Materials Technologies for Energy Storage Application" at the 'Role of Chemistry in Advanced Engineering Materials (RCAEM-2025)' organized by Vasavi Engineering College, Hyderabad, on February 08, 2025
85. Dr. Srinivasan Ananadan delivered an invited lecture on "Bridging the Gap: High Performance Materials for Energy and Environmental Applications from Lab to Market," at the 'One-day Workshop on Sustainable Practices for a Greener Future' organized by SSN Engineering College, Chennai, on February 11, 2025
86. Dr. R Balaji delivered an invited lecture on "Electrochemical Reformer- An Advanced Process for Hydrogen Production" at the 'International Conference Hydrogen Conclave 2025' organized by Suresh Gyan Vihar University, Jaipur, on February 12, 2025
87. Dr. Joydip Joardar delivered an invited talk on "Consolidation of Mechanically Activated Cr₂AlC MAX Phase-based Composites" at the 'International Conference on Powder Metallurgy and Particulate Materials (PM25)' organized by Powder Metallurgy Association of India (PMAI), Navi Mumbai, during February 12-19, 2025
88. Dr. K Ramya delivered an invited lecture on "PEMFC Materials and Applications" at the 'Technical Summit' organized by Bajaj Auto Ltd., Pune, on February 20, 2025
89. Dr. R Balaji delivered an invited lecture on "Green Hydrogen for PEM Fuel Cell Applications" at the 'Training Programme on Hydrogen Energy: Production, Storage and Utilisation' organized by National Institute of Solar Energy (NISE), New Delhi, on February 20, 2025
90. Dr. G Sivakumar delivered a keynote talk on "Optimizing the Indigenous La₂Ce₂O₇-based Thermal Barrier Coatings for Improved Thermophysical Characteristics and Performance" at the '2nd National Thermal Spray Conference' jointly organized by CSIR-Institute of Minerals & Materials Technology (CSIR-IMMT) and The Indian Thermal Spray Association (iTSA), Bhubaneswar, during February 21-23, 2025

91. Dr. Naveen Manhar Chavan delivered an invited talk on "Microstructural Evolution in Single and Successive Impacts in Cold Spray: What Decides the Final Microstructure?" at the '2nd National Thermal Spray Conference' jointly organized by CSIR-Institute of Minerals & Materials Technology (CSIR-IMMT) and The Indian Thermal Spray Association (ITSA), Bhubaneswar, during February 21-23, 2025
92. Dr. S Kumar delivered an invited talk on "Deposition of Thermally Sensitive Ni-based Materials-An Overview" at the '2nd National Thermal Spray Conference' jointly organized by CSIR-Institute of Minerals & Materials Technology (CSIR-IMMT) and The Indian Thermal Spray Association (ITSA), Bhubaneswar, during February 21-23, 2025
93. Dr. Neha Hebalkar delivered a keynote lecture on "Innovative Applications of Advanced Nanomaterials for Sustainable Future" at the 'National Conference on Applications of Advanced Materials in Chemical Sciences (AAMCS-2025)' organized by Sadguru Gadge Maharaj College, Karad, Maharashtra, on February 24, 2025
94. Dr. Raman Vedarajan delivered an invited lecture on "Hydrogen Fuel Cells" organized by VIT, Vellore, on February 26, 2025 (Virtual)
95. Dr. Raman Vedarajan delivered an invited lecture on "Electrodes in PEM Fuel Cell" organized by IIT Chennai, on February 28, 2025
96. Dr. R Vijay delivered a lecture on "Energy Storage Materials: Lab to Market" at 'National Science Day (NSD)-2025 Celebrations' jointly organized by GP Birla Archaeological Astronomical and Scientific Research Institute (GPBAASRI) and Indian Society of Geomatics Hyderabad Chapter (ISG-HC) at Hyderabad, on February 28, 2025
97. Dr. M Buchi Suresh delivered an invited talk on "Importance of Advanced Ceramics in Strategic Applications" at the 'National Science Day' organized by Vasavi College of Engineering, Hyderabad, on February 28, 2025
98. Dr. Malobika Karanjai delivered an invited lecture on "Soft Magnetic Composites for Low Loss-high Frequency Applications" at the 'One-day Brain Storming Session on Materials and Mechanisms for Avionics: Current and Future Trends' organized by Research Centre Imarat (RCI), Hyderabad, on March 1, 2025
99. Dr. Papiya Biswas delivered an invited talk on "Transparent Polycrystalline Ceramic Technologies Developed at ARCI for the Nation" at the 'Innovate to Elevate: Women Scientists Shaping the Future' organized by Indian Ceramic Society, on March 5, 2025 (Virtual)
100. Dr. S Sakthivel delivered a keynote lecture on "Sustainable Materials and Coatings Technology for Solar Thermal and PV Applications" at the 'International Conference on Sustainable Materials and Technology: Bridging Innovations and Research' organized by Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, on March 7, 2025
101. Dr. Ravi Bathe delivered an invited talk on "Laser Processing of Materials: From Laboratory to Industry" at the '33rd DAE-BRNS National Laser Symposium (NLS-33)' organized by Medi-Caps University, Indore, on March 8, 2025
102. Dr. R Balaji delivered an invited lecture on "Hydrogen - An Advanced Energy Storage Medium" at the 'National Seminar on Advances in Electrical Storage Systems, Batteries, and Electric Vehicles' organized by the SA Engineering College, Chennai, on March 12, 2025
103. Dr. Raman Vedarajan delivered an invited lecture on "Membrane Degradation in PEM-based Methanol Reformer for Hydrogen Production" at the 'Emerging Nanomaterials in Biological, Chemical and Engineering Applications - International Conference' organized by Vels Institute of Science, Technology & Advanced Studies (VITAS), Chennai, on March 14, 2025
104. Dr. Mani Karthik delivered an invited talk on "Materials and Technologies for Solar Thermal Energy Storage: Current Trends and Potential Applications" at the 'Two Days National Conference on Green Energy Technologies for Sustainability (NCGETS 2025)' organized by Madanjeet School of Green Energy Technologies, Puducherry, during March 20-21, 2025
105. Dr. R Vijay delivered a keynote lecture on "Energy Storage Materials: Lab to Market" at the 'Advancing Sustainability Through Chemical Engineering and Nanotechnologies (ASCENT2025)' organized by NIT Warangal, during March 20-22, 2025
106. Dr. PK Jain delivered an invited lecture on "Synthesis of Nanostructured Carbon Composites and their Applications in Energy" at the 'Advancing Sustainability Through Chemical Engineering and Nanotechnologies (ASCENT2025)' organized by NIT Warangal, during March 20-22, 2025

107. Dr. Sanjay Bhardwaj delivered an invited lecture on “Sustainability and Commercialization in Nanotechnology Domain” at the ‘Advancing Sustainability through Chemical Engineering and Nanotechnologies (ASCENT 2025)’ organized by NIT Warangal, during March 20-22, 2025
108. Dr. Srinivasan Anandan delivered an invited lecture on “Development and Demonstration of High-Performance Indigenous Materials for Energy and Environmental Applications: Lab to Market” at the ‘Advancing Sustainability through Chemical Engineering and Nanotechnologies (ASCENT 2025)’ organized by NIT Warangal, during March 20-22, 2025
109. Dr. Neha Hebalkar presented a plenary lecture on “Nanotechnology: Bridging Disciplines and Shaping Future” at the ‘National Seminar on Science Without Borders: A Multidisciplinary Vision for the Future’ organized by Dr. BR Ambedkar Open University, Hyderabad, on March 21, 2025
110. Dr. S Sakthivel delivered an invited lecture on “Nanomaterials and Functional Coatings for Solar Thermal and Photovoltaic Applications: Scaling for Production” at the ‘8th International Conference on Nanoscience and Nanotechnology (ICONN-2025)’ organized by SRM Institute of Science and Technology, Chennai, during March 24-26, 2025
111. Dr. R Vijay delivered a lecture on “Advanced Materials for Energy @ ARCI” at the ‘International Conference on Multifunctional Materials for Societal Applications (ICMMSA-2025)’ organized by Osmania University, Hyderabad, during March 26-28, 2025
112. Dr. Sanjay R Dhage delivered an invited talk on “Thin Film Materials for Efficient Solar Energy Conversion” at the ‘International Conference on Multifunctional Materials for Societal Application (ICMMSA-2025)’, organized by Osmania University, Hyderabad, during March 26-28, 2025

Participation in Training Programmes in India

1. Dr. Srinivasan Anandan attended a training programme on “Leadership Development Programme in Science and Technology (LEADS-2024)” jointly organized by Indian National Science Academy (INSA) and National Centre for Good Governance (NCGG), New Delhi, during April 01-07, 2024
2. Mr. A R Srinivas and Ms N Aruna attended a training programme on “Hands-on Training on Bus Bar Production” organized by Central Board of Irrigation and Power (CBIP), Goa, during June 10-12, 2024
3. Dr. M Buchi Suresh attended a training programme on “Electrical Safety Regulation and Best Practices”, organized by National Safety Council, Bengaluru on July 26, 2024
4. Mr. D Kutumba Rao, Mr. A Praveen Kumar, Mr. A Ramesh and Mr. K Ashok attended a training programme on “Electrical Safety Regulations and Best Practices” organized by National Safety Council, Bengaluru on July 26, 2024
5. Dr. Sanjay R Dhage attended a training programme on “Administrative Vigilance” organized by INSA, New Delhi, during July 31-August 02, 2024
6. Dr. Gururaj Telasang attended the “BIS Training Programme for Technical Committee Members 2024-2025” organized by National Institute of Training for Standardization, Noida, on August 12, 2024
7. Mr. S Ramakrishnan attended a training programme on “ANSYS Workshop with Academic Insight” jointly organized by ANSYS India and ENTUPLE Technologies, Chennai, on August 14, 2024
8. Mr. S Ramakrishnan attended a training programme on “ANSYS Academic Innovation Conference on Multiphysics and New Emerging Technologies” jointly organized by ANSYS India and ENTUPLE Technologies, Chennai, on September 04, 2024
9. Mr. Gyan Prakash Sahoo attended a training programme on “Building Competencies for Personal Excellence” organized by Art of Living, Bengaluru, during September 23-27, 2024
10. Dr. D C Jana attended a training programme on “Leadership Development Programme for Scientists” organized by Administrative Staff College of India (ASCI), Hyderabad, during October 14-18, 2024

11. Dr. K S Athira attended a training programme on "Building Competency through Personal Excellence" organized by Art of Living, Bengaluru, during November 04-08, 2024
12. Dr. Papiya Biswas attended a training programme on "Innovation Management Tools Programme" organized by Administrative Staff College of India (ASCI), Hyderabad, during December 02-06, 2024
13. Dr. B V Sarada attended a training programme on "Science Administration & Research Management" organized by the Administrative Staff College of India (ASCI), Hyderabad, during December 09-20, 2024
14. Ms. Kamal Vaishali, Mr. M R Renju and Mr. Shiva Prasad Reddy attended a training programme on "Government e Marketplace (GeM)" organized by Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, on December 12, 2024
15. Mr. D Ramesh attended a training programme on "Revisiting Fire Safety Systems to Understand Advancements" organized by Joint Director of Factories and Boilers, Bengaluru, on January 17, 2025
16. Mr. CH Venugopal attended a training programme on "Accounts of Autonomous Bodies" organized by Arun Jaitley Nation Institute of Finance Management (AJNIFM), Faridabad, during January 22-27, 2025
17. Dr. Srinivasan Anandan attended "12th Training Programme on Financial Management in Scientific Organizations for Scientists and Technologists" organized by Indian Institute of Public Administration, New Delhi, during January 27-31, 2025
18. Mr. N Srinivas attended a training programme on "Procurement of Goods and Services through GeM Portal" organized by Indian Institute of Foreign Trade, Grandhinagar, during January 30-31, 2025
19. Dr. K S Athira attended a special training programme on "Scientific & Technical Communication for R&D (Project Proposals)" organized by Mahatma Gandhi Institute of Technology (MGIT), Hyderabad, during February 08-09, 2025
20. Mr. K R C Soma Raju participated in the training programme on "Capacity Building programme on Socio-Economic Impact Assessment of Science & Technology Outcomes for Scientists/Technologists" organized by CSIR-HRDC, Ghaziabad, during February 10-14, 2025
21. Mr. S Sankar Ganesh attended a training programme on "Innovation Nexus Conference on Security, Data Protection, AI and Excellence Awards 2025" organized by Associated Chambers of Commerce and Industry of India (ASSOCHAM), Hyderabad on February 19, 2025
22. Dr. R Subasri attended the training programme on "Science and Technology for Rural Societies for Women Scientists and Technologists", organized by Indian Institute for Public Administration, New Delhi, during February 24-28, 2025

Participation in Indian Conferences/ Symposia/ Seminars/ Workshops/ Exhibitions

1. Mr. A Srinivas, Mr. S Sankar Ganesh attended workshop on "eOffice – A Digital Workspace Solution" organized by NIC, Hyderabad, on April 19, 2024
2. Dr. R Balaji attended workshop on "Quality Control in Green H₂ : Standards and Testing Infrastructure" organized by MNRE, New Delhi, on May 08, 2024
3. Dr. Rambha Singh attended two days workshop on "Official Language Implementation Scheme" organized by ICAR-NARM, Hyderabad, during May 28-29, 2024
4. Dr. Rambha and Ms. Anu Roy (Dr. Rambha Singh) attended one-day Workshop on "Official Language Staff/ General Staff of the Member Office of the Committee under the Aegis of Town Official Language Implementation Committee organized by CSIR-NGRI, Hyderabad, on May 30, 2024
5. Dr. G Ravi Chandra, Dr. K Suresh, Mr. M Ramakrishna, Dr. KS Athira and Mr. P Rajesh attended One Day Workshop on "Electron Channelling Contrast Imaging (ECCI) for Defect Characterization and Modelling" jointly organized by Electron Microscope Society of India (EMSI) and Defence Metallurgical Research Laboratory (DMRL), Hyderabad, on June 03, 2024

6. Mr. S Ramakrishnan attended the "AVL Simulation Conference Chennai 2024" organized by AVL India in IIT, Madras, on July 08, 2024
7. Mr. Gyan Prakash Sahoo attended the "Recent Advancements and Applications of High Temperature Materials: Processing, Manufacturing & Diagnostics (RAATEM-2024)" organized by ARCI, Hyderabad, during July 15-16, 2024
8. Dr. B V Sarada, Dr. Srinivasan Anandan, Ms. Chandra Gowtami (Dr. S Anandan) and Ms. Shivangi Tewatia (Dr. B V Sarada) attended "13th Edition of Bengaluru INDIA NANO" jointly organized by Department of Science & Technology (DST), Government of Karnataka, Karnataka Science & Technology Promotion Society (KSTePS), and Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, during August 1-3, 2024
9. Dr. R Vijay, Dr. BV Sarada and Dr. Sreenivasan Anandan attended the "Second Edition of EVOLVE" organized by Amara Raja Batteries Ltd, Hyderabad, on August 09, 2024
10. Dr. Sanjay R Dhage and Mr. A Srinivas attended a Workshop on "Enhancing Organizational Compliance: Mastering Conduct Rules and Strengthening Systems and Procedures" organized by India International Centre (IIC), New Delhi, on September 24, 2024
11. Dr. B V Sarada attended the "1st National Meeting on Sodium (Ion) Batteries" organized by IIT Bombay, during October 4-6, 2024
12. Dr. V Ganapathy attended the Workshop on "H2FC 2024: Fostering Start-up Ecosystem for Commercialization of Hydrogen Technologies" organized by ARCI, Chennai, on October 08, 2024
13. Dr. R Vijay, Dr. B V Sarada and Dr. S Anandan attended the "Stakeholders Meeting for Advancement in High-impact Areas (MAHA) Electric Vehicle (EV) Mission" organized by Anusandhan National Research Foundation (ANRF), New Delhi, on October 26, 2024
14. Dr. S Anandan attended the "Review Meeting on Integrated Clean Energy Material Acceleration Platform on Storage" organized by DST, at Dr. Moopen's Medical College, Wayanad, Kerala, on November 08, 2024
15. Dr. K S Athira attended the "78th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM-2024)" organized by IIM, Bangalore, during November 20-22, 2024
16. Dr. Vijaya Raghavan attended a workshop on "Coercivity Enhancement of SM-Fe-N using Novel Melting Zn based EU TEC-TIC Alloy" organized by VIT-AP University, Amaravathi, during, November 26-30, 2024
17. Dr. Papiya Biswas attended the "UNMESH-2025" organized by Research Centre Imarat (RCI), Hyderabad, during January 10-11, 2025
18. Dr. M Buchi Suresh and Dr. Papiya Biswas attended the "National Conference and Research to Business (R2B) Meet on Materials that Matter for Whiteware and Technical Ceramics" jointly organized by the American Ceramic Society and Indian Ceramic Society, Hyderabad Chapter, on January 24, 2025
19. Ms. Apoorva (Dr. Debdyuti Mukherjee) attended the "International Conference on Emerging Materials for Energy and Sustainability" organized by VIT, Vellore, during February 06-08, 2025
20. Mr. Gyan Prakash Sahoo attended the "2-Day Special Training Course cum Workshop on Scientific & Technical Communication for R&D (Project) Proposals" organised by Mahatma Gandhi Institute of Technology (MGIT), Hyderabad, during February 08-09, 2025
21. Dr. M Buchi Suresh attended the "India Energy Week 2025" organized by Ministry of Petroleum and Natural Gas, New Delhi, during February 11-14, 2025
22. Ms. Pragyan P Sahoo (Dr. Sanjay R. Dhage) attended the workshop "Life Cycle of a Sensor: Development to Application" organized by Defence Institute of Advanced Technology (DIAT), Pune, during February 17-21, 2025
23. Dr. K S Athira and Ms. T Navya attended the "National Conference on Challenges in Welding and Additive Manufacturing (NCWAM-2025)" organized by BITS, Hyderabad, during February 27-28, 2025
24. Ms. Sivakanali (Dr. S Anandan) attended the "Powder Characterization Workshop" organized by IIT Hyderabad, on March 5, 2025

Panel Discussion

Name	Technical Session Name	Event Name	Date
Dr. S Anandan	Government & Institutional Policies, Institutional Support, and Start-up Management	Programme for Round Table Meeting on Translational Research, organised by CeNS and JNCASR, Bengaluru	July 08, 2024
Dr. BV Sarada	Translating Medical Research into Industry Solutions: A Government Organization's Initiative	Conference on Medical Materials and Devices, organized by AMTZ and ASM International, Mumbai	September 04-06, 2024
Dr. PK Jain	---	Graphene Applications in Aerospace and Defence, organised by Hindustan Institute of Technology and Sciences, Chennai	September 14, 2024
Dr. R Vijay	Development, Certification, and Manufacturability of Biodegradable Materials: The Way Forward	Workshop on Biodegradable Implants: Materials and Processes (BIMP-2024), organized by ARCI	September 17, 2024
Dr. Sanjay Bhardwaj	Development, Certification, and Manufacturability of Biodegradable Materials: The Way Forward	Workshop on Biodegradable Implants: Materials and Processes (BIMP-2024), organized by ARCI	September 17, 2024
Dr. T Mohan	Government Initiatives/ Policies on Emerging Technologies for EV, Energy Storage and Beyond	International Symposium on Advancement of Emerging Technologies in Energy Storage, organized by Atria University, Bengaluru	February 05, 2025
Dr. Sanjay Bhardwaj	---	Roundtable Session on Hyderabad's Entrepreneurial Ecosystem, organized by The Indus Entrepreneurs (TiE), Hyderabad	February 13, 2025
Mr. Sudhakara Sarma	Emerging Materials	International Conference on Powder Metallurgy & Particular Materials (PM25) organized by PMAI, Mumbai	February 17-19, 2025

SCI Publications - 2024

1. Aditya Kumar, Nitin Tandekar, A Venu Gopal, Krishna Valleti, "An Assessment of Machining Performance of CAPVD-coated Carbide Tools in Face Milling of Ti-6Al-4V", *Ceramics International*, Vol. 50(9), p 16639-16649, 2024
2. B Kumar Swamy Reddy, V Ganapathy, Sushmee Badhulika, PH Borse, "Self-powered Photodetector based on 1D TiO₂-3D CdS Mixed Dimensional Heterostructure Fabricated at Low Temperature", *Solar Energy*, Vol. 274, Art. 112594, 2024
3. N Ravikiran, Harita Pant, PK Jain, VVSS Srikanth, "Dispersion of Novel OD Carbons in 15W40 Engine Oil using Ultrasonication for Enhanced Lubrication", *Chemical Engineering and Processing-Process Intensification*, Vol. 199, Art. 109747, 2024
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100. Paswan Sharma, LK Meena, G Krishna, SM Shariff, Raghuvir Singh, "Oxidation and Hot Corrosion Studies of Laser Hybrid Welded IN617 and P91 Alloys", *Transactions of the Indian Institute of Metals*, Vol. 77(5), p 1275-1286, 2024

101. F Punnya Priya, K Latha, K Ramya, "Improved Dynamic Performance of the Fuel Cell-Fed Boost Converter Using Super Twisting Sliding Mode Control Strategy", IETE Journal of Research, Vol. 70(2), p 1755-1765, 2024
102. M Dileep, Ravi Bathe, Indranil Manna, Jyotsna Dutta Majumdar, "Chemical and Mechanochemical Degradations of Ultrafast Laser Surface Structured Ti6Al4V in Simulated Body Fluid Environment", Applied Surface Science, Vol. 649, Art. 159096, 2024
103. P Rajesh Kumar, L Suryawanshi Prashant, C Mahendra, A Sri Hari Kumar, N Narendar, Shirish H Sonawane, "Effect of Ni Loading onto Pt (Pt-Ni/C) Electrocatalysts for PEM Fuel Cell: A Study of ORR Activity, Stability, and Temperature Effect", Asia-Pacific Journal of Chemical Engineering, Vol. 19(1), Art. e2993, 2024
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106. B Kumaar Swamy Reddy, MF Abdelbar, W Jevasuwan, PH Borse, Sushmee Badhulika, N Fukata, "Passivation-free High Performance Self-powered Photodetector Based on Si Nanostructure-PEDOT: PSS Hybrid Heterojunction", Applied Surface Science, Vol. 648, Art. 158992, 2024
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Non-SCI Publications

1. KRC Soma Raju, R Subasri, K Srinivasa Rao, "Ceramic-polymer Hybrid Coatings for Diverse Applications", Frontiers in Coatings, Dyes and Interface Engineering, Vol. 2 p 1-20, 2024
2. M Sundareswari, M Manjula, D Sivaprahasam, M Muthumari, "Structure, Electronic and Thermoelectric Properties of Novel Cubic $\text{Ir}_3\text{V}_{(1-x)}\text{Ti}_x$ ($x= 0.125, 0.25, 0.75, 0.875$) Refractory Materials for High Temperature Applications", Computational Condensed Matter, Vol. 39, Art. e00892, 2024
3. M Dileep, Ravi Bathe, Indranil Manna, Jyotsna Dutta Majumdar, "Effect of Process Parameters on the Corrosion Kinetics and Mechanism of Nanosecond Laser Surface Structured Titanium Alloy (Ti6Al4V)", Applied Surface Science Advances, Vol. 20, Art. 100580, 2024
4. B Sruti Muralikrishnan, P Sahana Devi, B Raman Vedarajan, Y Vidyalakshmi and K Ramya, "Functionalized Acetylene Black as an Effective Additive for ORR Electrocatalysts", Journal of Electrochemical Society of India, Vol. 73 (3&4), p 1-9, 2024
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6. N Tandekar, A Kumar, Krishna Valleti, "Machining of Ni-based Superalloys using CAPVD Coated Carbide Tools", Materials Today Communications, Vol. 39, Art. 109101, 2024
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8. Sanjay Bhardwaj and Karuna Jain, "Commercializing the Advanced Materials R&D in the Indian Ecosystem", Asia-Pacific Journal of Management Research and Innovation, Vol. 19(2-3), p 150-159, 2024

Books and Book Chapters

1. A chapter on "Bioinspired Strategies for Corrosion Protection and Antifouling Coatings" authored by KRC Soma Raju, Aarti Gautam, Ramay Patra, K Srinivasa Rao, KV Gobi, R Subasri, in the book on 'Novel Anti-Corrosion and Anti-Fouling Coatings and Thin Films', (Ed) Dr Hari Murthy, Vinay Jha Pillai, Kukatlapalli Pradeep Kumar and Matthew Cowan, ISBN: 978-1-394-23431-8, Wiley, p 251-285, 2024
2. A chapter on "Carbon Nanostructures as Support Material in Fuel Cells" authored by Jayaraj Prithi, Raman Vedarajan and N Rajalakshmi in the book on 'Nanoelectrocatalysts for Energy and Water Treatment', (Ed) Kumar Raju, Katlego Makgopa, Kwena D. Modibane, Eric Lichtfouse, ISBN: 978-3-031-55328-8, Springer Nature, p 133-155, 2024
3. A chapter on "Thin Film Photovoltaics using Cu(InGa)Se₂ Nanomaterials" authored by Amol C. Badgujar, Brijesh Singh Yadav, RO Dusane and Sanjay R. Dhage in the book on 'Thin Film Nanomaterials: Synthesis, Properties and Innovative Energy Applications', ISBN: 978-981-5256-09-3, Bentham Science, p 36-64, 2024
4. A chapter on "Aligned Carbon Nanotube Thin Film based High Energy Cathode Emitters" authored by Balaji Padya, K Santosh Kumar, N Ravikiran, Sanjay R. Dhage, Pavi Meduri and PK Jain in the book on 'Thin Film Nanomaterials: Synthesis, Properties and Innovative Energy Applications', ISBN: 978-981-5256-09-3, Bentham Science, p 257-284, 2024

Other Articles Published Via Print, Digital or Electronic Media

1. Ravi Bathe, "A Cost-effective Solution for Friction and Wear Management in Internal Combustion Engines" DST Website, August 02, 2024; ANI News Website, September 13, 2024; PIB, Delhi, September 13, 2024; OEM Update Website, September 13, 2024; MAPPES Website, September 29, 2024
2. M. Buchi Suresh, "Solid Oxide Fuel Cells: Future Power Technology for Power Generation" Srujan-ARCI's Hindi Magazine, Vol. 8, p 9, 2024-2025
3. R Prakash, R Gopalan, T Mohan, VVN Phani Kumar, "Establishment of Lithium-ion Battery Pack Testing Facility", Srujan-ARCI's Hindi Magazine, Vol 8, p 14-19, 2024-2025
4. Sanjay Bhardwaj, "Enhancing the Impact of Technology Development Efforts Using TRL-based Methodologies", Srujan- ARCI's Hindi Magazine, Vol. 8, pp.19-21, 2024-25
5. K. Divya, "Additive Manufacturing" Srujan-ARCI's Hindi Magazine, Vol 8, p 33-35, 2024-2025
6. K Swati and Priya Anish Mathews, "Geographical Indication: Identity, Importance and Protection" Srujan-ARCI Hindi Magazine, Vol 8, p 39-40, 2024-25
7. LIB Team Members, "Establishment of State-of-the-art Lithium Ion Battery Pilot Plant Facility for Various Chemistries", DST Website, March 13, 2025

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1. Sreejitha Raj, Akhila Raman, A Saritha, Vikas Rajan, Priji C, 'Corrosion in Electrocatalysts of Fuel Cells: Mitigating by 2D Materials' CORCORN 2024 Proceedings, p 1-8, 2024

Contribution to Professional Societies/Bodies/Committees

Name	Contribution / Role
Dr. R Vijay	<ul style="list-style-type: none"> • Senate Member, Indian Institute of Technology (IIT), Tirupati • Member, Scientific and Research Advisory Committee for Kotak School of Sustainability, Indian Institute of Technology (IIT), Kanpur • Governing Council Member, MeitY Centre, National Centre for Additive Manufacturing (NCAM)
Dr. PK Jain	<ul style="list-style-type: none"> • Joint Secretary, Indian Carbon Society • President, Indian Carbon Society, Hyderabad Chapter
Dr. Sanjay Bhardwaj	<ul style="list-style-type: none"> • Expert Member, Evaluation and Monitoring Committee for the review of Regional Technology Transfer Offices (RTTOs) supported under National Biopharma Mission, BIRAC (Department of Biotechnology, Government of India) • Member, Kalam Program for IP Literacy and Awareness (KAPILA) Committee, Research & Development Cell, University of Hyderabad (UoH), Hyderabad • Member, University Technology Management Cell, V N Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra • Member, Departmental Research Committee, Department of Chemical Engineering, Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad

Name	Contribution / Role
Dr. Joydip Joardar	<ul style="list-style-type: none"> Member, Governing Council, Powder Metallurgy Association of India (2023-2027)
Dr. Malobika Karanjai	<ul style="list-style-type: none"> Joint Secretary, Powder Metallurgy Association of India (PMAI) (2024-25) Session Chair, Plenary Session and in-charge of Powder Processing and Sintering session in International Conference on Powder Metallurgy and Particulate Materials and Exhibition (PM25) held at Mumbai during February 19-21, 2025
Dr. BV Sarada	<ul style="list-style-type: none"> Editorial Board Member, 'Scientific Reports Journal'
Dr. R Prakash	<ul style="list-style-type: none"> Member, Subject Expert Committee (SEC) of INSPIRE Fellowships for Physical Sciences
Dr. Sanjay R Dhage	<ul style="list-style-type: none"> General Secretary, Indian Carbon Society, Hyderabad Chapter
Dr. M Buchi Suresh	<ul style="list-style-type: none"> Executive Member, Indian Ceramic Society, Hyderabad Chapter
Mr. K V Phani Prabhakar	<ul style="list-style-type: none"> Member, Managing Committee of Indian Institute of Welding (IIW), Hyderabad Chapter
Ms. Priya Anish Mathews	<ul style="list-style-type: none"> Member, Board of Institute Innovation Council, Sarojini Naidu Vanitha Pharmacy Maha Vidyalaya for IPR and Innovation Matters

Awards and Honours

- Dr. Mani Karthik received the 'Prestigious Award of Chartered Chemist (CChem)' by The Royal Society of Chemistry, London, United Kingdom, on April 26, 2024
- Dr. PK Jain received the 'Best Scientist of the Year' award from Modern Plastics in Mumbai, on June 11, 2024
- Dr. R Subasri was nominated as an 'Expert Member' by DST-INSPIRE Faculty Selection Committee for Chemical Sciences for the period August 12, 2024, to August 11, 2026
- Dr. PK Jain was honoured as the 'Fellow of Telangana Academy of Sciences' by Telangana Academy of Sciences, on August 13, 2024
- Dr. Srinivasan Anandan received the 'ECSI Amara Raja National Award 2024' by the Electrochemical Society of India (ECSI) at the "3rd International Conference on Electrochemical Science and Technology" organized by ECSI and CSIR-NPL, New Delhi, on September 18, 2024
- Mr. Ramay Patra (Dr. R Subasri) received the 'Best Oral Presentation Award' at the "International Conference on Electrochemical Science and Technology (ICONEST 2024)" jointly organized by Electrochemical Society of India and CSIR- National Physical Laboratory (CSIR-NPL), at CSIR NPL, New Delhi, during September 18-20, 2024
- Dr. R Subasri received the 'AICTE Distinguished Professional Award' by AICTE on September 26, 2024 for a period of three years
- Dr. R Subasri was honoured with 'IAAM Scientist Medal Award' in recognition of contributions to Nanocomposites and Nanotechnology from the International Association of Advanced Materials (IAAM), Sweden, on September 26, 2024
- Dr. P Suresh Babu was honoured with "Best Reviewer Award" from Springer Nature and The Indian Institute of Metals for the journal Transactions of the Indian Institute of Metals, on November 20, 2024
- Dr. Priji C received 'Best Oral Presentation Award' at the "DAE-BRNS International Conference on Electrochemistry for Industry Health and Environment (EIHE)" organized by Bhabha Atomic Research Centre (BARC), Mumbai, during January 21-25, 2025
- Mr. G Praneeth Raj (Dr. M Buchi Suresh) received 'Best Poster Award' at the "National Conference & Research to Business (R2B) Meet" organized by the Indian Ceramic Society, Hyderabad Chapter, on January 24, 2025
- Mr. Sudhakara Sarma received 'Best Paper Award for R&D Professional' at the "PM25 International Conference" organized by Powder Metallurgy Association of India (PMAI), Mumbai, on February 20, 2025
- Dr. Malobika Karanjai received 'Sri SLN Acharyulu Memorial Award' at the "PM25 International Conference" organized by Powder Metallurgy Association of India (PMAI), Mumbai, on February 20, 2025



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(as on March 31, 2025)

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Dr. Tata Narasinga Rao (upto 06/05/24)

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(From 24/04/24)
Mr. Golu Kumar Jha, Technical Assistant 'A' (From 26/04/24)

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Mr. N. Srinivas

Senior Finance & Accounts Officer

Mr. G. M. Rajkumar

Senior Administrative & Personnel Officer

Mr. A. Srinivas

Finance & Accounts Officer (Projects)

Mr. Anirban Bhattacharjee

Security, Fire & Safety Officer

Mr. D. Ramesh

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 Ms. K. Madhura Vani, Officer 'A' (From 17/03/25)

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 Mr. P. Prasad Babu, Assistant 'A' (Up to 11/12/24)
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 Mr. Nalamasa Sampathkumar, Assistant 'A'
 Mr. Ramavath Sunil Naik, Assistant 'A'
 Mr. Rayikindi Ganesh, Assistant Gr. "A" (from 27/02/25)
 Mr. Sai Kumar Kandhukuri, Assistant "A" (from 17/03/25)

Junior Translation Officer

Dr. Rambha Singh

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Ms. Sakina Hussain, Lab Assistant 'A'

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Dr. R. Gopalan (from 13/06/2024)
 Dr. Roy Johnson (from 01/07/2024)
 Dr. V. Chandrasekharan
 Dr. T. Mohan
 Mr. D. Thirunaryanan
 Mr. G Venkata Narayana
 Mr. R. Varadarajan (from 10/07/2024)
 Mr. Shantanu Kumar Dhahagam (from 18.12.2024)
 Mr. K. Ramesh Reddy (from 23.07.2024)
 Mr. Md. Sadiq
 Mr. T. Satyanarayana
 Mr. J. Bansilal
 Mr. A. Satyanarayana

Medical Consultants

Dr. P. Sathish Kumar M.B.B.S., M.S.(General Surgery)
 Dr. Divya Teena, M.B.B.S., M.D. (Pulmonology)

Project Scientists in Projects

Dr. P. Vivekanandhan
 Dr. S. Paulraj
 Dr. C. Priji
 Mr. G. Vijayaragavan

Project Technical Assistant in Project

Mr. R. Vasudevan
 Mr. N. Kannadasan
 Mr. Debendra Nath Kar

Mr. K. Velmurgan
Mr. K. Shanmugam
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Mr. Gampolla Mukesh

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Ms. Mandaloju Soumya
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Mr. R. Ramesh Naik
Ms. K. Bhagyalaxmi
Mr. J .Ashok (from

09/01/25)
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Mr. Mukesh Sairam (from 16/01/25)
Mr. M. Sai Rohit (from 16/01/25)
Ms. Anjali Mishra (from 20/01/25)
Ms. Supriya Saha
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FINANCIAL REPORT



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INDEPENDENT AUDITOR'S REPORT

To
Governing Council Members of International Advanced Research
Centre for Powder Metallurgy and New Materials
(ARCI), Hyderabad.
Report on the Financial Statements

We have audited the accompanying financial statements of International Advance Research Centre for powder Metallurgy and New Materials (ARCI) ("THE SOCIETY"), which comprise the consolidated Balance Sheet as at March 31, 2025, the consolidated Income and Expenditure Account and consolidated Receipts and Payments Account for the year then ended and a summary of consolidated significant accounting policies and other explanatory notes of the following funds:

- Operational Fund;
- Technology Demonstration and Transfer fund; and
- Sponsored Projects fund

Management Responsibility for the Financial Statements

The Governing Body of the Society is responsible for the preparation of these statements of the society, in accordance with generally accepted Accounting principles in India (GAAP) and the significant accounting policies stated in the financial statements. This responsibility also includes the maintenance of adequate accounting records for safeguarding the assets of the society and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments estimates that are reasonable and prudent, and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements, that are free from the material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our examination in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the examination to obtain reasonable assurance about whether financial statements are free from material misstatements. Examination of Financial statements involves performing procedures to obtain audit evidence about the amount of disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the society's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by the Management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion and to the best of our information and according to the explanation given to us, the aforesaid financial statements of the society, for the year ended March 31, 2025, are prepared in all material aspects, in accordance with Generally Accepted Accounting Principles India (GAAP) and the significant accounting policies stated in Note 24 to the Financial Statements

Other Matters:

- In our opinion, proper books of accounts as required by the law have been kept by the society so far as it appears from our examination of those books.
- The Balance Sheet, the Income and Expenditure Account, and Receipts and Payments account dealt with by this report are in agreement with the books of accounts.

UDIN : 25028786BMIIIR6364

DATE: 03/09/2025

For P. VISWANADH & ASSOCIATES,
Chartered Accountants,
FRN: 005603S

P. Viswanadh
P. VISWANADH
Proprietor
M.No.028786



FORM OF FINANCIAL STATEMENTS (NON- PROFIT ORGANISATIONS)**Name of Entity International Advanced Research Centre For Powder Metallurgy And New Materials (ARC- INTERNATIONAL)****ARC INTERNATIONAL FUND (OPERATIONAL) BALANCE SHEET AS AT 31-3-2025**

Amount- INR

GRANTS- IN- AID: FUND AND LIABILITIES	Schedule	Current Year	Previous Year
GRANTS- IN- AID	1	1,37,66,83,663.48	1,22,79,98,769.81
RESERVES AND SURPLUS	2	0.00	0.00
EARMARKED /ENDOWMENT FUNDS	3	0.00	0.00
SECURED LOANS AND BORROWINGS	4	0.00	0.00
UNSECURED LOANS AND BORROWINGS	5	0.00	0.00
DEFERRED CREDIT LIABILITIES	6	0.00	0.00
CURRENT LIABILITIES AND PROVISIONS	7	42,17,42,847.73	40,26,86,412.69
TOTAL		1,79,84,26,511.21	1,63,06,85,182.50
ASSETS			
FIXED ASSETS	8	1,04,03,98,622.26	1,02,05,56,827.32
INVESTMENTS - FROM EARMARKED /ENDOWMENT FUND	9	0.00	0.00
INVESTMENTS -OTHERS	10	0.00	0.00
CURRENT ASSETS ,LOANS ,ADVANCES ETC.	11	75,80,27,888.95	61,01,28,355.18
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)			
TOTAL		1,79,84,26,511.21	1,63,06,85,182.50
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

As per our report of even date
for **M/s P.Viswanadh & Associates**
Chartered Accountants
Firm Registration No. 005603S

Sd/-
G.M.Raj Kumar
Senior Finance & Accounts Officer

Sd/-
Dr. R.Vijay
Director

Sd/-
P.Viswanadh
Proprietor
Membership No. 028786
Date: 03-09-2025
Place: Hyderabad

FORM OF FINANCIAL STATEMENTS (NON- PROFIT ORGANISATIONS)**Name of Entity International Advanced Research Centre For Powder Metallurgy And New Materials (ARC- INTERNATIONAL)****INCOME AND EXPENDITURE ACCOUNT OF ARC INTERNATIONAL FUND (OPERATIONAL) FOR THE YEAR ENDED 31-3-2025**

Amount- INR

INCOME	Schedule	Current Year	Previous Year
Income from Sales /Services	12	0.00	0.00
Grants /Subsidies	13	59,00,00,000.00	65,01,65,551.00
Fees /Subscriptions	14	0.00	0.00
Income From Investments (Income on Investment from earmarked /endowment Funds).	15	0.00	0.00
Income from Royalty, publications etc	16	0.00	0.00
Interest Earned	17	62,91,052.27	72,87,699.81
Other Income	18	4,97,16,745.94	3,36,21,375.19
Increase /(decrease) in-stock of finished goods and work-in-progress	19	0.00	0.00
TOTAL (A)		64,60,07,798.21	69,10,74,626.00
EXPENDITURE			
Establishment Expenses	20	42,65,39,965.24	45,21,22,071.01
Other Expenses	21	25,02,36,746.97	25,15,05,252.74
Expenditure on Grants/Subsidies	22	0.00	0.00
Interest	23	49,98,147.27	64,78,425.00
Depreciation (Net Total at the year-end -Corresponding to Schedule 8)		15,47,27,829.06	14,20,83,288.79
TOTAL (B)		83,65,02,688.54	85,21,89,037.54
Balance being excess of Expenditure over Income (B-A)		19,04,94,890.33	16,11,14,411.54
Transfer to Special Reserve [Specify each]			
Transfer to /From General Reserve			
BALANCE being Excess of Expenditure over Income T/F to- GRANTS IN AID		19,04,94,890.33	16,11,14,411.54
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

As per our report of even date
for **M/s P.Viswanadh & Associates**
Chartered Accountants
Firm Registration No. 005603S

Sd/-
G.M.Raj Kumar
Senior Finance & Accounts Officer

Sd/-
Dr. R.Vijay
Director

Sd/-
P.Viswanadh
Proprietor
Membership No. 028786
Date: 03-09-2025
Place: Hyderabad

**INTERNATIONAL ADVANCED RESEARCH CENTRE FOR POWDER METALLURGY AND NEW MATERIALS
(ARC-International) BALAPUR POST. HYDERABAD**

SCHEDULE –24 BACKGROUND INFORMATION & SIGNIFICANT ACCOUNTING POLICIES

1. Operation Fund of ARC – International (OP Fund of ARCI) is the main fund of International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI/ Society).
Grants received from Department of Science and Technology (DST), Ministry of Science and Technology, Government of India (GOI) are recognized in the financial statements of OP Fund of ARCI as Income of the Society if these grants are for meeting operational expenses of the Society and as part of Corpus, if utilized for the purposes of capital expenses. These Grants are allocated by GOI in the form of annual budgets under Plan Funds to DST. DST draws the funds from GOI and forwards the same to ARCI. The funds released by DST are in the form of Grants in Aid.
Other Funds of the Society are Technology Development & Transfer Fund (TDT) and Sponsored Project Fund (SP Funds).
2. Basis of preparation of financial statements:
Financial statements of Op Fund of ARCI, Hyderabad, have been prepared on historical cost convention and on accrual basis unless otherwise stated.
Significant Accounting Polices:
(A) Grants:
Grants are recognized on receipt basis.
Grants received from DST and earmarked for special / specific projects are grouped under Sponsored Project Fund.
(B) Reserves & Surpluses:
Sixty percent of Net Surplus / Deficit in Technology Demonstration & Transfer Fund (TDT Fund) is transferred to OP Fund of ARCI and is recognized under Reserves ad Surplus. Balance Fifty percent is retained in TDT Fund
3. Fixed Assets:
Fixed assets are stated at cost. Cost includes duties, taxes, freight, insurance etc attributable to acquisition and installation of asset.
Depreciation and Amortization :
Depreciation on fixed assets (except Lease Hold building) is provided on written down value method as per rates stated in Income Tax Rules, 1962.
Non -Refundable advance towards Lease Hold Building is amortized over lease period.
4. Interest Income:
Interest income from bank balances/deposit is recognized on time proportionate basis.
5. Research and Development (R&D) Expenditure:
R&D expenditure including cost of raw materials, consumables, other inputs and services etc. is charged off as revenue expenditure. Raw materials, consumables, stores spares and other inputs are procured on need basis and issued to indenting departments soon after they are received. Hence values of closing stock of these materials is not recognized in the accounts.
6. Foreign Exchange Transactions:
Foreign exchange transactions during the year are recorded at the exchange rate prevailing on the date of transactions.
7. Retirement Benefits:
Contributions of Society's share of Provident Fund and New Pension Scheme (Defined Contribution Plans) are charged to Income and Expenditure Account as per applicable rules/statutes.
Provision towards gratuity and leave encashment (Defined benefit Plan) is made on actuarial valuation carried out by Life Insurance Corporation of India. The Society has covered its gratuity and leave encashment liability with Life Insurance Corporation of India (LIC) and contributions are made to LIC on yearly basis as per the actuarial reports shared to the Society by LIC.
8. Margin Money Deposits:
Society places one hundred percent of its funds as Margin Money Deposits with Banks towards Letters of Credit issued to the vendors of the Society. These are grouped under Loans and Advances- Advances Recoverable in Cash Kind.

As per our report of even date
for **M/s P.Viswanadh & Associates**
Chartered Accountants
Firm Registration No. 005603S

Sd/-
G.M.Raj Kumar
Senior Finance & Accounts Officer

Sd/-
Dr. R.Vijay
Director

Sd/-
P.Viswanadh
Proprietor
Membership No. 028786
Date: 03-09-2025
Place: Hyderabad

**INTERNATIONAL ADVANCED RESEARCH CENTRE FOR
POWDER METALLURGY AND NEW MATERIALS
(ARC-International)
BALAPUR POST. HYDERABAD
ARCI (OPERATIONAL) FUND**

SCHEDULE -25 NOTES TO THE ACCOUNTS

1. Department of Science and Technology (DST) sanctioned and released during the year Rs.59,00,00,000/ towards revenue and Rs:28,99,60000/- as capital grant-in-aid under Plan (Previous year Rs.65,85,00,000 and Rs.17,46,00,000/- towards revenue and capital respectively under Plan grant-in-aid). Grants were refunded/ returned during the year Rs. Nil towards revenue and Rs. 20,800/- as Capital grant-in-aid under plan (previous year Rs:83,34,449 and 5,48,80,921.Under Non-Plan, Grant-in-aid sanctioned was nil.
2. Capital Work in Progress
Rs. 9,26,69,788/- as at March 31,2025 as stated in Schedule 8 to the financial statements – pending capitalization for more than three years. Management identified certain deficiencies while installing these equipments. The process of resolving the deficiencies is going on. In the opinion of the management of the Society, all these capital works are capable of being used for the purpose for which these assets were acquired once these deficiencies are rectified/ assets are commissioned. The management, at present, is of the opinion that these capital works do neither require any impairment nor provisioning.
3. The figures of previous year have been regrouped/reclassified wherever necessary.

As per our report of even date
for **M/s P.Viswanadh & Associates**
Chartered Accountants
Firm Registration No. 005603S

Sd/-
G.M.Raj Kumar
Senior Finance & Accounts Officer

Sd/-
Dr. R.Vijay
Director

Sd/-
P.Viswanadh
Proprietor
Membership No. 028786
Date: 03-09-2025
Place: Hyderabad

FORM OF FINANCIAL STATEMENTS (NON - PROFIT ORGANISATIONS)
Name of Entity International Advanced Research Centre For Powder Metallurgy And New Materials (ARC- INTERNATIONAL) HYDERABAD
RECEIPTS AND PAYMENTS OF ARC INTERNATIONAL FUND (OPERATIONAL)
FOR THE YEAR ENDED 31-3-2025

Amount- INR

RECEIPTS	Current year	Previous year	PAYMENTS	Current year	Previous year
1. Opening Balances			I. Expenses		
a) Cash in hand	0.00	0.00	a) Establishment Expenses	38,69,73,277.20	42,33,93,671.00
b) Bank Balances			b) Other Expenses	25,23,08,274.94	25,01,80,414.94
i) In Current accounts			Total Expenses	63,92,81,552.14	67,35,74,085.94
ii) In Deposit accounts	0.00	0.00	II) Payments made against various projects	0.00	0.00
			Payments made against various projects	0.00	0.00
iii) Savings accounts	2,39,94,080.72	89,19,337.20	Total of payments Against Projects	0.00	0.00
Total Opening Balances	2,39,94,080.72	89,19,337.20			
II. Grants Received					
II. Grants Received	87,99,39,200.00	76,98,84,630.00	III) Investments and deposits made		
a) From Government of India			a) out of Earmarked / Endowment funds	0.00	0.00
b) From State Government			b) out of Own Funds (investments-others)	0.00	0.00
c) From other sources [details]			1) Fund received on closed Projects		
1) Fund received on closed Projects			Total Grants Received	87,99,39,200.00	76,98,84,630.00
Total Grants Received	87,99,39,200.00	76,98,84,630.00	IV) Expenditure on Fixed Assets & Capital Work		
III. Income on Investments From			-in-Progress		
a) Earmarked / Endowment funds	0.00	0.00	Purchase of fixed Assets	29,05,39,826.00	12,04,65,127.00
b) Own Funds (oth investments)	0.00	0.00	Total Income on investment	0.00	0.00
Total Income on investment	0.00	0.00	Total Expenditure on Fixed Assets & Capital WIP	29,05,39,826.00	12,04,65,127.00
IV. Interest Received			V) Refund of surplus money/ loans		
a) On Bank Deposits	49,98,147.27	64,78,425.00	a) To Government of India	0.00	0.00
B) Interest from Sponsored Projects	0.00	0.00	b) To state Governments	0.00	0.00
Loans , Advances to staff etc.	0.00	0.00			

Total Interest Received	49,98,147.27	64,78,425.00	c) to other providers of funds	0.00	0.00
V.Other Income	8,48,14,023.00	3,48,20,207.00	VI) Finance charges (Interest)	0.00	0.00
VI.Amount Borrowed	0.00	0.00			
VII. Any other receipts [Give details]			VII) Other Payments (Specify)		
			1) Interest -DST	49,98,147.27	64,78,425.00
1) Sales of Fixed Assets	23,08,559.00	5,66,889.46	2) Security Deposit & EMD	3,37,050.00	0.00
2)Tax Deduction at Source & GST Deductions	0.00	0.00			
3) Deposits - Security	0.00	3,13,468.00			
4) TDS Refund IT Dept	26,948.00	17,06,728.00			
5) Sales-Subabul Trees	6,13,105.00	18,22,034.00			
Total : Any other receipts	29,48,612.00	44,09,119.46	Total : Other Payments	53,35,197.27	64,78,425.00
			VIII) Closing Balances		
			a) Cash in hand	0.00	0.00
			b) Bank Balances		
			i) In Current accounts	0.00	0.00
			ii) In Deposit accounts	5,42,17,280.00	0.00
			iii) In Savings accounts	73,20,207.58	2,39,94,080.72
			Total Closing Balances	6,15,37,487.58	2,39,94,080.72
Grand Total	99,66,94,062.99	82,45,11,718.66	Grand Total	99,66,94,062.99	82,45,11,718.66

As per our report of even date
for **M/s P.Viswanadh & Associates**
Chartered Accountants
Firm Registration No. 0056035

Sd/-

P.Viswanadh

Proprietor

Membership No. 028786

Date: 03-09-2025

Place: Hyderabad

Sd/-

G.M.Raj Kumar

Senior Finance & Accounts Officer

Sd/-

Dr. R. Vijay

Director

Our Collaborators

1. Altmin Private Limited
2. Applied Materials
3. Amara Raja Energy & Mobility Limited and Amara Raja Advanced Cell Technologies Private Limited
4. Agropak Private Limited
5. ABB Global Industries and Services Private Limited
6. Azeriri Private Limited
7. Ants Innovation Private Limited
8. Adolf7 Automotive Industries Private Limited
9. Aegis Care Advisors Private Limited
10. Asaco Private Limited
11. Bharat Electronics Limited
12. Bharat Heavy Electricals Limited
13. Bhabha Atomic Research Centre
14. Belarusian State University of Informatics and Radio Electronics
15. Bharat Petroleum Corporation Limited
16. Council of Scientific and Industrial Research (CSIR)
17. Charite Berlin- Germany
18. Central Glass & Ceramic Research Institute
19. Centre for High Technology
20. CIPLA Limited
21. Cancric Private Limited
22. Carborundum Universal Limited
23. Defense Research and Development Organization
24. DashamLabs Private Limited
25. Dharmavana Nature Ark Association
26. Entity 2 Energy Storage Private Limited
27. Eqube Energy and Research Services LLP
28. GE BE Private Limited
29. Hindustan Aeronautics Limited
30. Hindustan Petroleum Corporation Limited
31. Hydrojan Ecosystem Energy and Mobility Solutions Private Limited.
32. Hylenr Technologies Private Limited
33. Indian Institute of Chemical Technology
34. Indian Space Research Organization
35. Indira Gandhi Centre for Atomic Research
36. Indian Institute of Technology-Bombay
37. Indian Institute of Technology-Madras
38. Indian Institute of Technology-Kanpur
39. Indian Institute of Technology-Kharagpur
40. Indian Institute of Technology-Hyderabad
41. Indian Oil Corporation Limited
42. Indian Rare Earths Limited Technology Development Council
43. Institute for Problems of Materials Science (IPMS), Ukraine
44. KCS Europe GmbH- Germany
45. L&T Electrolyzers Limited
46. L&T Green Tech Limited
47. Malaviya National Institute of Technology Jaipur
48. Mishra Dhatu Private Limited
49. Mahindra University
50. National Institute of Technology-Warangal
51. National Institute of Technology-Tiruchirappalli
52. National Institute of Technology- Nagpur
53. Nsure Reliable Power Solutions Pvt. Ltd.
54. Nile, Li-Cycle Private Limited
55. Neosurgix Medical Technologies Private Limited
56. National Institute of Solar Energy
57. Pioneer Xenergy Private Limited
58. Permanent Magnets Limited
59. Prasah Private Limited
60. PR & SE Carbides Pvt. Ltd.
61. Prayogik Technologies Private Limited
62. Phasetron Engineers India Limited
63. Riddhi Technologies Private Limited
64. Reliance Industries Limited
65. Raghu Vamsi Machine Tools Pvt Ltd
66. SAP Parts Pvt. Ltd.
67. Scalesphere Accelerators Private Limited
68. Toyota Kirloskar Motor Pvt. Ltd.
69. Tata Steel Limited
70. TVS Lucas
71. The Bombay Textile Research Association
72. University of Hyderabad
73. Unicef Pvt. Ltd.
74. University Paris-Saclay and Centre National De La Recherche Scientifique
75. Volton Elements Pvt Ltd
76. VoltAsun Technologies Private Limited
77. Wipro Enterprises (P) Ltd.
78. Watthour Private Limited

Editorial board

Dr. R. Vijay (Chairman)

Dr. Pawan Kumar Jain

Dr. Sanjay Bhardwaj

Ms. Priya A Mathews

Mr. R. Vijaya Chandar

Mr. Arun Seetharaman

Ms. N. Aparna Rao

Mr. T. Sarveswaran

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