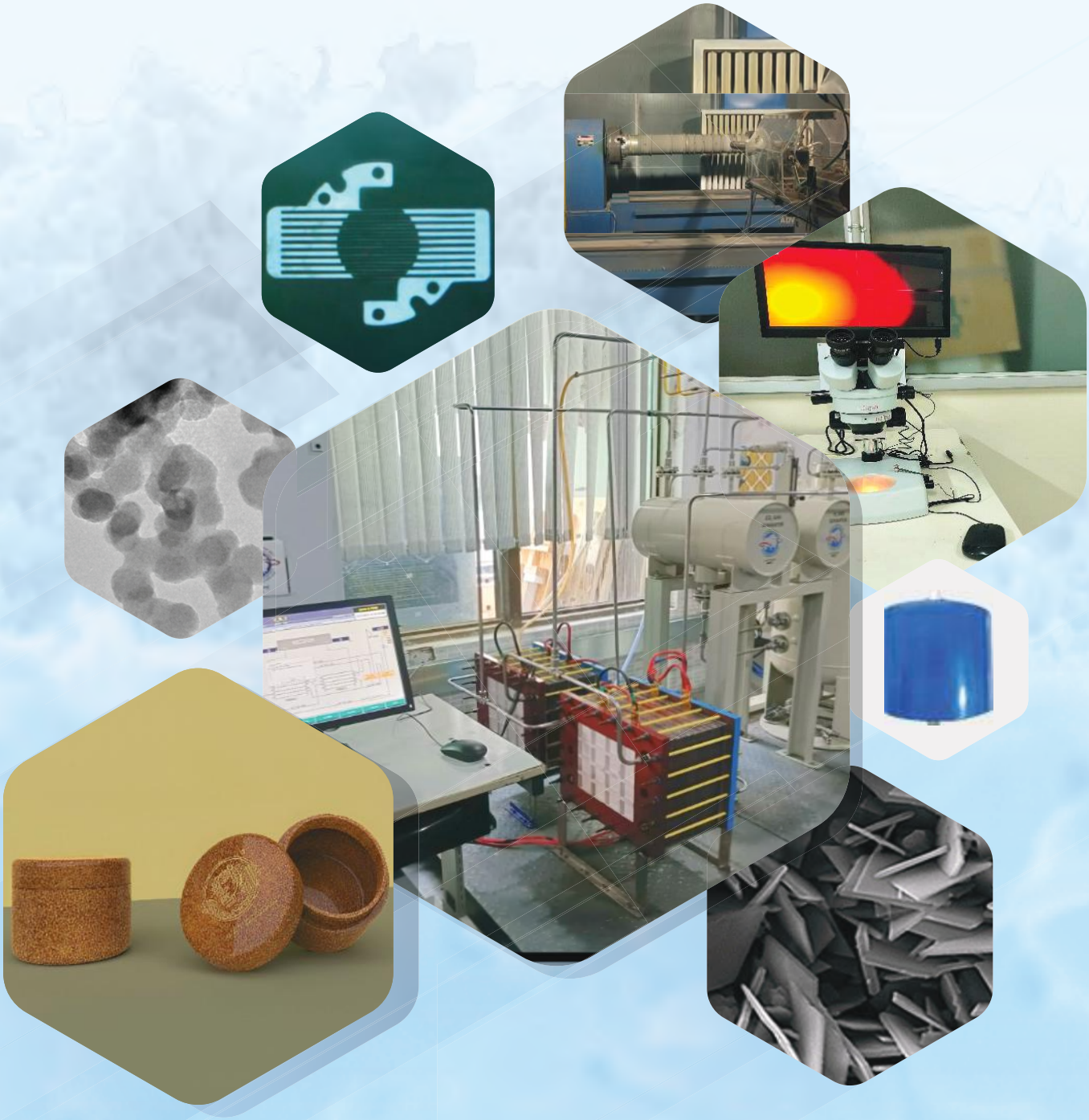
इंटरनेशनल एडवांस्ड रिसर्च सेंटर
INTERNATIONAL ADVANCED RESEARCH CENTRE
FOR POWDER METALLURGY AND NEW MATERIALS
फॉर पाउडर मैटलर्जी एंड न्यू मैटीरियल्स

ए आर सी आई
ARCI



Annual Report 2023-2024

www.arci.res.in

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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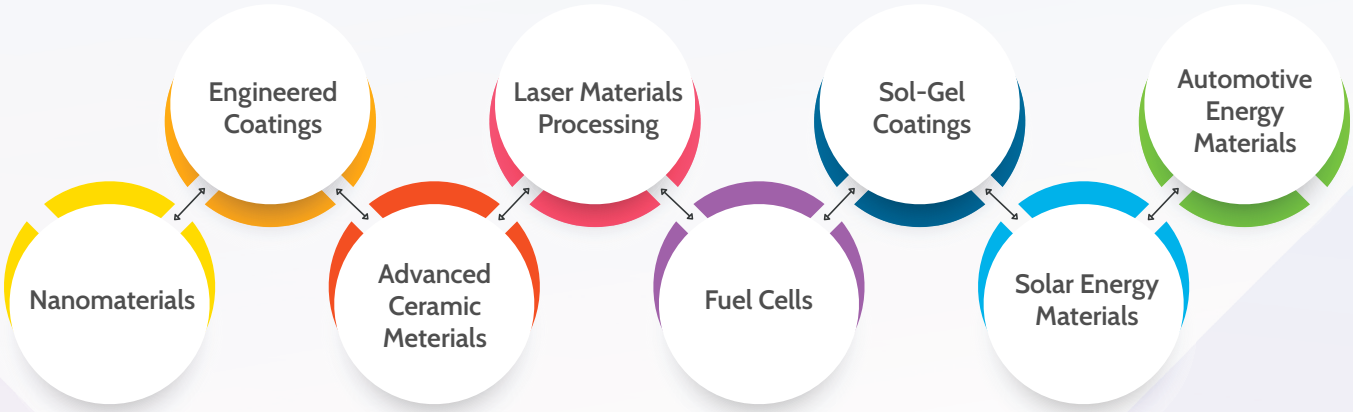
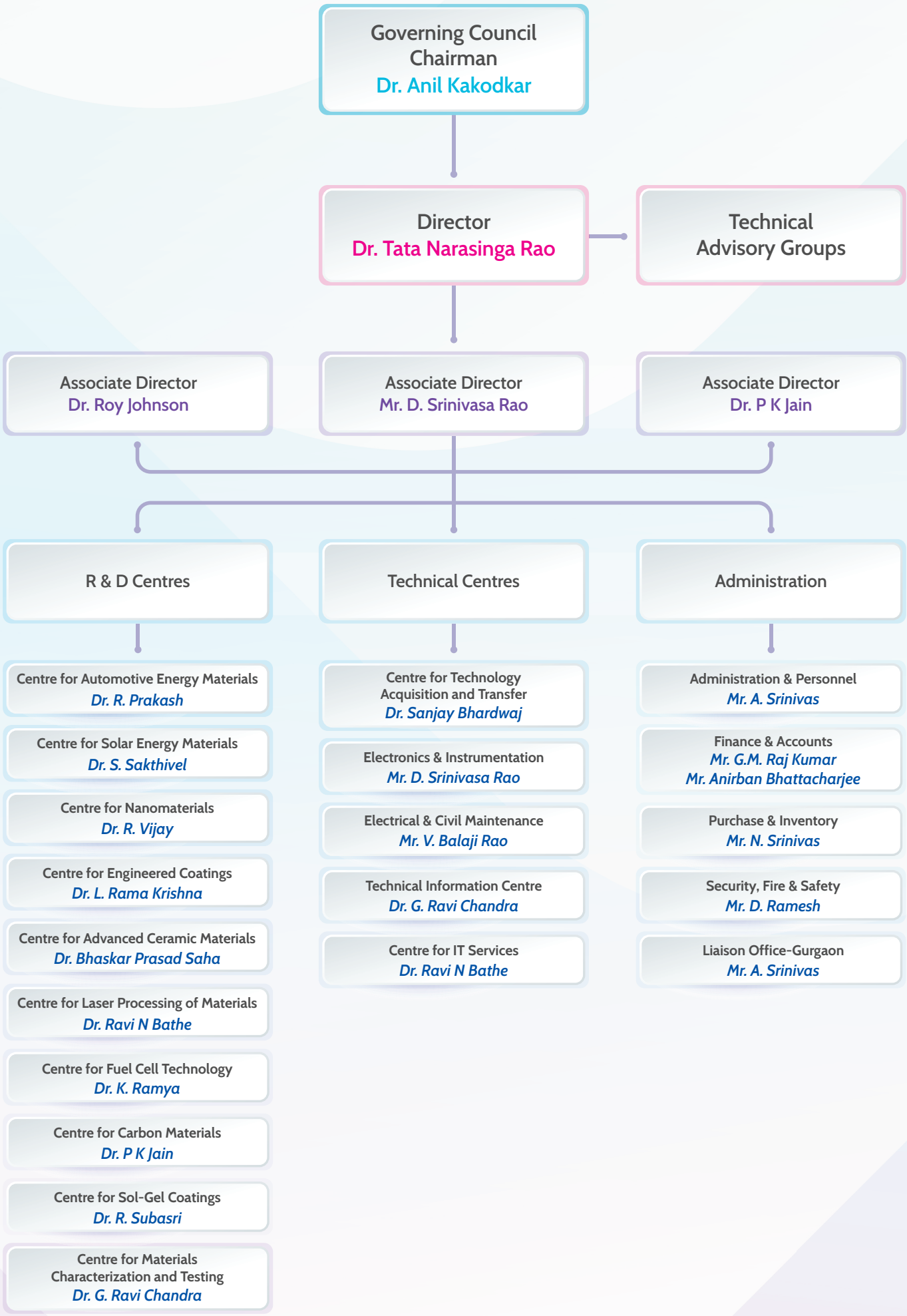


Organizational Structure



International Advanced Research Centre for Powder Metallurgy & New Materials

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Indian Institute of Science, Bengaluru

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Director, ARCI

Dr. Roy Johnson (Non-Member Secretary)
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Head, Climate, Energy and Sustainable Technology (CEST) Division
Department of Science & Technology, New Delhi

Director's Report

I consider it as a great pleasure to present the annual performance report of ARCI for the year 2023-24. The institute has been balancing between the fundamental research activities and the technological developments. The research inventions are translated into technologies to benefit the strategic sector as well as the industry. MoUs have been signed with several academic/research institutes and industries for collaborative research. Scientists have been working under several Government. funded, industry sponsored as well as consultancy projects.

The contributions from the institute to various research areas including energy storage & conversion, hydrogen technologies, biomedical, and aerospace both for strategic and civilian sectors are reflected in the form of patents filed/granted, publications and the technologies transferred during this year. Technical Research Centre (TRC), sponsored by DST, on Alternative Energy Materials and Systems has shown excellent progress, with a Know-how document handing over on technology for carbon coated Lithium Iron Phosphate (C-LFP) Cathode Powder Material to the Hyderabad based start-up to which the technology was licenced previously, as a part of completing the technology transfer activities from ARCI. ARCI continued to extend support to the company in terms of training their manpower, characterizing their samples produced with ARCI's recipe, and holding technical discussions to help them understand the process in detail. ARCI's Advanced Materials Technology Incubator (AMTI) facility adjacent to its R&D campus at Hyderabad, stands as an example to show ARCI's commitment towards the Indian industries especially micro and small scale industries and startups. ARCI has signed an agreement with the technology receiver of C-LFP, by whom a pilot facility was established at the incubator facility and ARCI has provided the required services and technical support. The facility was inaugurated by eminent scientists.

Another important achievement during this period is the transfer of the technology know-how for manufacturing of dispersion strengthened tungsten plates by a novel PM route involving spark plasma sintering to a Hyderabad based industry and the product was certified by authorized certification agencies, RCMA and RDAQA for large scale production. Supply order for delivering 100 numbers of tungsten-based weight balancing components was completed. Research carried out in several other important areas have moved further to higher TRLs and are ready for technology transfer.

The research activities on other areas towards technology development have progressed significantly in last one year, in the areas of engineered coating, solar energy materials, laser processing including additive manufacturing, carbon materials, fuel cells and advanced ceramics. It is worth noting about the commissioning of a large facility to produce low expansion glass ceramics for strategic and defence applications. The facility allows indigenous development of low expansion glass as an import substitute in line with government call on self-reliance. Impressive progress was also made at laboratory research level in a wide range of areas. For example, superfast charging LFP-LTO battery, high performance materials Na-ion and Li-S batteries have been demonstrated. Development of low cost and environmental-friendly wear resistant ODS-FeAl engineered coatings, sol-gel based dual functional coatings and synthesis of 2D materials like Boron nitride (h-BN) nano-sheets and vanadium sulfide (V3S4) nanoflakes are note worthy examples. An innovative concept proposal was made to make use of solar-thermally generated steam as feed source for high efficiency electrolysis of water through solid oxide electrolyzer cell (SOEC) to produce green hydrogen. A proposal was submitted for funding in collaboration with an Indian company.

The research performance at fundamental as well as translational level has resulted in significant number of publications with an impressive average impact factor and patents. Outreach activities including summer internships, students visits to ARCI facilities, lectures by ARCI scientists at various conferences and workshops, and holding workshops at ARCI have brought good visibility to ARCI. Outstanding progress was made in implementation of Hindi language in line with government guidelines.

I take this opportunity to thank Department of Science and Technology (DST), Chairman and the Members of the Governing Council and Technology Advisory Groups (TAGs) for their valuable guidance and continued faith & support. Let me thank all the scientists, engineers, technical, administrative and financial personnel and the enthusiastic students for their contributions and continuous support in upholding ARCI's mandate and I reiterate my belief in putting forward all our efforts in meeting the Institute's goals and national goals.

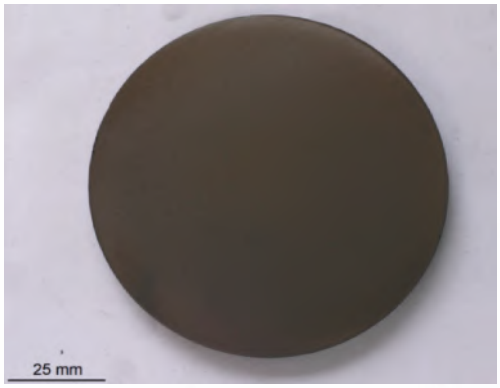
Dr. Tata Narasinga Rao
Director, ARCI

Technology Transfers

Technology Transfers Completed

Novel Powder Metallurgy (PM) process for Manufacturing Dispersion Strengthened Tungsten Plates

The technology know-how transfer for manufacturing dispersion strengthened tungsten plates by a novel PM route involving spark plasma sintering was carried out with Innomet Advanced Materials Private Limited, Hyderabad in July 2023. During the year 2023-24, the supply order for delivering 100 numbers of tungsten-based weight balancing components was completed involving the technology receivers, and the deliverables were supplied successfully meeting all technical specifications. The product was certified by authorized certification agencies, RCMA and RDAQA for large scale production.



Dispersion strengthened tungsten plate

Technology know-how transfer with Innomet Advanced Materials Private Limited

Carbon Coated Lithium Iron Phosphate (C-LFP) Cathode Powder Material Technology (Exclusivity for All Territories other than India)

After successful in-house and third party validation of ARCI's carbon coated nano size Lithium Iron Phosphate (C-LFP) Cathode Powder Material, the technology transfer agreement was signed with M/s. ALTMIN Pvt. Ltd., Hyderabad on February 17, 2023 for the production of battery grade C-LFP cathode material for Li-ion batteries on "exclusive rights for territories other than India". As part of technology transfer activities, 15 kg of C-LFP has been supplied to M/s. ALTMIN Pvt. Ltd., and it was successfully validated by third party, WMG, UK. Later, the entire LFP production process and electrochemical testing were demonstrated to staff of M/s. ALTMIN Pvt Ltd., during February 12 – 20, 2024. Finally, the Know-how document was handed over to M/s. ALTMIN Pvt Ltd., on February 22, 2024 in order to complete the technology transfer activities from ARCI.

Technology demonstration to M/s. ALTMIN personnel

Hand-over of Know-how document to M/s. ALTMIN Pvt. Ltd.

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 47 receivers (Know-How Document has been handed over) and few technologies are under transfer. The following table depicts the technologies transferred:

S.No.	Technology	Industry Targeted	Status
1-8	Electro Spark Coating (ESC) Equipment	Hard, wear resistant coatings	Transferred to 8 companies on nonexclusive basis
9	Magnesia Aluminate Spinel (MAS)	Steel, cement and power plants	Transferred on exclusive basis
10	Ceramic Crucibles	Carbon and Sulphur analysis	Transferred on exclusive basis
11	Energy Efficient Air Heaters from Ceramic Honeycombs	Industrial heating	Transferred on exclusive basis
12-15	Detonation Spray Coating (DSC)	Wear and corrosion resistant coatings on various components	Transferred to 4 companies on region exclusive basis
16	Reinforced Graphite Sheets and Seals	Automotive sector	Transferred on exclusive basis
17	Heat Pipes Heat Sinks	Waste heat recovery systems, solar energy applications, power electronics	Transferred on exclusive basis
18	Evaporation Boats	Metallization	Transferred on exclusive basis
19	Ceramic Honeycomb Molten Metal Filters	Molten metal filtration	Transferred on exclusive basis
20	Calcium Aluminate Cements and Furnace Sealants	Refractory castables	Transferred on exclusive basis
21-23	Micro Arc Oxidation (MAO)	Hard (1800 VHN) wear resistant coatings on Aluminum and Titanium alloys	Transferred to 3 companies on region exclusive basis
24	ESC Equipment Manufacturing	Diverse segments	Transferred on non-exclusive basis
25	Nanosilver Impregnated Ceramic Water Filter Candles to Impart Antibacterial Function	Water purification	Transferred on non-exclusive basis
26	Nanosilver based Textile Finishes for Antibacterial Applications	Anti-bacterial applications	Transferred on exclusive basis
27	Nanotitaniumdioxide based Textile Finishes for Self Cleaning Applications	Self-cleaning applications	Transferred on exclusive basis
28	Decorative Coatings on Glass	Aesthetic applications	Transferred on non-exclusive basis

S.No.	Technology	Industry Targeted	Status
29	Aerogel Flexible Sheet Technology	Thermal Insulation applications	Transferred on exclusive basis
30	Ceramic Honeycomb Based Energy Efficient Air Heaters and Eco-friendly Sanitary Napkin Incinerators	Incinerator Applications	Transferred on exclusive basis
31	Laser Cladding Technology for burner tip nozzles	Thermal Power Plants Applications	Transfer Complete
32	LWIR ZnS Domes	IR Seeker Application	Transfer Complete
33	MWIR ZnS Domes	IR Seeker Application	Transfer Complete
34	Ceramic Inserts for Anti-mine Boots	Strategic Application	Transfer Complete
35-37	Super hydrophobic easy-to-clean coatings	Solar PV Panels	Transfer Complete to 3 companies
38	High temperature compliant glass sealants	For missile applications	Transfer complete
39	UVC based tunnel baggage disinfection system for disinfection of baggage to fight COVID-19	Commercial Complexes, Hospitals etc.	Transfer complete
40	UVC based disinfection trolley to fight against COVID-19 by rapid cleaning of hospital environment.	Hospitals, Medical Care Centres etc.	Transfer complete
41	UVC based disinfection cabinet (UVC Safe box and UVC Safe Blade Handheld) to fight against COVID-19	Offices, Hospitals etc.	Transfer complete
42	Lithium Iron Phosphate (LFP) Cathode Materials technology for Li-ion Batteries	Li-ion Batteries for Electric Vehicles	Transfer complete
43	Synthesis of Electrocatalysts for use in Fuel Cells	Fuel Cells	Transfer Complete
44	Anti-reflective sol from organic solvent based composition for solar PV glass	Solar PV glass	Transfer Complete
45	(a) Synthesis of sol and (b) scratch and abrasion resistant coatings of sol on acrylic and PVC laminates	Acrylic and PVC Laminates	Transfer Complete
46	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
47	Novel powder metallurgy (PM) process for fabricating dispersion strengthened tungsten plates technology	Jet vanes	Transfer Complete

Technologies Available for Transfer/Adaptation

Technologies Available for Transfer

S.No.	Technology	Key Features	Applications
01	Nano-sized Lithium Iron Phosphate (LFP) cathode material for high power Li-ion battery application Level: Transferred to two companies on non-exclusive basis for Indian territory; Transferred to one company on exclusive basis for territories other than India; and Ready for transfer on non-exclusive basis in India	• 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 • LFP's electrochemical performance at prototype level (specific capacity, cyclic stability and rate capability) is on par with the performance of the commercially available LFP • Demonstrated the process at semi pilot scale	• Electrode material for rechargeable batteries (cylindrical/ pouch/ prismatic) in electric vehicles • Stationary storage applications
02	Broad-band Anti-reflective (AR) coating using Organic solvent based composition Level: Transferred to one company and Ready for transfer to other interested companies	• > 2 % Transmission enhancement on Photo Voltaic (PV) cover glass on a single side • The coating demonstrated through industrial roller coating process and validated to meet industrial standards.	• Photo Voltaic (PV) cover glasses • Concentrated Solar Power (CSP) cover glasses • Optical lenses
03	Platinum (Pt) based electrocatalysts Level: Transferred to one company and Ready for transfer to other interested companies	• High durability • On par efficiency with commercially available Electrocatalysts • Facile synthetic route • High corrosion resistance	• Fuel cells • Hydrogenation reactions
04	Exfoliated graphite and its value-added products Level: Transferred to one company and Ready for transfer to other interested companies	• Binder-free compaction of material • Shape-tailored material • Very light weight • Density-controlled compaction • Sandwich or reinforced material with better mechanical properties • Efficient and cost-effective	• Flexible sheets • Flexible tapes • Bipolar plates • Seals • Reinforced seals, sheets and tapes • Ultra-light weight boards
05	Bio-friendly self-disinfecting coating on fabric against COVID-19, H1N1 and bacteria Level: Ready for Transfer	• Efficacy > 99.9% against gram positive and negative bacteria. • Efficacy ≥ 99.2% and≥ 99.997% against SARS-CoV-2 (CCMB) and H1N1 (BUREAU VERITAS), respectively (ISO 18184). • The four layered mask exhibited bacterial filtration efficiency ≥ 99.7% (ASTM F2101), particulate filtration efficiency at 0.3 microns: ≥ 99.3 (ASTM F 2299/F2299M-03: 2017) • Breathability: 61.2 Pa/cm^2 (EN 14683: 2019). • Splash resistance and water repellent and classified as class 1 in flammability test • Technology developed in collaboration with Centre for Cellular and Molecular Biology (CCMB) and Resil Chemicals Pvt. Ltd.	• Self-disinfection masks • Medical suits • Medical textiles • Sports textiles
06	Nano-sized Lithium Titanium Oxide (LTO) anode material for high power Li-ion battery application Level: Ready for Transfer	• Process for the large-scale production (15 kg/batch) of LTO developed. • LTO delivers a superior rate capability of 145 mAh/g at 4C with good cyclic stability • Patents in India, USA, Germany, Japan, South Korea and China for this invention were granted	• Electrode material for rechargeable batteries in electric vehicles • Stationary storage applications

S.No.	Technology	Key Features	Possible Applications
07	Petcoke-based high energy Supercapacitor for EV application Level: Ready for Transfer	• Process for the production of supercapacitor grade porous carbon. • Indigenous supercapacitor devices of 1200 F, 2.7V and 1.2Wh produced. • Supercapacitor module of 75F, 43V, 19.2 Wh demonstrated • Technology developed in collaboration with Hindustan Petroleum Corporation Limited (HPCL), Bengaluru	• Automotive (E-bicycle, public transportation) • Stationary energy storage applications • Smart grid applications
08	Advanced detonation spray coating technology Level: Ready to Transfer	• 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 wide range of powders, carbide, oxide, metal powders • Lower substrate temperature & low oxide content • Coatings with 50-2000 microns thickness can be produced	• Steel industry application such as Bridle rolls • Textile & Paper industry applications such as wire passing pulleys, plungers, steeped cone pulleys, bearing stopper plates, guide rolls • Gas compressor applications such as spindle valve, • compressor disc, compressor shaft • HP & LP turbine blades, compressor discs, LCA nozzles, thrust beating sleeves, propeller shaft seals. • Power and Energy applications such as guide vanes, spindle valves, hydro turbine blades.
09	High power LFP/LTO cells Level: Prototype testing ongoing	• Tab-less technology • Fast charging capability (17 C) • High rate capability • Long cycle life • No thermal runaway	• Power tools • Drones • Cranking • Two wheelers
10	Lithium Ion Battery (LIB) cell (LFP/graphite) fabrication technology Level: Prototype testing ongoing	• 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	• Electric Mobility and Energy Storage Systems
11	Broad-band Anti-reflective coating development by using cost-effective and environmentally friendly aqueous solvent composition Level: Prototype Testing ongoing	• > 2 % Transmission enhancement on PV cover glass on a single side • Coating demonstrated through industrial roller coating process and validated to meet the industrial standards	• AR Coating on PV and CSP cover glasses, Optical lenses, Displays, etc.
12	Carbon nanoparticles based lubricants Level: Prototype Testing ongoing	• > 50% reduction in Coefficient of Friction (CoF) with the incorporation of Carbon nanoparticles into base lubricant oil. • Observed no significant change in the density and viscosity of the base lubricant oil after incorporation of nanoparticles.	• Nano lubricants for bearings, automobiles, heavy vehicles and machineries, etc.

S.No.	Technology	Key Features	Possible Applications
13	Polymer Electrolyte Membrane (PEM) fuel cell based power supply systems Level: Prototype testing ongoing	• 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	• Power generation, electric vehicle applications • As decentralized power pack for homes, industries etc. • As combined heat and power units for homes • As uninterrupted power source even when the power outage is for long duration (>8hrs) • As backup power for telecom industries.
14	Indigenous Components for PEM Fuel Cell Level: Prototype testing ongoing	• Membrane Electrode Assembly (MEA): Employs a state-of-the-art membrane coating technique (nozzle-less ultrasonic spray coating) to precisely control the electro catalyst'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.	• Fuel Cells
15	Polymer electrolyte membrane based electrochemical methanol reformer for hydrogen generation Level: Prototype Testing Ongoing	• Grey Hydrogen (99.99%) • Modular stacks • Demonstrated upto 5kg/day • Renewable energy compatible • Adaptable to Graphitic bipolar plates • Power consumption 1/3rd of conventional PEM based electrolyzers	• Fuel Cell • Steel industry • Pharma industry • Cement industry
16	Pulse electro deposition Level: Prototype testing ongoing	• Non line of site process, economical and ecofriendly • 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 traditional hard chrome process	• 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 Al and steel manufacturing, stamping tools and dies, molds for plastic manufacturing utilized chrome plating for increasing its (tool) life

Technologies Available for Adaptation:

S.No.	Technology	Key Features	Possible Applications
1	Repair and refurbishment of critical components using laser cladding Level: Repeatability/ consistency check completed at coupon level	• 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	• Aerospace • Automotive • Energy • General engineering sectors
2	High performance varistors made from doped ZnO nanopowders Level: Repeatability/ consistency check completed at coupon level	• Break down voltage 10-33 kV/cm • Low leakage current density 0.7μA/cm^2 • Coefficient of non-linearity (70-160) • Superior to the commercially available varistors	• Power distribution • Automobiles and Electronics
3	Large-scale low-cost production of two-dimensional tungsten disulfide and molybdenum disulfide powder Level: Repeatability/ consistency check completed for powder production and application trials are ongoing	• 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: Upto 350° C in air for free standing 2D-WS_2 powder (Up to 450° C in composite form); Up to 2500 C in air for free standing 2D-MoS_2 powder. • Purity: Grade I: 99%+ purity; Grade 2: 98% purity (with up to 2% C)	• 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 petrochemical and hydrogen evolution reaction catalyst.
4	Sol-gel coating formulation for imparting anti-bacterial property by inhibiting the biofilm formation Level: Repeatability/ consistency check at coupon level completed	• Aqueous formulation • Room temperature curable coating • Anti-bacterial • Hydrophobic • Improved mechanical properties at 80°C curing temperature	• Surgical sutures • Contact lens case, hernia repair mesh • Hearing aids and surgical appliances.
5	Scratch Resistant, Tarnish Protection Sealant Coatings for Metals Level: Repeatability/ consistency check at coupon level completed	• Easy-to-clean • High pencil scratch hardness (8H) and abrasion resistance • High temperature tarnish protection (200°C) • Low temperature curable compositions used as replacement for chrome-free primers to protect against corrosion (130°C x 0.5 h) • Protection against acid attack and ion leaching • Possibility of coloured coating	• Household appliances • Packaging industry such as copper bottles • Automotive industry such as exhaust parts and wheel rims of motor cycles, cars etc. • Architectural and interior decoration • Sealant coatings for anodizing and thermal spray coatings in industry
6	Antibacterial powders for prevention of infections and improved sanitation Level: Repeatability/ consistency check at coupon level completed	• Easy-to-apply • Compatible with sols, resin, lacquer and paints • Offers very good protection against corrosion also • >98% log reduction against bacteria such as Escherichia coli, Staphylococcus aureus and Klebsiella pneumoniae.	• Walls, railings, elevators etc. • Operation theatres • Schools • Scrub pads for domestic and industrial application. • Paints and lacquer.

S.No.	Technology	Key Features	Possible Applications
7	Oxide dispersion strengthened (ODS) iron aluminide powders for thermal spray coatings Level: Repeatability/ consistency check at coupon level completed	• Wear resistance is higher than NiCr-Cr_3C_2 coatings • Erosion resistance is comparable to NiCr-Cr_3C_2 coatings up to 750 C	• Wear and corrosion resistance coatings for power plants, aerospace and other industrial applications
8	Fe-P soft magnetic materials Level: Repeatability/ consistency check ongoing at coupon level	• Bs (saturation induction) ~ 1.9 T • µmax (Permeability) ~ 1.5x104 • Coercivity < 1 Oe • Core loss ~ 170 - 200 W/kg	• Motors, Alternators, Relay and other electromagnetic devices
9	Quantum-sized TiO_2 particles based super-hydrophilic and self-cleaning anti-soiling coating for photovoltaic application Level: Repeatability/ consistency check ongoing at coupon level	• High Omni transparency with no transmittance / power loss after coating • Excellent photo induced super hydrophilicity and self-clean property • 2.5% lower soiling loss compared to that of uncoated PV module • High weather and mechanical stabilities	• 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 coupon level	• 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	• 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 coupon level	• 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) ◦ High deposition rate or coverage area ◦ Low deposition rate or coverage area ◦ For Ni based materials, Steels (Optional) • Compressed AIR as process and carrier gas • Max Pressure-20 bar; Maximum Temperature-600oC • Cu, Al, Ag, Zn, Sn, Ni, SS, Ta, Nb, Ti and alloys and composites	• Repair and refurbishment applications • Coatings for electrical contacts, lugs, EMI shielding, heat sinks • Coatings for high temperature corrosion resistance, Bio medical, 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 coupon level	• Ca10(PO4)6 (OH)2 particle size having less than 23 nm with narrow size distribution • Phase purity greater than 99% • Process parameters for production of phase pure HAP and mixture of HAP and Ca3(PO4)2 nanopowders of different sizes at 1 Kg level have been optimized	• 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

Advanced Materials Technology Incubator (AMTI) at ARCI

Introduction

Micro and small scale industries along with startups are categorized as important constituents of the economy, contributing highly to employment generation, alleviation of poverty and upliftment of masses in the human society. In specific, it is the manufacturing sector that has driven growth. In the larger interests of the nation, it is proposed to encourage entrepreneurs in the manufacturing sector by strengthening their operational skills and sharpen their competitiveness as a whole keeping in mind the technology upscaling needs.

ARCI's commitment towards ensuring proliferation of novel technologies in the Indian industries especially micro and small scale industries and startups is exemplified by ARCI's Advanced Materials Technology Incubator (AMTI) facility adjacent to its R&D campus. ARCI's AMTI is intended to facilitate incubation of new enterprises with innovative technologies and providing them physical, technical and networking supports and services. The facility will promote knowledge-based innovative ventures that seek the nurturing of new technologies from ARCI. Entrepreneurial ideas will be fostered and developed in a supportive environment for various technologies in the area of materials science and technology.

Efforts have been made to reach micro, small and medium entrepreneurs of different manufacturing sectors utilizing ARCI's technical know-how and expertise in various thrust areas using ARCI's AMTI. In order to facilitate smooth functioning of the AMTI, a committee was constituted to be a one point contact in facilitating all AMTI related operations that include:

- Formulating the guidelines for the eligibility of technology based enterprises/start-ups for incubation at AMTI
- Providing a conducive/proper infrastructure and required utilities for starting of operations by the technology based enterprises/start-ups (electricity, water etc.)
- Ensuring that the technology based enterprises/start-ups complies with all statutory requirements/ clearances before starting operations at AMTI. For example, obtaining clearance from Pollution Control Board (PCB), all safety procedures etc.
- Regulating entry and exit of manpower at all levels including goods and vehicles movement to and from AMTI
- Ensure that basic infrastructure and environment (including Flora and Fauna) in and around AMTI are intact and monitored/maintained periodically
- Possible contribution of knowledge base from ARCI/other organizations for growth of technology based enterprises/start-ups at AMTI, and support for forging identified partnerships

Agreement signing with M/s. ALTMIN Private Limited

During the year, ARCI signed an Agreement for providing services with M/s. ALTMIN Private Limited on April 5, 2023 to provide the required services to M/s. ALTMIN Private Limited including the required space / shed within ARCI's AMTI and extend technical services to M/s. ALTMIN Private Limited.

M/s. ALTMIN Private Limited is the recipient of Lithium Iron Phosphate (LFP) Cathode Materials Technology developed by ARCI and has been licensed the technology both on exclusive basis for territories other than India and on non-exclusive basis within India. The shed occupied by M/s. ALTMIN Private Limited was inaugurated by Dr. V.K. Saraswat, Member, NITI Aayog and Dr. Anil Kakodkar, Chairman, Governing Council, ARCI and Former Chairman, Atomic Energy Commission of India,on August 18, 2023.

Facility of M/s. ALTMIN Private Limited at AMTI

ARCI
Patent Portfolio

National Patents Granted

S.No.	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
01	Post-calcination modification of morphology and improvement of coercivity in high energy-milled strontium hexaferrite powders	530705	28/03/2024	202111003235	23/01/2021
02	Refurbishment of aircraft components using laser cladding	528806	18/03/2024	201911007994	28/02/2019
03	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
04	A laser-based surface processing apparatus and a method to process metallic materials and components	523424	11/03/2024	201611034362	07/10/2016
05	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
06	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
07	Process for preparing durable solar control coatings on glass substrates	506428	02/02/2024	201811024034	27/06/2018
08	Laser based clad-coatings for protecting the power plant components for life enhancement	486341	20/12/2023	201811039663	19/10/2018
09	A method of producing strontium hexaferrite powders having high coercivity suitable for bonded magnets	480912	12/12/2023	202111008252	26/02/2021
10	Method of preparation of highly efficient skutterudite thermoelectric materials for thermoelectric modules and the product thereof	480419	11/12/2023	202111036278	11/08/2021
11	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
12	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
13	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
14	Method of preparing gas diffusion layer for the electrode of ECMR cell for hydrogen generation method of preparing gas diffusion layer for the electrode of ECMR cell for hydrogen generation	469592	16/11/2023	201911030852	31/07/2019
15	Method of fabricating tungsten based composite sheets by spark plasma sintering technique for making components	469058	14/11/2023	201911014933	13/04/2019
16	A novel equipment to accomplish power metallurgy processing starting from the 'raw materials' to finished product	460596	19/10/2023	201711011552	30/03/2017
17	An ecofriendly incinerator to dispose of the used sanitary napkins and bio medical waste	459775	17/10/2023	201821021430	07/06/2018
18	Antibacterial scrub pads and process of preparing the same	456240	03/10/2023	202111041925	16/09/2021
19	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
20	Method of producing porous particles-fibers carbon composite material for supercapacitor applications and the product thereof	444960	14/08/2023	202011027265	26/06/2020
21	An improved process for the preparation of stable nano silver suspension having antimicrobial activity	443383	07/08/2023	201611027145	09/08/2016

S.No.	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
22	Method for preparing multifunctional isotropic and uni-directional super hydrophobic surfaces on substrates using femtosecond laser	441368	28/07/2023	202011022242	27/05/2020
23	Biofilm inhibiting sol-gel composition for coating on substrates and process of preparing the same	440726	27/07/2023	202111001104	11/01/2021
24	A grid independent fuel cell system with a unitized (DC & AC) power conditioner	440238	24/07/2023	201911006700	20/02/2019
25	Transition metal-based solar selective absorber coated substrate and method of manufacturing the same	439790	20/07/2023	201911019139	14/05/2019
26	High temperature polymer electrolyte membrane fuel cells with exfoliated graphite based bipolar plates	431480	10/05/2023	494/DEL/2014	20/02/2014
27	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
28	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
29	Method of preparation of carbon supported platinum electrode catalyst for PEM fuel cells and product thereof	418482	18/01/2023	202011035825	20/08/2020
30	A process for in-situ carbon coating on alkali transition metal oxides	416052	29/12/2023	201611007451	03/03/2016
31	Method of producing in-situ carbon coated lithium iron phosphate cathode material for lithium ion batteries	412586	28/11/2022	202011056608	28/12/2020
32	An improved aqueous method for producing transparent aluminium oxy nitride (ALON) articles	412454	25/11/2022	1409/DEL/2012	08/05/2012
33	Antimicrobial aqueous based sol-gel composition for coating on substrate and process of preparing the same	411262	11/11/2022	201911045386	07/11/2019
34	Process of electroless nickel/nickel phosphide (EN) deposition on graphite substrates	408686	10/10/2022	201811041418	01/11/2018
35	Method of producing carbon nanostructure materials for heat transfer, lubrication and energy storage applications	404762	28/08/2022	202011017775	25/04/2020
36	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
37	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
38	Process for producing the nano Boron by cryo-milling	391804	11/03/2022	201911025690	27/06/2019
39	A system for treating a surface of bearing components and a process thereof	388398	03/02/2022	201711046511	23/12/2017
40	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
41	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

S.No.	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
42	An improved method for making sintered polycrystalline transparent sub-micron alumina article	378836	07/10/2021	1358/DEL/2011	10/05/2011
43	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
44	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
45	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
46	A device for and a method of cooling fuel cells	370365	25/06/2021	1408/DEL/2012	08/05/2012
47	Exfoliated graphite separator-based electrolyzer for hydrogen generation	369206	14/06/2021	3073/DEL/2013	17/10/2013
48	An improved test control system useful for fuel cell stack monitoring and controlling	366702	14/05/2021	269/DEL/2013	31/01/2013
49	An improved process for preparing durable multifunctional coatings on metal/alloy substrates	366262	06/05/2021	201711020529	12/06/2017
50	A method of preparing of anti-tarnishing organic-inorganic hybrid sol-gel and coating the same	366131	05/05/2021	2049/DEL/2015	07/07/2015
51	A method of producing high performance lithium titanate anode material for lithium ion battery applications	365560	28/04/2021	201711006147	21/02/2017
52	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
53	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
54	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
55	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
56	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
57	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
58	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
59	A novel laser surface modification technique for hardening steel	343960	12/08/2020	337/DEL/2013	06/02/2013
60	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
61	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
62	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

S.No.	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
63	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
64	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
65	Enhanced thermal management systems for fuel cell applications using nanofluid coolant	339836	30/06/2020	1745/DEL/2012	07/06/2012
66	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
67	Methods of preparation of high performance ZnO varistors and improved compositions	339072	22/06/2020	2765/DEL/2015	03/09/2015
68	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
69	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
70	A novel electrochemical method for manufacturing CIGS thin film containing nanomesh like structure	337455	28/05/2020	426/DEL/2015	16/02/2015
71	A method and an apparatus for preparing nickel tungsten based nanocomposite coating deposition	337108	20/05/2020	201611001190	13/01/2016
72	Method of producing multifunctional self-assembled mixed phase titania spheres	335724	22/04/2020	3777/DEL/2014	19/12/2014
73	Production of graphene-based materials by thermal spray	335723	22/04/2020	2626/DEL/2015	25/08/2015
74	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
75	An improved process for preparation of nanosilver coated ceramic candle filter	327532	17/12/2019	1249/DEL/2011	28/04/2011
76	Catalytically and chemically modified carbon nanostructures for storage of hydrogen	323653	24/10/2019	405/CHE/2013	30/01/2013
77	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
78	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
79	Fuel cell system equipped with oxygen enrichment system using magnet	321825	27/09/2019	2985/DEL/2012	25/09/2012
80	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
81	A method for synthesis of tungsten disulphide nanosheets	320209	11/09/2019	1703/DEL/2012	04/08/2012
82	Process for producing anti-reflective coatings with scratch resistance property	314900	27/06/2019	1777/DEL/2012	11/06/2012
83	A process for preparing nanocrystalline olivine structure transition metal phosphate material	310620	31/03/2019	405/DEL/2012	14/02/2012
84	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

S.No.	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
85	An improved process for producing silica aerogel thermal insulation product with increased efficiency	305898	18/01/2019	2141/DEL/2015	15/07/2015
86	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
87	An improved method of preparing porous silicon compacts	304349	12/12/2018	912/DEL/2011	31/03/2011
88	An improved solar selective multilayer coating and a method of depositing the same	303791	30/11/2018	1567/DEL/2012	22/05/2012
89	An improved process for preparing nanotungsten carbide powder useful for fuel cells	303338	22/11/2018	81/DEL/2007	12/01/2007
90	Improved fuel cell having enhanced performance	301158	19/09/2018	606/DEL/2007	20/03/2007
91	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
92	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
93	An improved method for producing ZnO nanorods	293775	05/03/2018	2759/DEL/2010	19/11/2010
94	A hydrophilic membrane based humidifier useful for fuel cells	291871	18/01/2018	95/DEL/2007	16/01/2007
95	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
96	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
97	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
98	Improved method for producing carbon containing silica aerogel granules	290370	07/12/2017	2406/DEL/2010	08/10/2010
99	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
100	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
101	An improved method for preparing nickel electrodeposited having predetermined hardness gradient	285178	14/07/2017	1455/DEL/2009	15/07/2009
102	A process for the preparation of nanosilver and nanosilver-coated ceramic powders	284812	30/06/2017	2786/DEL/2005	19/10/2005
103	Improved method of producing highly stable aqueous nano titania suspension	282988	28/04/2017	730/DEL/2009	09/04/2009
104	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	17/05/2006
105	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
106	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

S.No.	Title of Patent	Patent Number	Date of Grant	Application Number	Date of Filing
107	An improved process for the preparation of doped zinc oxide nanopowder useful for the preparation of varistors	254913	03/01/2013	1669/DEL/2006	20/07/2006
108	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
109	An improved method of forming holes on a substrate using laser beams	239647	29/03/2010	3205/DEL/2005	29/11/2005
110	Titanium based biocomposite material useful for orthopedic and other implants and a process for its preparation	228353	03/02/2009	2490/DEL/2005	14/09/2005
111	An improved boronizing composition	220370	27/05/2008	289/MAS/2001	03/04/2001
112	A method and a device for applying a protective carbon coating on metallic surfaces	211922	13/11/2007	719/MAS/1999	08/07/1999
113	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
114	A process for preparing ceramic crucibles	207700	20/06/2007	806/MAS/2000	26/09/2000
115	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
116	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
117	Device for gas dynamic deposition of powder materials	198651	25/01/2006	944/MAS/2001	22/11/2001
118	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
119	A process for the production of dense magnesium aluminate spinel grains	198208	16/02/2006	520/MAS/2000	06/07/2000
120	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
121	Ceramic honey comb based energy efficient air heater	200787	02/06/2006	30/MAS/1999	07/01/1999
122	Improved process for the preparation of magnesium aluminate spinel grains	200272	02/05/2006	29/MAS/1999	07/01/1999
123	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
124	A process for preparation of reaction bonded silicon carbide components	195429	31/08/2006	1886/MAS/1996	28/10/1996
125	A process of producing chemically treated expanded graphite and a device having such graphite	187654	05/12/2002	562/MAS/1994	07/06/1995
126	A process for the preparation of short ceramic fibres	186751	07/06/2002	537/MAS/1994	20/05/1994
127	An indirect heated catalytic converter for use with vehicles	185433	10/08/2001	809/MAS/1994	25/08/1994
128	A solar cooker	184675	25/05/2001	498/MAS/1994	13/06/1994
129	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
01	A top-lid assembly for a battery cell and a method for producing the top-lid assembly	202441016527	07/03/2024
02	Improved intercalation process via cryo treatment to produce high quality exfoliated graphite	202341067942	10/10/2023
03	A zirconium oxide layer based Mg-Zn-Zr alloys and its method of preparation thereof	202341055508	18/08/2023
04	Metals-embedded resorcinol-formaldehyde xerogel based carbon cathode for high-performance batteries and a method of preparation thereof	202341042659	26/06/2023
05	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
06	A biomass-derived porous carbon as sulfur host for energy storage device and a method of preparing thereof	202341033390	11/05/2023
07	Opto-electronic device and method of fabricating opto-electronic device	202341027664	14/04/2023
08	Bi-layered dental implant and process for the preparation thereof	202341014475	03/03/2023
09	Fabrication of tab-less and high power cylindrical LFP-LTO cell for fast charging lithium ion battery applications	202341004527	23/01/2023
10	Method of producing spinel nanostructured materials and spinel-PCM nanocomposites for thermal energy storage applications	202241064003	09/11/2022
11	Method of producing highly crystalline TiO_2 nanoparticles suspension and its use in perovskite solar cell	202241054454	22/09/2022
12	A superhydrophilic, omni transparent antisoiling coating for photovoltaics, and a method for synthesizing the same	202241052009	12/09/2022
13	System and method for fast charging of lithium-ion batteries	202241044449	03/08/2022
14	An automated spray coating deposition system	202241037966	01/07/2022
15	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
16	A process for fabricating a polypropylene cloth web-reinforced EPDM rubber-$CaCO_3$ composite membrane and an electrochemical cell	202241028889	19/05/2022
17	Anti-clogging cold-spray nozzle to deposit clog-prone materials	202211017972	28/03/2022
18	Autogenous laser welding system and method for joining thick metallic parts without filler wire feeder	202211005404	01/02/2022
19	Method for reducing friction on metallic substrates by preparing micro dimpled textures by ultrafast laser	202111051880	12/11/2021
20	Durable corrosion resistant coating for fuel cell separator and the process thereof	202111051526	10/11/2021
21	Method of manufacturing the catalyst coated membrane for the proton exchange membrane fuel cells	202011046496	25/10/2020
22	Method of producing nano porous graphene sheet-like structured high and low surface area carbon sheets from petroleum coke	202011007399	20/02/2020
23	A method of preparing the thermoelectric module for power generation from automotive exhaust and the thermoelectric module thereof	201911045857	11/11/2019
24	An improved gas dynamic cold spray device and method of coating a substrate	201711006749	26/02/2017
25	Process and apparatus for protection of structural members from wear, corrosion and fatigue damage	1839/DEL/2015	22/06/2015
26	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 the Patent Office	Indian Patent/Family details
01	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
02	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
03	A process for the preparation of nano silver and nano silver-coated ceramic powders	South Africa Sri Lanka Indonesia	2006/8591 14258 IDP000044402	30/04/2008 02/11/2011 06/02/2017	13/10/2006 17/10/2006 18/10/2006	IN284812 IN284812 IN284812
04	A process for continuous coating deposition and an apparatus for carrying out the process	South Africa UK USA Japan France	2009/06786 2464378 US8486237B2 5442386 2937342	26/05/2010 15/05/2013 16/07/2013 27/12/2013 18/12/2015	30/09/2009 02/10/2009 14/10/2009 15/10/2009 12/10/2009	1829/DEL/2008 1829/DEL/2008 1829/DEL/2008 1829/DEL/2008 1829/DEL/2008
05	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
06	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
07	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
08	An improved hybrid methodology for producing composite, multilayered and graded coatings by plasma spraying utilizing powder and solution precursor feedstock	South Africa Canada	2012/02480 2784395	28/11/2012 16/09/2014	05/04/2012 31/07/2012	IN 323443 IN 323443
09	Multi-track laser surface hardening of low carbon cold rolled closely annealed (CRCA) grades of steels	USA Australia	US11186887B2 AU2014362928	30/11/2021 21/02/2019	10/12/2014 10/12/2014	IN375427 IN375427
10	A method of producing high performance lithium titanate anode material for lithium ion battery applications	Japan Germany USA China Korea	JP7121734B2 DE112018000205B4 US11001506B2 CN110023245B KR102512034B1	09/08/2022 17/07/2023 11/05/2021 11/01/2022 15/03/2023	10/04/2019 28/06/2019 22/05/2019 22/05/2019 02/07/2019	IN365560 IN365560 IN365560 IN365560 IN365560
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 Republic of Korea Europe	JP7074870B2 KR102497808B1 EP20763813.1	16/05/2022 03/02/2023 -	16/09/2020 09/09/2020 11/09/2020	IN520936 IN520936 IN520936
13	Method of producing single layer omnidirectional broadband antireflective and super hydrophilic coatings for solar and other applicationst	USA	US18254847B2	-	26/05/2023	IN202011051833
14	Method of producing in-situ carbon coated lithium iron phosphate cathode material for lithium-ion batteries and the product thereof	Australia USA UAE Japan Europe China Israel Brazil	2021412505 18/254,730 P6001377/2023 JP2023535024A 21914895.4 CN1166861098 IL 304060A BR 112023012812-9	- - - - - - - -	01/05/2023 29/05/2023 06/06/2023 09/06/2023 09/06/2023 20/06/2023 26/06/2023 26/06/2023	IN412586 IN412586 IN412586 IN412586 IN412586 IN412586 IN412586 IN412586

Important Projects undertaken by ARCI during 2023-24

ARCI engages in collaborative research and development programmes with both governmental and private entities. It focuses on a wide range of cutting-edge technologies in the areas of Powder Metallurgy, Nanomaterials, 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 offers technical solutions to industries through a variety of job works and characterization assignments.

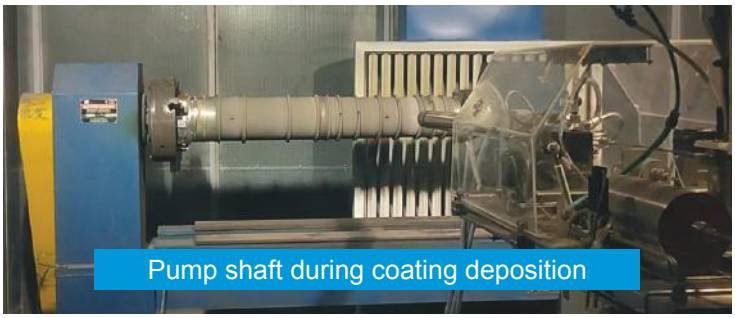
Below is a list of important projects undertaken by ARCI during the year 2023-2024:

S.No.	Project Title	Name of the Agency/Funding Body
01	A novel approach toward developing high energy density and low-cost cathode materials for fabricating micro-size all-solid-state printed batteries	Department of Science and Technology (DST)
02	Investigation and development of all phosphate dual ion solid state batteries	DST (Indo-Russian)
03	Development and scale-up of indigenous next generation solid oxide fuel cell technology and demonstration of process line (10 kW) for prototype production	Centre for High Technology – Oil Industry Development Board (CHT-OIDB)
04	Assessing suitable additive manufacturing technology for processing titanium aluminide components with desired microstructures and high temperature properties for aero-engine applications (consortium project)	Industry-Academia Centre of Excellence (DIA-CoE), IIT Bombay
05	Development of ceramic and ultra-high molecular weight polyethylene (UHMWPE) textile based hybrid polymer composite armour (consortium project with MNIT, Jaipur)	Ministry of Textiles
06	Rare-earth corrosion inhibitor-based corrosion protection coatings for metals/alloys	IREL (India) Limited
07	Detonation spray coating on pump shaft for reactor coolant pump	KSB Ltd
08	Development activities of laser beam welding for elliptical propellant tank application	Programme-AD, DRDO
09	Laser cutting of microheaters	Larsen & Toubro (L&T) Ltd
10	Demonstration the fuel cell system	Toyota Kirloskar Motor Pvt Ltd
11	Development of new applications using multi-walled carbon nanotubes (MWCNTs)	Indian Oil Corporation Ltd
12	Development of laser processed iron ore sinters for hydrogen reduced iron and steel making	University Of Hyderabad
13	Orientation programme on the fabrication of electrode & coin cell and their testing for LIB application	Padmaja Greentech Pvt Ltd
14	Feasibility study of CMX superalloy using SLM additive manufacturing	Indian Institute of Technology (IIT) Hyderabad
15	Micro X ray diffraction analysis	Mishra Dhatu Nigam Limited (MIDHANI)
16	Anti-reflective (AR) coatings on solar PV panels	Borosil Renewables Ltd
17	Development of Fe-Si based composite coatings by cold spray coatings	Centre For Materials For Electronic Technology (C-Met)

Applications - Products Developed

Indigenous development of wear and corrosion resistant coating on pump shafts for power plant applications

Power generation is one of the vital sectors for any nation's development and sustainable energy generation , with as much lower carbon footprint as possible, is need of the hour. Therefore, with an objective of enhanced service life and efficient functioning, several components of thermal/nuclear power plants that are usually exposed to harsh environments are to be provided with coatings in order to protect them from the corrosion, erosion, oxidation and thermal degradation.



Cermet coatings deposited and demonstrated on power plant pump shaft using DSC technology

In this direction, Cr2C3-NiCr and WC-Co based cermet coatings were deposited utilizing the indigenously developed detonation spray coating technique. With its lowest possible porosity (porosity <1%), optimum level of carbide decomposition or decarburisation, the coatings have exhibited better properties and performance than many other candidate coatings deposited by other feedstock materials and spray variants. Till date, the cermet coatings deposited by DSC on a large number of components were provided to the Indian industry both by ARCI and its technology receivers and collaborators. In one of the recent activities, Carbide coating was deposited successfully for the first time on nuclear power plant coolent pump shaft using detonation spray system and supplied to.

Sol-gel barrier coatings on biodegradable containers from coconut shell and bamboo powders

Naturally compostable packaging is gaining ground, due to growing concerns around carbon emissions and plastic pollution. Coconut and bamboo powders along with agriculture residue based organic binders are used to mould containers with good durability, flexibility and water resistance for packaging various products, and as an alternative to plastic packaging. But such biodegradable products are facing leaching of the binder from container when the products, like gel or cream, are filled in them. Low temperature curable sol-gel nanocomposite coatings are economical, transparent and act as barriers against leaching. Coated containers exhibited excellent barrier properties, adhesion strength of 5B and solvent resistance. Demonstration of application know-how of coatings and handing over of know-how document to M/s Agropak Private Limited was completed.

Salient features

- Transparent and high gloss coatings
- Low curing temperatures < 100°C
- 1 month pot life for the sol
- No adhesive and cohesive failure of coating
- ≥ 3H scratch hardness

Proven applications

For use with plant based packaging material that can withstand 100°C.

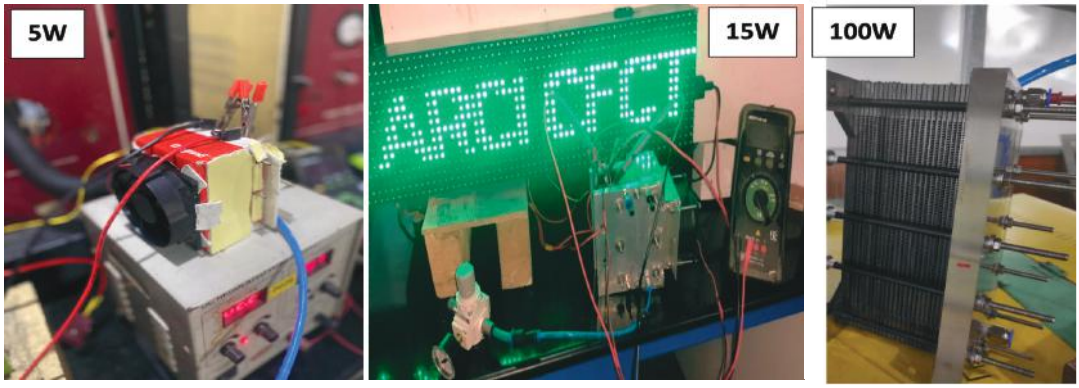
Biodegradable containers made from coconut shell and bamboo powders

Handing over of know-how document

Polymer Electrolyte Membrane fuel cell (PEMFC) Products

Polymer Electrolyte Membrane Fuel Cells (PEMFC), one of the low temperature fuel cells, are being developed in its entireness for application in decentralised power generation systems. Water cooled PEMFC stacks ranging from few watts to 10kW as single module were developed. The balance of plant components have also been integrated with the stacks for automated operations. The stacks of 5kW capacity have been demonstrated at Neyveli Lignite corporation, GAIL (Noida), BARC (Mumbai) and Tamilnadu Disaster Management services for stationary power applications. A product for backup power applications in Telecom Tower, Data centre etc. has also been developed. Air cooled stacks ranging from few watts to 100 Watts have been developed for charging mobile phones, electronics etc.

PEMFC products



Open cathode air breathing stacks- 5-100W

Development of Poloymer Electrolyte Membrane (PEM) based Electrochemical Methanol Reformer (ECMR) for hydrogen production

PEM based ECMR offers more advantages in terms of electrical energy consumption hydrogen production, purity and near ambient condition operation when compared to conventional water electrolysis and thermo chemical reformation route. This technology was demonstrated by developing electrolysis unit to produce hydrogen upto 5.0kg/day capacity and the corresponding energy consumption is around17-18 kWhr/kg of hydrogen. The produced hydrogen is highly pure (99.9%) and can be used directly for PEM fuel cell. The core components of Membrane electrode assembly like bipolar plates and several other process equipment were indigenously developed. The system was also integrated with renewable energy source of PV power and demonstrated by producing about 8.0 kg of hydrogen.

PEM Based ECMR for Hydrogen Generation

Development of hard and tough thin film coatings for Briquetting plant components

As part of Govt. of India clean energy research initiative, ARCI has created wear-resistant TiCrN coatings for the compenents of briquetting machine used for producing pellets/briquetts from biowaste. These coatings will reduce equipment downtime and make the production of coal-alternative pellets and briquettes more economically viable. A facility in Patiala, Punjab, dedicated to this project, tested the coated components. The coated components have reduced per tonne production costs while increasing component life by 1.5 to 2.0 times. Both, farmers and those working to reduce pollution can benefit much from this demonstration.

Briquetting plant shredder blades coated with wear resistant TiCrN coating

Novel Spinel nanoparticles absorber based Flat Plate collector

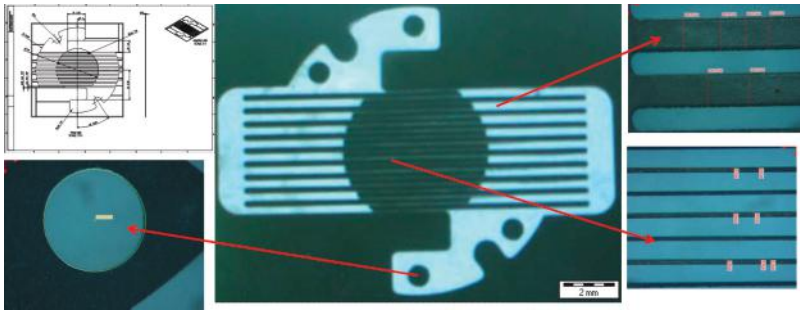
A novel ambient temperature curable spinel nanoparticle coatings on absorber-based flat plate collector (1m x 2m) was established using CuMnNiO4 spinel oxide nanoparticles synthesized by co-precipitation process. A single-layer selective absorber coating was uniformly sprayed on a flat plate panel comprising Cu/Al fins using a single-step automated spray system and cured at ambient temperature. It shows significant advantages for non-concentrated solar thermal systems for economical and easy scale-up while maintaining uniform solar absorptance of 95% across the coated area, high photothermal conversion efficiency (>70%), and high durability compared to commercial coatings. This novel absorber-coated flat plate collector was evaluated with a commercial collector under similar field conditions, which revealed that it was on par with the commercial system. This technology is available for transfer on both exclusive and non-exclusive basis.

$CuMnNiO_4$ Spinel nanoparticles based absorber coated flat plate panel

$CuMnNiO_4$ Spinel nanoparticles based absorber coated Flat plate collector

Ultrafast Laser Fabrication of Micro-Heaters for Micro-Electromechanical System (MEMS) Sensors

Microheaters, being small in-situ heating elements, are used in the development of thermally sensitive microdevices, such as MEMS sensors. For the protection of fragile MEMS membranes against various humidity levels, an integrated micro-heater for temperature and humidity control was designed and fabricated. Using ultrafast laser cutting on a 25 µm thick Nickel sheet, precise dimensions of 50 µm electrode widths and 100 µm separations were achieved. The high-performance microheater ensures reliable thermal management and humidity control for the MEMS devices. It reveals the possibility of employing ultrafast laser technology for precise micro-scale fabrication and advanced MEMS applications.



Schematic design of the microheater and optical microscope image of ultrafast laser-fabricated microheater array.

Adaptive Laser Clad-Coating Technology (LCCT) for Nozzle Tips used in Thermal Power Plant

ARCI's Adaptive Laser Clad-Coating Technology (LCCT), patented on December 20, 2023 (Patent 486341), was successfully implemented on burner nozzle tips at NTPC's Farakka thermal power plant. Over a four-year period (February 2020 – December 2023), the LCCT-coated splitter plates were tested on a 200MW boiler. The project aimed to develop wear-resistant coal nozzle tips. LCCT process utilized a 6+2 axis robot-integrated fiber-coupled diode laser system for enhanced deposition efficiency. Inspections in January 2023 revealed that the LCCT coatings remained largely unaffected, with minimal wear occurring only in uncoated areas. The LCCT portions demonstrated significantly prolonged durability compared to the base metal. Given the superior performance of LCCT-coated nozzle tips over conventional coatings, ARCI plans to transfer this technology to thermal power plant stakeholders, including maintenance contractors.

All four Burner Tips installed in Stage-I Unit-3 (Elevation-B) Boiler of 200MW NTPC-Farakka Thermal Power Plant

Indigeneous development of high conductivity Cu coatings for Electrowinning industry

Highly electrically conductive Cu coatings on electrodes is developed for electrowinning industry (M/s Teewave Industries, Hyderabad and M/s TATA International, Vizag). A relatively cost effective methodology is devised to deliver conductivities in excess of 50 MS/m with the use of inexpensive dendritic Cu powder and post treatment using mobile IR heater. Next step is to explore coating on real time electrode.

Industrial scale Electrode (left) & Cold spray Cu coating on SS for proof of concept (right)

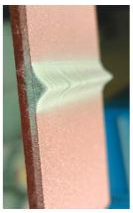
High Conductive coatings as better heat sinks for Avionics applications

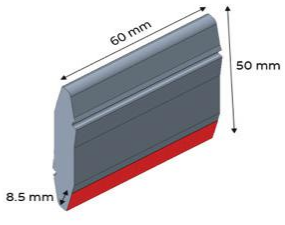
Cu coating on Heat sink components for HAL Hyderabad for avionics application was developed. 2 mm thick coatings were developed on Al alloy heat sinks. Stage-I tests are being carried out on prototype heat sinks at HAL Hyderabad.

Cu coated Al alloy heat sink for avionics applications

Development of Silver based coatings for circuit breakers

Ag-50%WC composite coating on circuit breaker arm (Pure Copper), used in high performance electrical components, was developed. Process parameters were optimised and a formal order was executed for depositing 3 mm thick coating on 60 mm long breaker assembly for ABB India, Hyderabad.



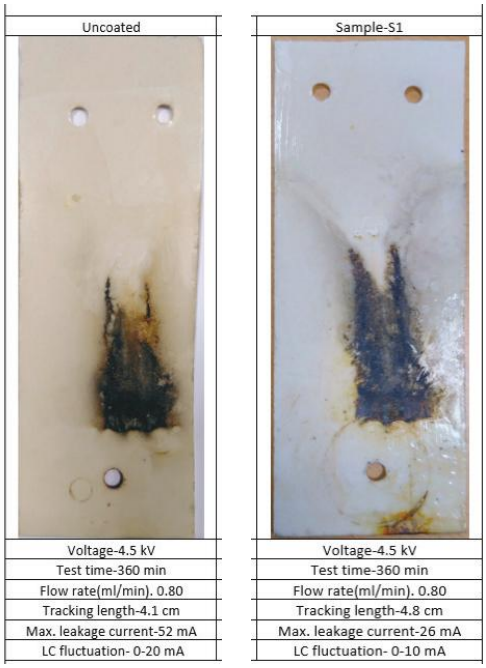


Ag-50%WC on flat Cu plate (left) and visual of the actual component to be coated shortly

Development of coatings to prevent degradation of plastic components of electrical safety devices

A hybrid nanocomposite sol-gel formulation was developed and deposited on plastic components used in electrical safety devices, to prevent their degradation after facing arcing temperature. The coated samples exhibited low electrical leakage current < 0.1 mA at 5 kV, a comparative tracking index > 600V, and could thermally withstand for continuous operation at 200 °C. These coatings also exhibited excellent mechanical properties in terms of scratch hardness and adhesion strength. Coated samples qualified the severe flammability test and the inclined plane tracking index tests. Electrical endurance tests are underway to assess consistency in results for practical application.

Coated plastic component



Uncoated (left) and coated (right) coupons after in-plane tracking tests showing superior endurance properties of coated coupon in terms of minimum leakage current and lower leakage current fluctuation

Ecofriendly, Biofilm Inhibiting nanocomposite coatings for prevention of surgical site infections

Formation of biofilms on/inside the incision site is the cause for surgical site infections (SSI). Biofilm inhibition presents a greater potential in reducing SSI than bactericidal treatment. Triclosan, chlorhexidine, nanosilver, nanocopper and nanoceria etc. exhibit cytotoxicity under certain conditions and hence, alternate materials and biosinspired strategies for obtaining the antibacterial property are needed. In this context, patented non-cytotoxic, biofilm inhibiting, improved hydrophobic coating formulations were developed and deposited on surgical sutures, contact eye lens cases, surgical equipment to render them antibacterial. Durability with respect to temperature, humidity, exposure to body plasma was investigated and results found to be promising.

Contact lens case

Lims Forceps

Lims Forceps

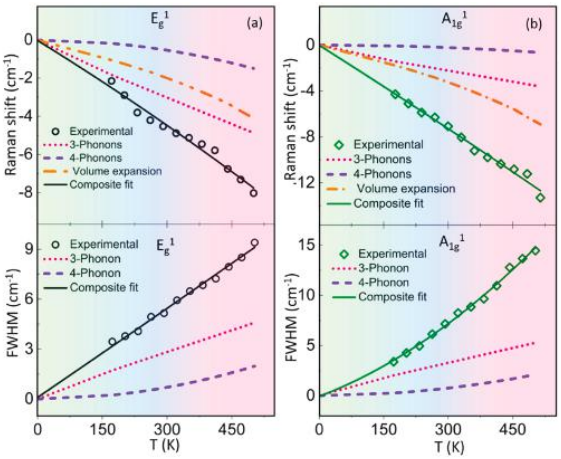
Schematic of the sitting pattern of water drop and bacteria on the improved hydrophobic surface having hierarchical nano projections, the biofilm inhibition effect due to less adhesion of bacteria as well as water.

Research Highlights

Low lattice thermal conductivity in p-type Mg_3Sb_2 thermoelectric system

Contributors: *Minati Tiadi and Manjusha Battabyal*

Layered polycrystalline Mg_3Sb_2 has attracted considerable attention as a promising thermoelectric (TE) material for low to moderate temperature applications, thanks to its cost-effectiveness, environmental friendliness, and the ability to form both p- and n-type Mg_3Sb_2 through efficient doping. Enhancing the thermoelectric efficiency (zT) of a system requires reducing its lattice thermal conductivity, as described by the equation $zT = \sigma S^2 T/(\kappa_e + \kappa_{lattice})$. In this equation, σ represents electrical conductivity, S is the Seebeck coefficient, $\kappa_{lattice}$ is the lattice thermal conductivity, and κ_e is the electronic thermal conductivity at absolute temperature T. To improve zT in a TE system, it is essential to increase S and σ while decreasing κ_e and $\kappa_{lattice}$. Although first-principle band structure calculations have provided predictive insights into electronic transport properties, achieving a detailed microscopic understanding of thermal transport in the layered Mg_3Sb_2 system remains a challenging task.



The anharmonic contributions due to three-phonon, volume expansion and four-phonon to the Raman peak shift, and three-phonon and four-phonon contributions to the FWHM of Raman peaks in $Mg_{2.985}Li_{0.015}Sb_2$ are displayed in (a), and (b).

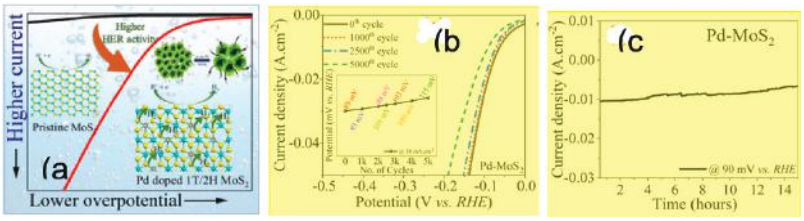
Using temperature-dependent Raman spectroscopy, we have identified a strong anharmonic interaction between the optical phonon modes in polycrystalline Mg_3Sb_2. Additionally, we observed a gradual decay of all optical phonons as the temperature increased, confirming a reduction in lattice thermal conductivity at higher temperatures. Introducing Li into the Mg_3Sb_2 lattice creates a disparity among the crystallographic axes for the phonon modes, which intensifies the anharmonic phonon vibrations in $Mg_{2.985}Li_{0.015}Sb_2$ compared to Mg_3Sb_2. The estimated anharmonic constant, approximately $4.5\times10^{-4}K^{-1}$ for $Mg_{2.985}Li_{0.015}Sb_2$, closely matches those of other heavier thermoelectric systems, primarily due to quasiharmonic volume expansion and anharmonic phonon-phonon interaction. The lattice thermal conductivity estimated from the Raman modes aligns with the experimental values, confirming the significant influence of optical phonons on the thermal transport of layered Mg_3Sb_2. These findings provide a comprehensive exploration of the interplay between optical phonon modes and the origins of substantial phonon anharmonicity in the lightweight polycrystalline Mg_3Sb_2 system [1].

Reference: [1] Minati Tiadi, Dillip K Satapathy, and Manjusha Battabyal, Physical Review B, Realizing high phonon anharmonicity in layered Mg 3 Sb 2: A temperature-dependent optical phonon study, 2024, 109, 195201, DOI: 10.1103/PhysRevB.109.195201

Pd-doped MoS_2 nanosheets as Hydrogen Evolution Reaction (HER) electrocatalyst for enhanced electrocatalytic water splitting

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

Developing highly active, stable, and economic electrocatalysts for efficient water electrolysis is crucial for the sustainable production of hydrogen. In this study, a highly effective and affordable electrocatalyst for hydrogen evolution was developed using an easy and straightforward one-step hydrothermal method for in situ doping of Pd into the lattice of MoS_2. The electrocatalytic activity of a cathode prepared via drop-casting using Pd–MoS_2 nanostructured powder for HER applications was studied in acidic and alkaline water, as well as simulated sea water. For a current density of 10 mA cm^{-2} during HER application, nanostructured Pd–MoS_2 exhibited greater electrocatalytic activity in acidic conditions with an overpotential of only 89 mV vs. RHE (acidic) compared to 149 mV vs. RHE (alkaline) and 165 mV vs. RHE (simulated sea water). Moreover, in acidic, alkaline, and simulated sea water, Pd–MoS_2 demonstrated superior activity during electrocatalytic water splitting and low cell potentials of +1.98, +2.03, and +2.18 V, respectively.



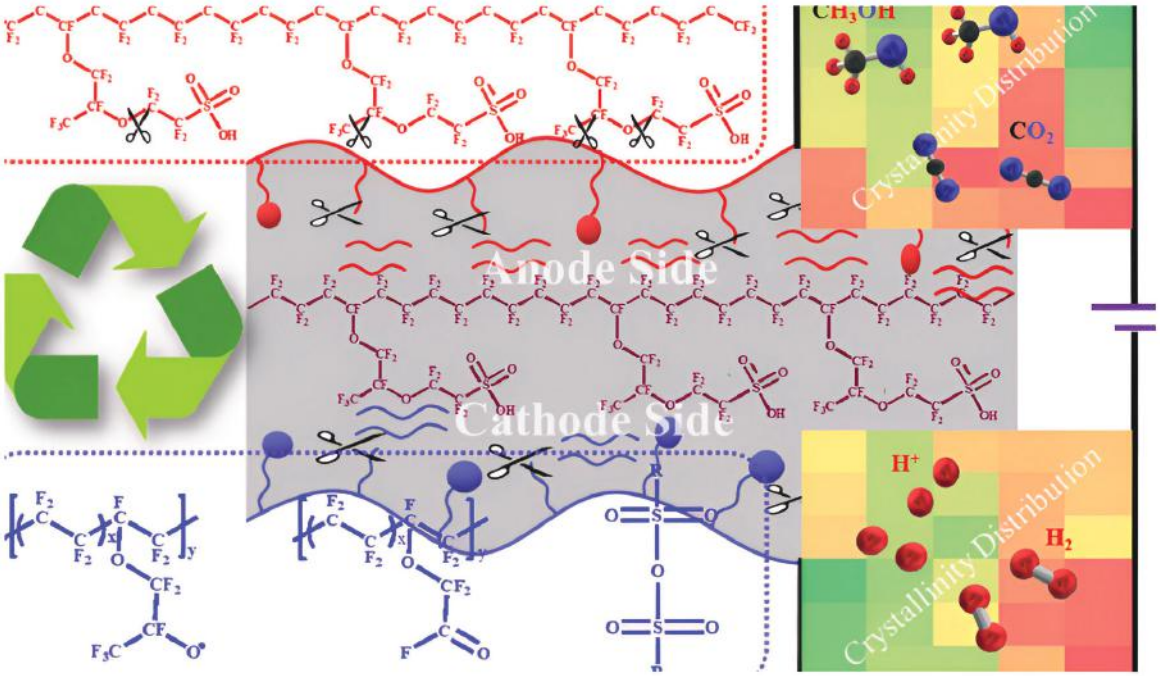
(a) Schematic representation demonstratin Pd-MoS_2 as electrocatalyste, (b) Durability curve recorded before and after 1000, 2500 and 5000 cycles of CV for samples Pd-MoS2 (Pd-MS5) in 0.5M H_2SO_4 electrolyte, (c) time run for 15 hours to measure the stability of sample Pd-MoS_2

Reference: Jyoti Gupta, Dibakar Das, Pramod H. Borse and B. V. Sarada, In situ Pd-doped MoS_2 nanosheets as an HER electrocatalyst for enhanced electrocatalytic water splitting, Sustainable Energy Fuels, 8, 1526,2024

Recycling of Polymer Electrolyte Membrane (PEM) from Electrochemical Methanol Reformer

Contributors: *Raman Vedarajan, Sreeraj P, Ramya R, and Gopalan R*

The Centre for Fuel Cell Technology, ARCI, has embarked on a novel initiative to recycle crucial components of fuel cell and methanol based PEM electrolyzer stacks, deviating from conventional recycling methods predominantly focused on catalysts. These conventional methods frequently involve chemical and thermal treatments, leaving the proton exchange membrane (PEM), known for its high cost, relatively unexplored. Recognizing this gap, the development of a non-destructive method to separate the catalyst from the PEM was initiated. Initially, an efficient and expeditious recycling approach was developed resulting in an accumulation of PEMs and consequently, a more straightforward screening process to assess the suitability of PEMs for reutilization was devised.



Pictorial representation of End-of-life electrochemical methanol electrolyzer polymer electrolyte membrane exhibiting higher degradation on the anode side compared to the cathode side.

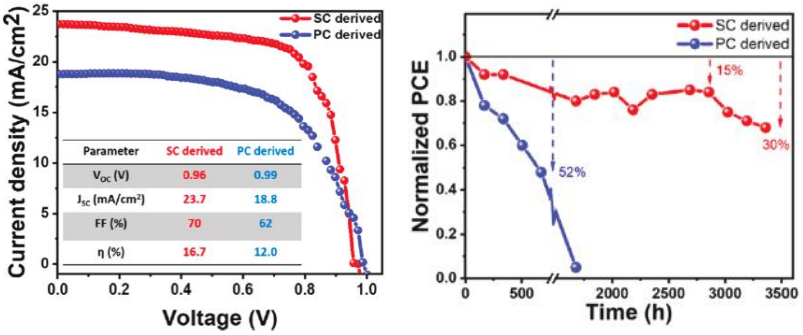
This process involves evaluating their crystalline structure using X-ray diffraction and detecting any signs of degradation through Fourier transform infrared spectroscopy. Surprisingly, in case of electrolyzers, the anodic side of the membrane showed greater degradation compared to the cathodic side of the membrane. This was analytically evinced with the presence of short chains on the anodic side. However, degradation due to the condensation of amorphous sulfonic acid groups and the formation of crystalline anhydrides led to diminished proton conductivity. Since the membranes in methanol-based PEM electrolyers were severely damaged, the reusability in the hydrogen-based energy generation and conversion systems are not advisable.

Reference: Crystallinity in Polymer Electrolyte Membranes used in H2 generators: Degradation Mechanism from the Perspective of Recycling. Sreeraj, P., Vedarajan, R., Ramadesigan, V., Ramya, K., and R Gopalan. Polymer Degradation and Stability, 215 (20023) 110460 https://doi.org/10.1016/j.polymdegradstab, 110460,2023

Single crystal redissolution strategy derived perovskite precursor ink for stable and efficient solar cells

Contributors: *Ramya Krishna, Ganapathy Veerappan, and Easwaramoorthi Ramasamy*

MAPbI3 perovskite absorber ink is obtained by vapor mediated approach from MAPbI3 single crystals by exposing it to methylamine vapor for application in perovskite solar cells (PSC). This single crystal-derived ink shows a significant blue shift in the steady state photoluminescence emission due to MAPbI3 lattice slicing. Absorber films coated by spin coating process using single crystal derived MAPbI3 ink show better charge extraction, carrier lifetime, and device performance than the conventional powder derived film.



Current-voltage characteristics (left) and stability (right) of perovskite solar cells fabricated using powder-based and single crystal based precursor.

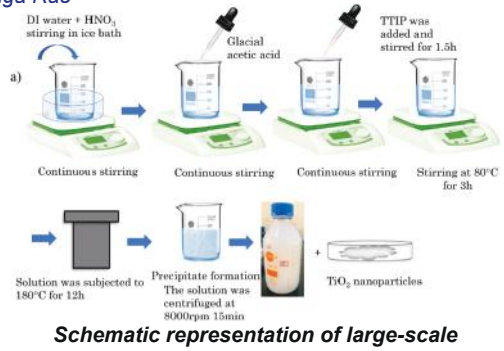
Power conversion efficiency (PCE) of 16.7% is recorded for single crystal derived PSC compared to 12% of the conventional powder derived PSC demonstrating superior film quality. Highly crystalline films with lower traps and uniform absorbance in the entire visible region resulted in enhanced JSC (23.7 mA/cm2). A high fill factor (70%) is achieved due to the dense, pinhole free films with long columnar grains resulting in low series and high shunt resistance. Single crystal derived PSCs were stable with 85% (70%) PCE retention for up to 2850 h (~3500 h) when the devices were kept in ambient (25 ± 3 °C and 50 ± 10% RH); the highest reported so far. Tests under similar conditions using conventional powder derived devices degraded within 700 h with less than 50% PCE retention. The $MAPbI_3$ absorber layer, coated using single crystal derived ink, exhibits superior photovoltaic performance and stability over the conventional $MAPbI_3$ film derived from powder precursors.

Reference: B. Ramya Krishna, Ganapathy Veerappan, P. Bhyrappa, C. Sudakar, Easwaramoorthi Ramasamy, $MAPbI_3$ single crystal derived precursor ink for stable and efficient perovskite solar cells, Journal of Alloys and Compounds 944 (2023) 169082, https://doi.org/10.1016/j.jallcom.169082,2023

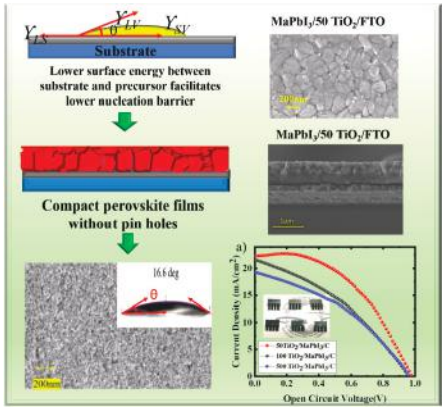
Low-temperature curable TiO_2 sol for separator and HTM-free carbon-based perovskite solar cells

Contributors: *V. Ganapathy, Reshma Dileep K, R. Easwaramoorthi, and Tata Narasinga Rao*

Development of an ambient temperature curable TiO2 mesoporous layer for perovskite solar cells (PSCs), eliminating the need for a binder and enabling the use of environmentally friendly solvents is taken up at ARCI. The TiO_2 layer was synthesized via a hydrothermal method followed by minimal post-processing techniques. The resulting anatase TiO_2 sol was optimized to be compatible with various coating techniques such as spin coating, dip coating, and spray coating, allowing for its application at sub-50°C temperatures.



Schematic representation of large-scale anatase sol and nanoparticle synthesis by hydrothermal method.



(a) Schematic diagram representing impact of TiO_2 surface energy with different temperature processing and its influence on perovskite film formation and its impact on overall photovoltaic performance.

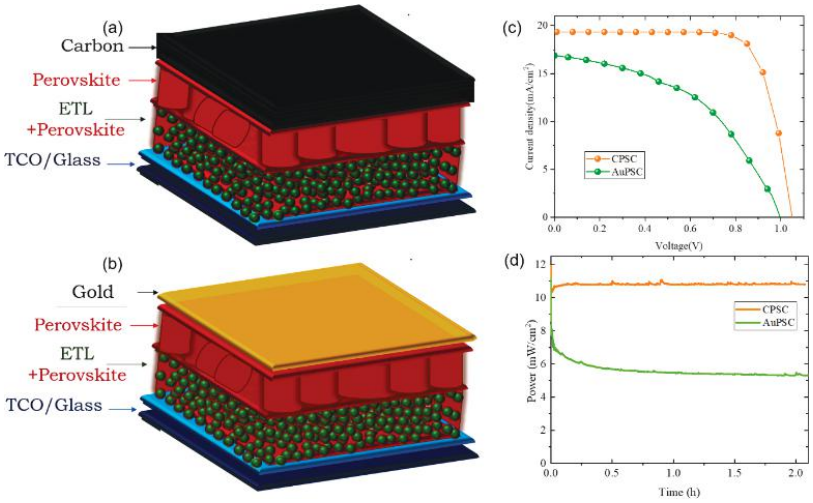
A comprehensive investigation was conducted to study the effects of annealing temperatures ranging from 50 to 500°C on the crystallographic, morphological, electrical, and surface properties of the TiO_2 films derived from the TiO_2 sol. Carbon-based perovskite solar cells (CPSCs) were fabricated and the results revealed that the CPSCs utilizing the TiO_2 electron transport layer (ETL) annealed at 50°C exhibited the highest efficiency of 11.1%. Since the sol can be produced in large quantities, is compatible with various coating techniques, and can be processed at lower temperatures, it can be used for flexible solar cell applications and also for large-scale deposition techniques.

Reference: Low-temperature curable TiO_2 sol for separator and HTM-free carbon-based perovskite solar cells, Materials Advances, 5, 539-548, https://doi.org/10.1039/D3MA00427A,2024

Impact of carbon cathode vs gold cathode in HTM free perovskite solar cells

Contributors: *V. Ganapathy, Reshma Dileep K, R. Easwaramoorthi, Tata Narasinga Rao, and Eva Unger*

Carbon-based hole transport material free perovskite solar cells (CPSCs) are an innovative device architecture that mitigate inherent challenges associated with record-breaking perovskite solar cells (PSCs), which rely on metal/hole transport materials (HTMs), such as instability, manufacturing intricacy, and higher costs. The charge carrier dynamics at the carbon(C)-perovskite interface in CPSCs and its implications on photovoltaic performances and stability are investigated. The study reveals that the C-electrode effectively acts as a selective barrier, impeding electrons while facilitating the extraction of holes at the C-perovskite interface.



Schematic illustration of HTM free (a) CPSC and (b) AuPSC. (c) Current-Voltage characteristics of CPSC and AuPSC. (d) Operational stability of CPSC and AuPSC under MPPT conditions.

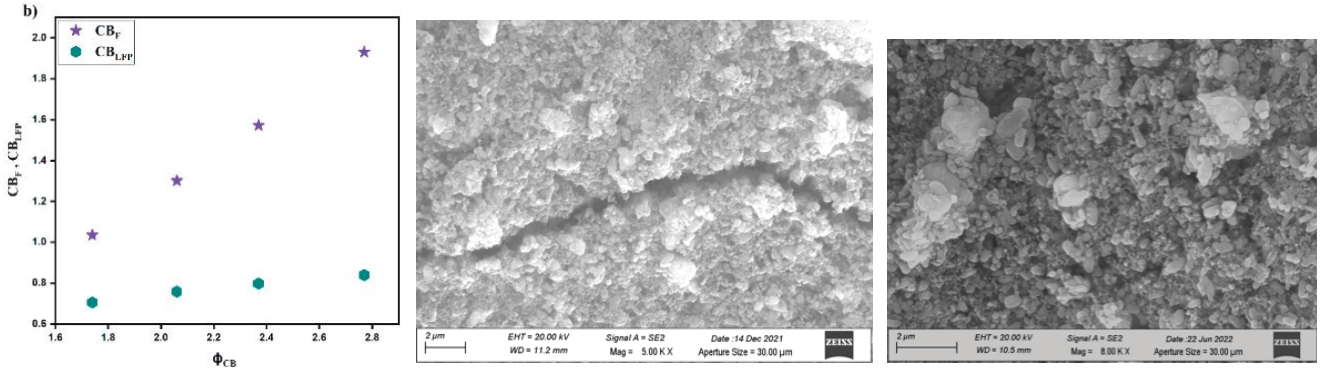
This selective blocking mechanism holds significant implications for improving the performance and stability of CPSCs over HTM-free PSCs with gold (Au) electrodes. By delving into these pivotal aspects, this work aims to contribute to the advancement and understanding of CPSCs for sustainable and efficient energy conversion. The device architecture selected for this work is schematically shown in Figure 1a and b. Current-voltage characteristics of CPSCs (Figure 1c) showcases superior stability and photovoltaic performance (15.3%), than the AuPSCs (10.5%). The Au electrodes are reported to trap moisture and hinder the release of water molecules from the perovskite accelerating the degradation leaving an uneven surface with pinholes exposing the perovskite underneath. In contrast, the absence of surface morphological changes after ageing indicates that the thick hydrophobic carbon electrodes shielded the perovskite layer

Reference: Charge carrier dynamics at carbon/perovskite interface: implications on carbon-based HTM-free solar cell, Solar RRL, 8, 2300960, https://doi.org/10.1002/solr.202300960 , 2024

Capacity degradation in Lithium-Ion Cells: exploring the influence of free Carbon Black content and drying-induced cracks in $LiFePO_4$ Electrodes

Contributors: *Sahana M.B., Kumari Konda, and R Gopalan.*

In $LiFePO_4$ (LFP) electrodes, carbon black (CB) is added to enhance electronic conductivity. Within the electrode, a portion of CB remains as free carbon while the rest adheres to LFP particles. The free carbon content in LFP/CB/binder compositions via rheology studies was quantified. Low carbon levels increase CB-binder domains, reducing conductivity, while excess carbon induces cracking and islands during fabrication. The findings shed light on how free carbon affects electronically connected active materials, impacting capacity in the nominal voltage zone during cycling. This research provides vital insights for optimizing electrode performance in lithium-ion batteries.



Plot of carbon black estimated to be attached to LFP, CB_{LFP} , and the remaining, free carbon black, CB_F, vs volume fraction of CB, Φ_{CB}.

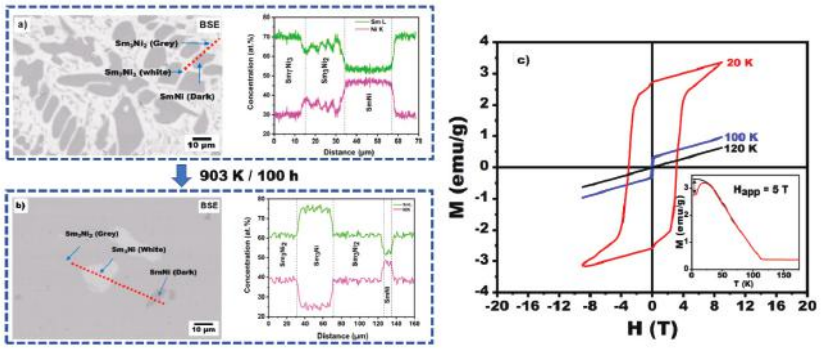
Reference: Kumari Konda, Megha Sara Jacob, Jyoti R. Seth, Vinay A. Juvekar, Raghavan Gopalan, Sahana B. Moodakare, Capacity degradation of lithium-ion cell: The role of free carbon black content in the slurry and drying induced cracks in $LiFePO_4$ electrode, Journal of Energy Storage, Volume 74, Part B, 109477, 2023

Stabilization of high temperature Sm3Ni2 Phase

Contributors: *Vijayaragavan, D. Prabhu, Ravi Gautam, and R. Gopalan*

Sm2Fe17Nx is considered as the potential alternative to Nd2Fe14B magnet owing to its excellent intrinsic magnetic properties since its discovery. However, a sintered magnet has not been realized yet owing to the decomposition phenomenon of the hard magnetic Sm2Fe17N3 phase at a temperature above 630 °C. The metal bonding technique has been attracting attention as a potential method to fabricate bulk Sm-Fe-N magnets. This technique uses low melting metals like Zn or eutectic alloys having melting points lower than the decomposition temperature of that particular phase. Usually, Sm-based low melting eutectics are preferred due to the good wettability with Sm-Fe-N powders and also for its reducing ability to remove the surface oxide from the powders

In this work, the microstructure evolution and phase analysis of the Sm60Ni40 alloy were investigated. The arc melted sample retained the high temperature stable (> 600 °C) Sm7Ni3 and Sm3Ni2 phases along with the congruently melting SmNi phase. The high temperature stable (600 °C - 630 °C) Sm3Ni2 phase was stabilised by Annealing the as-cast sample at 903 K for 100 hours.. Rietveld refinement was performed to resolve the crystal structure of Sm3Ni2 phase and it was observed that Sm3Ni2 phase stabilizes in monoclinic crystal structure (space group: C2/m) with a lattice parameter of a=13.49 Å, b=3.75 Å, c=9.68 Å and β=106.6°. The Curie temperature of the Sm3Ni2 phase was determined to be ~110 K. The high squareness ratio of 82% along with high coercivity of 3 T indicates that the Sm3Ni2 phase possess spontaneous uniaxial magnetic anisotropy.



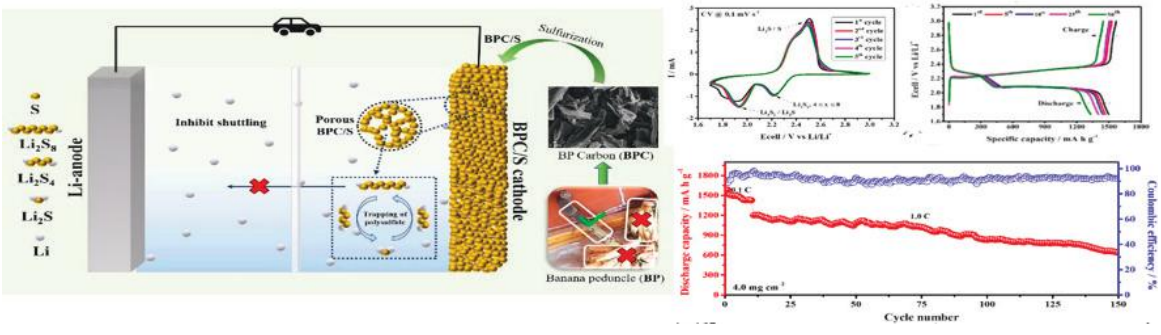
Backscattered SEM images showing the stabilization of Sm3Ni2 in the annealed sample (b) from the multiphase as-cast microstructure (a) along with hysteresis loop measurement (c) exhibiting the high coercivity of the Sm3Ni2 phase

Reference: G. Vijayaragavan , D. Prabhu, M.B. Ponnuchamy , K.R.S. Preethi, Ravi Gautam, Mainak Saha, R. Gopalan, K.G. Pradeep Journal of Magnetism and Magnetic Materials 566, 17032, 2023

Highly porous banana peduncle-derived carbon as sulfur host for high-rate performance lithiumsulfur batteries

Contributors: *B. V. Sarada, Katchala Nanaji, and Tata Narasinga Rao*

Lithiumsulfur batteries (LSBs) have gained considerable interest because of their high gravimetric energy density (2600 Wh kg^{-1}) and theoretical specific capacity of sulfur (1675 mA h g^{-1}). Sulfur can potentially be used as a cathode in Li-based secondary batteries to realise high-energy-density batteries. In the present work, the cathode uses banana peduncle, a biomass as a carbon precursor, to enhance the specific surface area and porosity after chemical activation. The carbonsulfur composite prepared with a sulfur loading of 75 % yields a significantly high initial discharge capacity of 1498 mA h g^{-1} at 0.1C, which remains stable with a very minimal capacity decay for the subsequent 100 charge-discharge cycles. Even at a high current rate (2C), the electrode shows a remarkable discharge capacity of 1076 mA h g^{-1}, reflecting the efficacy of the as-fabricated cathode for LSB for high current applications. Further, the cycling performance is corroborated with high aerial sulfur loading (4 mg cm^{-2}) to investigate the commercial feasibility.



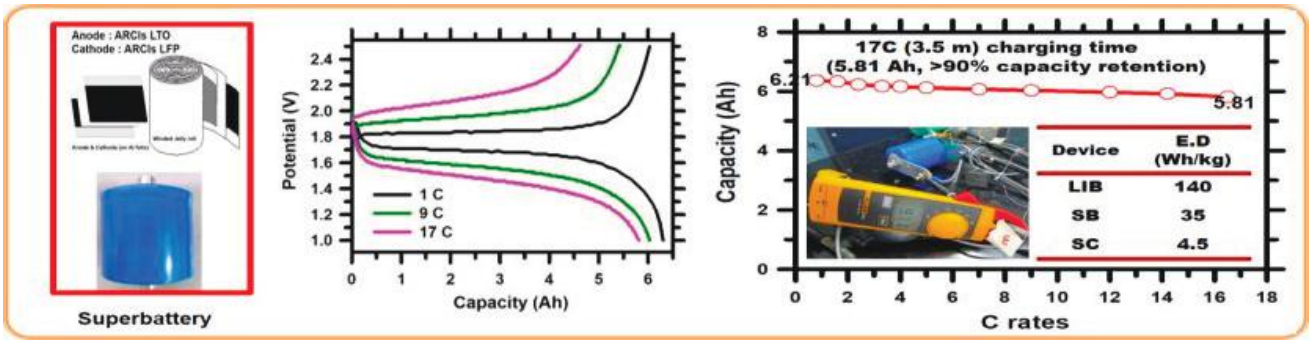
(a) Schematic of porous carbon as sulfur host for cathode, (b) Cyclic voltammograms of the C-S cathode in half-cell, (c) Cycle stability at high mass loading of the Carbon-sulfur at 1.0 C.

Reference: Sony K. Cherian, Katchala Nanaji, Bulusu V. Sarada, Tata Narasinga Rao, Chandra S. Sharma, Sulfur confinement into highly porous banana peduncle-derived carbon for high-rate performance lithium-sulfur battery, Journal of Energy Storage, 89 ,111803,2024

Development of Super-Battery for High Energy and High Power Li-ion Battery Application

Contributors: *S. Anandan, K. Nanaji, R. Vijay, and Tata Narasinga Rao*

A tab-less 6080-sized Super Battery (60 mm diameter & 80 mm height) using safe, robust, chemically and thermally stable fast charging lithium titanate (LTO), and carbon coated $LiFePO_4$ (C-LFP) as anode and cathode, respectively was fabricated and demonstrated for the first time. The super battery exhibited extraordinary charge-discharge rates up to 17C, and delivers a capacity of 5.8Ah which was attributed to tab-less technology adopted during the fabrication of LFP-LTO. This demonstrates a Li-ion battery with near-supercapacitor behaviour, and expects to address the key challenge of deploying an energy storage device having high energy and high power in a single device, indicating its promise for a wide range of applications including public transportation, regenerative breaking, power tools, power source for drones etc.



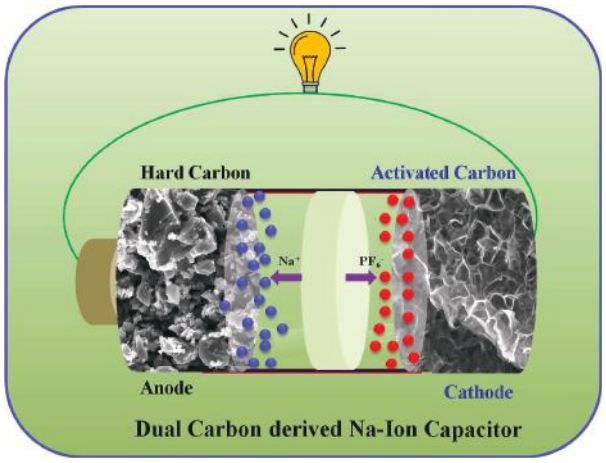
Fabrication of LFP-LTO Superbattery and its electrochemical performance

Reference: Fabrication of Tab-less and High Power Cylindrical LFP-LTO cell for Fast Charging Lithium Ion Battery Application, S. Anandan, K. Nanaji, R. Vijay, Tata Narasinga Rao, Indian Patent Application No. 202341004527 dated 22.01.2024.

A High-Performance Dual Carbon Na-ion Capacitor Fabricated from a Single Bio-waste precursor

Contributors: *Tata Narasinga Rao and Katchala Nanaji*

A major limitation of Sodium-ion capacitors (SIC) lies in their dissimilar charge storage mechanism of ion adsorption cathodes with fast reaction kinetics, versus battery-like anodes, having slow kinetics. It is possible to address this concern by designing a SIC architecture with effective electrode strategies. In this study, a dual carbon SIC is constructed from a single bio-waste precursor (pistachio shell) by employing a facile approach to achieve a graphene sheet-like activated carbon cathode and disordered hard carbon anode as respective positive and negative electrodes. Both the activated carbon cathode and hard carbon anode exhibit good electrochemical properties in terms of high reversible specific capacity and exceptional rate capability vs. Na/Na^+. The dual carbon SIC with an optimized positive-to-negative electrode mass ratio delivers an excellent energy density of 141 Wh kg^{-1} at 198 W kg^{-1} whereas the activated carbon-based supercapacitor exhibits an energy density of 24 Wh kg^{-1} at 675 W kg^{-1}.



Schematic illustration of the dual carbon Na-ion Capacitor system

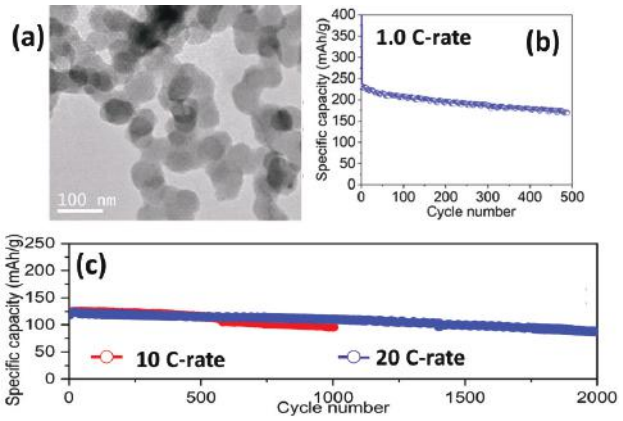
Hence, pistachios shell derived activated carbon sheets with large effective surface area possess sufficient porosity for facile ion transfer kinetics, while hard carbon anode with disordered structure facilitates Na -ion intercalation, thus balancing the electrode kinetics of both the electrode materials in SIC device.

Reference: Katchala Nanaji and Tata Narasinga Rao. A High-Performance Dual-Carbon Na-Ion Capacitor Fabricated from a Single Bio-waste Precursor, Energy Technology, 2300493,2023

Development of spherical shaped hard carbon for sodium-ion storage applications

Contributors: *Bijoy Kumar Das, M. Venkatesh, R. Gopalan, and Tata Narasinga Rao*

Sodium-ion batteries (SIBs) are considered as promising alternatives to widely used Lithium-ion batteries (LIBs) due to their low cost, elemental abundance, encouraging electrochemical performance and safety features. The main objective of ARCI is to indigenously develop the potential electrode materials with high specific capacity and cycle life to integrate them in proto-type SIB for stationary and EV applications. Hard carbon is identified as one of the potential anode for SIBs due to its outstanding electrochemical performance. A simple and novel flame pyrolysis route followed by calcination at different temperature was employed to prepare spherical hard carbon nanoparticles (<100 nm) from a low-cost bio-source. The prepared hard carbon shows a high reversible capacity of ~287 mAh/g at 0.1 C (1C= 300 mA/g).



(a) TEM images of hard carbon prepared by flame synthesis; Specific capacity vs cycle number plots for hard carbon at (b) 1.0 C-rate, (c) 10 and 20 C-rates. Voltage: 0-2.5 V and 1 C = 300 mA/g.

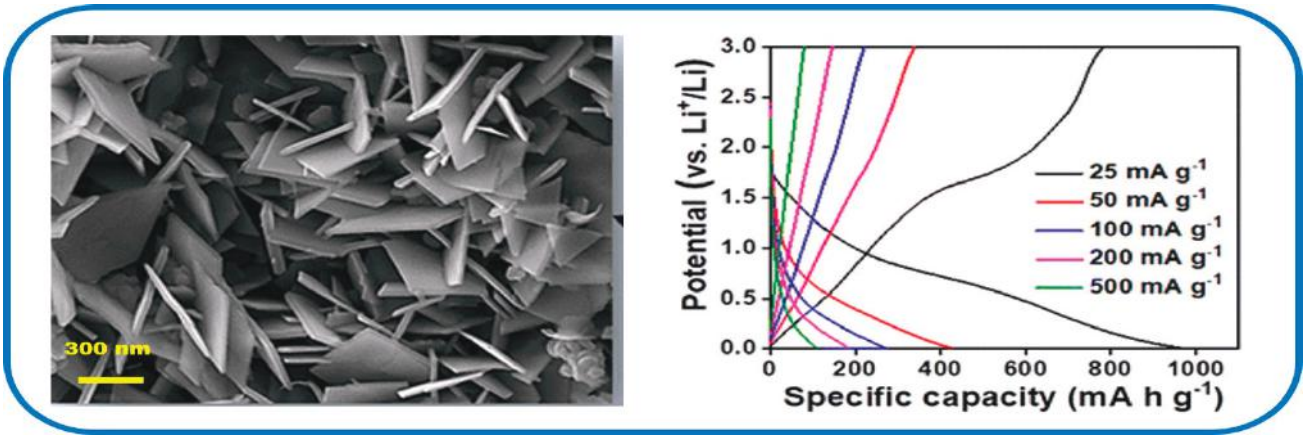
When cycled at 1.0 C-rate, it shows specific capacity of ~235 mAh/g with 72% of capacity retention after 490 cycles. Excellent rate performance has been seen even at 20 C (6 A/g) with high specific capacity of 118 mAh/g at 70% capacity retention after 2000 cycles, which is one of the highest values reported so far. Particle size and morphology altogether have played significant role in achieving high specific capacity and C-rate performance by providing shorter diffusion path and larger sodium ion storage sites.

Reference: S. Sharma, M. Venkatesh, R. Gopalan, Tata Narasinga Rao and Bijoy Das; Quasi-diffusion controlled high rate sodium-ion storage performance of flame pyrolysis derived spherical hard carbon, Carbon, 226, 119158,2024

Solid-gas synthesized stable V_3S_4 nanoflakes as an efficient anode for Li-ion battery applications

Contributors: *Joydip Joardar, R. Vijay, Tata Narasinga Rao, and Ramkrishna Sahoo*

A unique synthesis strategy was demonstrated for obtaining V_3S_4 nanoflakes from bulk V_2O_5 via a two-step synthesis route where the hydrothermal treatment in the presence of ammonium sulfide modifies the bulk V_2O_5 into a VO_2 nanosheet and the solid–gas reaction completely sulfurizes the chemically modified compound at 500°C resulting in the formation of V_3S_4 nanoflakes. The solid–gas reaction synthesis strategy under controlled pressure–temperature conditions results in the formation of V_3S_4 at a relatively low temperature. Detailed physicochemical characterization indicates the phase purity and high air stability of the material. The electrochemical characterization indicates the anodic behavior of the as-prepared material as a Li-ion battery anode having a high reversible capacity of 781 mA h g−1 at 25 mA g−1.



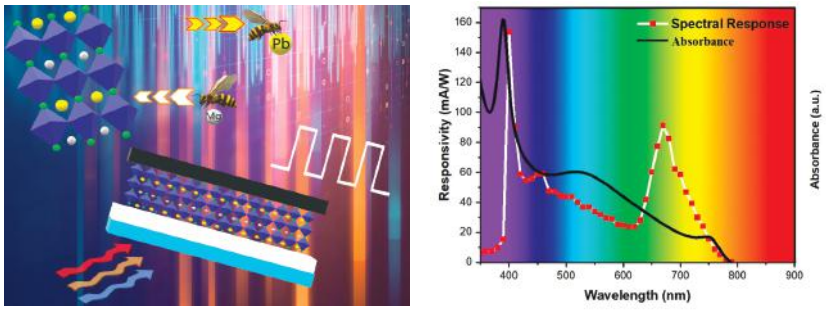
FE-SEM image of V3S4 nanoflakes and its electrochemical performance as anode for Li-ion batteries

Reference: Balla Rekha Madhuri, Harish Kumar Adigilli, Anirudha Karati, Joydip Joardar, R. Vijay, Tata Narasinga Rao and Ramkrishna Sahoo, Solid–gas synthesis of stable V3S4 nanoflakes: electrochemical characterization as a Li-ion battery anode, New J. Chem., 48, 3447-3455,2024

Solution based Fabrication of photodetector by Eco-Friendly Mg Substitute for Toxic Pb in Perovskite

Contributors: *P.H.Borse, V. Ganapathy, R. Easwaramoorthi, Smrutiranjan Panda, and B. Kumaar Swamy Reddy*

Light detection is considered as the most important aspect, for various commercial and defence applications. Photo-detector, an optoelectronic device converts the incident photons into electrical output. A new Mg substituted $MAPb_{0.5}Mg_{0.5}Cl_2I$ perovskite, broadband photo-detector has been developed at ARCI. The synthesized perovskite photodetector addresses the high toxicity of Pb^{2+} in methyl ammonium lead halide ($MAPbX_3$), by replacing 50% Pb with Mg. The broadband photo-detector is engineered to detect the three regions of wavelengths (UV, Vis and NIR light photons).



Schematic representation of lead is being partially removed and magnesium being added in the perovskite crystal structure and schematic diagram of carbon cathode based perovskite photodetector (left side); Wavelength dependent responsivity of the detector of the optimized sample of Mg:Pb-5:5 (right side)

This best-performing material, demonstrates excellent responsivity (153.74 mA/W), high detectivity (6.5 x 10^{10} Jones), and fast response/recovery times (411 ms/50 ms) in self-powered photodetectors.

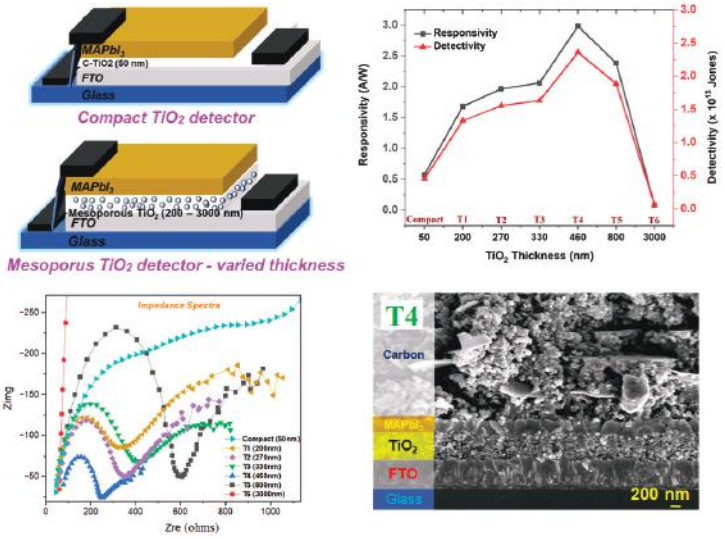
Such energy conserving photo-detectors find tremendous applications in communication, remote sensing, safety and security, process control-automation, environmental sensing, astronomy, defence etc.

Reference: Fabrication of a self-powered broadband photodetector by 50% replacement of Pb by Mg in the $CH_3NH_3Pb_{0.5}Mg_{0.5}Cl_2I$ perovskite lattice, Mater. Advances. 4, 6522-6534 https://doi.org/10.1039/D3MA00411B, 2023

Fabrication of stable, solution processed self-biased photodetector using, TiO_2, carbon based electrodes

Contributors: *P.H.Borse, V. Ganapathy, R. Easwaramoorthi, Smrutiranjan Panda, and B. Kumaar Swamy Reddy*

Photodetector is a crucial component in IOT devices, presently being developed for 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, NIR light photons into related electrical output. Perovskite, an innovative photo-active material, is being considered for photo-detection development at ARCI. This broadband photo-detector is engineered by making use of $MAPbI_3$-based material with controlled electron dynamics via mesoporous TiO_2 and carbon electrode to realize a superior design of photodetector yielding superior responsivity (2.9 A/W) and faster photo switching of order of milli-second scale. This fabricated prototype portrays high and viable scope towards the commercialization of “improved material containing photodetector”.



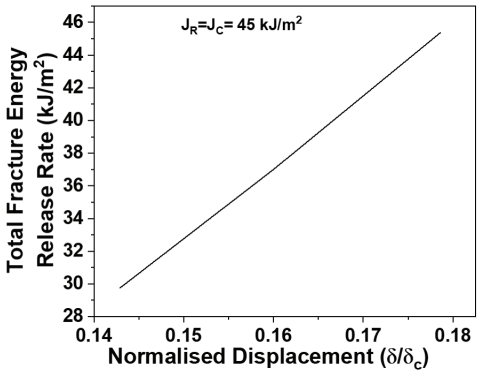
Schematic representation of photodetector device fabrication using compact and mesoporous TiO_2 layers (top left); The graph variation in responsivity (-■-) and detectivity (-▲-) of devices fabricated with variation in the mesoporous TiO_2 layer thickness compared to that of the compact TiO_2 layer (top right) ; Expanded view of EIS curves of devices fabricated with compact TiO_2 layer and varied thickness of mesoporous TiO_2 layers (bottom left); Cross-sectional FE-SEM image mesoporous device of T4 ((bottom right),

Reference: Exploring the impact of electron transport layer thickness and morphology on perovskite infiltration and photoresponse in HTM-free self-powered photodetector, Solar. Energy 265, 112106 https://doi.org/10.1016/j.solener.2023.112106, 2023

Studies on Fracture, Structural, Optical Properties of Lithium Aluminosilicate Glass-ceramics for High End Applications

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

Lithium Aluminosilicate (Li_2O-Al_2O_3-$2SiO_2$) is a very important class of material. This material exhibits a combination of superior physico-chemical and optical properties, extremely low thermal expansion coefficient, high thermal shock resistance, high mechanical stability, etc. This extraordinary combination of properties makes Lithium Aluminosilicate a perfect option for use in laser gyroscopes, telescopes, space mirrors, and even in civilian applications such as specialized kitchen cooktops, cookware, etc. In the present study, Lithium Aluminosilicate samples were produced by melt-casting technique. Using Lithium carbonate, Silica, and Aluminium hydroxide, along with a few other additives. The mix of raw materials was melted at 1400-1500°C and cast at 1300°C.



R-curve of Lithium Aluminosilicate glass-ceramics

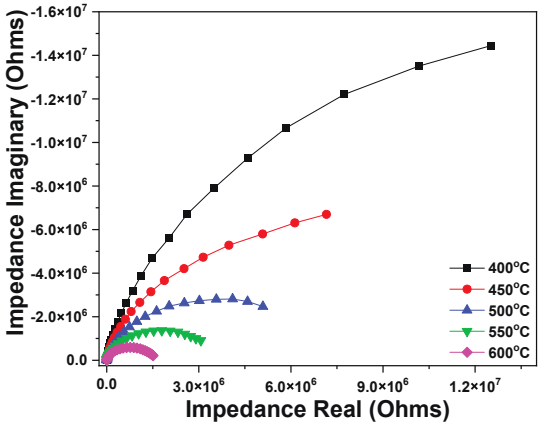
The cast samples are annealed and further ceramized at 800°C to achieve crystallinity. Ceramized samples exhibited β-spodumene phase ($Li_{0.33}Al_{0.33}O_2Si_{0.667}$), 2.53-2.54 g/cm^3 density, Knoop hardness of 597-669 kg/mm^2, flexural strength of 110-114 MPa and compressive strength of 221 MPa before fracture and 1.04-1.18 MPa$\sqrt{m}$ of fracture toughness which are at par with the reported values. R-curve demonstrated an increasing trend in the total fracture energy release rate with respect to the normalised displacement without any sign of saturation which indicates the further scope for optimisation of fraction of crystals present in the glass matrix to obtain the predominant toughening behaviour.

Reference: Papiya Biswas, M. Buchi Suresh, D. C. Jana, Bhaskar P. Saha, Roy Johnson, Ceramics International 50 ,4708–4714,2024

Dielectric & Electrical properties of Slip Casted $MgAl_2O_4$ Spinel optical ceramics for High Temperature Application

Contributors: *M Buchi Suresh, Papiya Biswas, B P Saha, and Roy Johnson*

Magnesium Aluminate ($MgAl_2O_4$) spinel is of interest due to its high thermal stability, mechanical resistance and better sinterability. It has unique properties of low dielectric constant and high Quality factor. It is also transparent to light above 320 nm due to large optical band gap (3.8 eV) and hence used in optoelectronic, spacecraft application for thermal control coatings and as high temperature ceramic material. In the present work the high temperature dielectric and complex impedance spectroscopic properties of $MgAl_2O_4$ spinel ceramics prepared by conventional slip casting method were systematically investigated. Dielectric properties measured with frequency and temperature revealed a decrease in dielectric constant (εr) and real part of impedance (Z') with frequency. The spinel exhibited dielectric constant of 30@1MHz for sintered sample and 38@1MHz for HIPed sample.



Nyquist plots at different temperatures

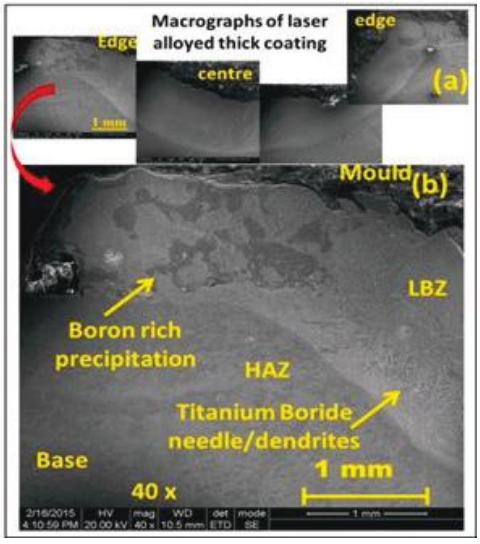
Nyquist plots were taken from impedance measurements on sintered and HIPed samples as shown in figure-1 resulted into deviated semicircles. It can be observed that the intercept of each depressed semi-circles on real axis shifts towards high frequency side with increase in temperatures, which indicates that the bulk resistance (Rb) of $MgAl_2O_4$ spinel sample decreases. The complex impedance analysis suggests predominant conduction due to grain and grain boundaries. Activation energy obtained from the conductivity plot (0.21eV for sintered and 0.25eV for HIPed sample) indicates an Arrhenius type thermally activated process due to oxygen vacancies suggesting the conduction by hopping mechanism.

Reference: Madireddy Buchi Suresh, Papiya Biswas, B P Saha & Roy Johnson, Journal of Materials Science: Materials in Electronics 34 , 1877,2023

Superhard boride coatings by laser surface alloying

Contributors: *K Monisha, J Senthilselvan, Md. Aqeel, and S M Shariff*

Laser assisted surface alloying is one among the advanced surface modification techniques for development of super hard coatings of metal-matrix composite or ceramic nature. Titanium and its alloys are critical light weight metals widely used in chemical, aerospace, medical and automobile applications due to their excellent corrosion resistance, toughness and strength properties. However, they suffer from poor hardness and tribological properties, and as a result any surface modification with super-hard coating can envisage its wide adoption. Since amorphous boron can easily convert into crystalline form with laser interaction resulting in formation of hard titanium boride on titanium substrate. Applying this phenomenon with Self-propagating High-temperature Synthesis (SHS) in laser surface alloying of Cp-Titanium with amorphous born (using a diode laser with pre-placement of amorphous boron under argon environment) yielded formation of superhard coating. Indeed, a high negative value of Gibbs Free Energy (ΔG) and Activation Energy (E_Q) entailed spontaneous formation of TiB_2 (of 4000 HV) with uniform distribution on the surface layer, which exhibits a hardness of 800-1600 HV(Figure). Comparative wear volume analysis of laser-alloyed and untreated substrate during ball-on-plate linear reciprocating wear test as per ASTM G133-05 standard exhibited four-fold improvement in wear resistance for the laser coating associated with hard borides formation.



Laser borided Ti coating processed at 3-kW laser power: region (a) exhibiting stitched view of alloyed track and region (b) high magnification microstructure of coating edge exhibiting dendrites of borides and boron precipitation.

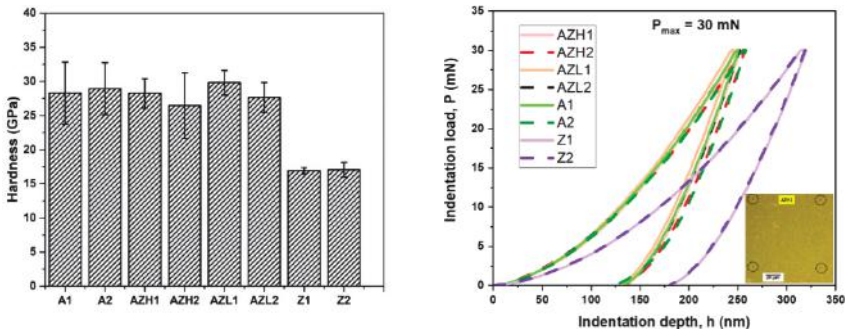
References:

1. **K Monisha, S M Shariff, A. Sekar, Ravi Raju, J Manonmani and J Senthilselvan, Titanium boride coating by high power diode laser alloying of amorphous boron with titanium and its surface property investigations, Optics and Laser Technology, 170 ,110159,2024**
2. **K Monisha, S M Shariff, R Raju, J Manonmani, S Jayaraman, Titanium boride and titanium silicide phase formation by high power diode laser alloying of B_4C and SiC particles with Ti: Microstructure, hardness and wear studies, Materials Today Communications, 31 ,103741,2022**

Understanding the individual role of composition and SPS temperature on microstructure and hardness of alumina-zirconia composites

Contributor: *Dibyendu Chakravarthy*

The individual effect of composition and spark plasma sintering (SPS) conditions on the hardness of alumina, zirconia and alumina–zirconia (AZ) composites was investigated. AZ composites with varying zirconia content were prepared and their grain sizes were varied by altering the SPS temperature. The size and volume fraction of secondary ZrO_2 particles vary according to the composition. The hardness of the AZ composites vary marginally with the size of the matrix alumina phase but markedly with the volume fraction of the ZrO_2 phase. Altogether, the AZ composite with a finer grain size and low volume fraction of secondary ZrO_2 phase exhibits the highest hardness, while coarse-grained microstructure and high ZrO_2 content contributes to significantly lower hardness.



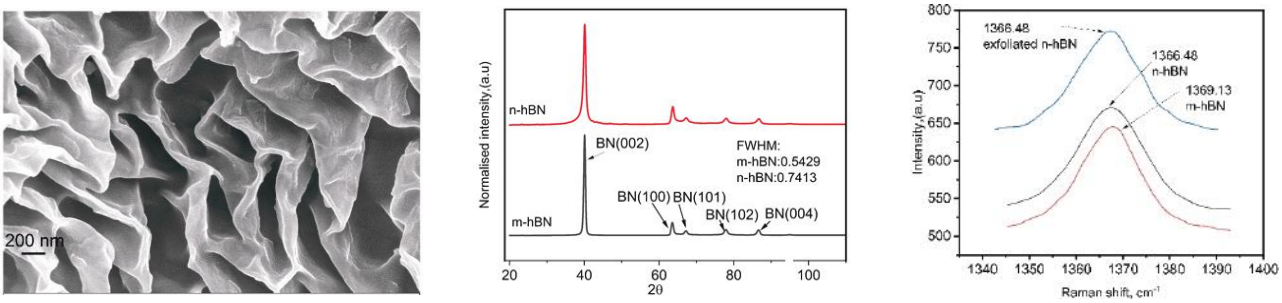
(a) Representative P–h curves from nano-indentation at P_{max} = 30 mN; inset: optical micrograph showing the indents in the microstructure of AZH1 composite; (b) hardness for monolithic Al_2O_3 and ZrO_2 ceramics (A1, A2 and Z1, Z2) as well as AZ composites with varying ZrO_2 content and grain sizes (AZL1, AZL2, AZH1, and AZH2).

Reference: S. Basu, A.C.Arohi, A. Mahato, D. Chakravarty, I. Sen, S. Roy, Understanding the individual role of composition and SPS temperature on microstructure and hardness of alumina-zirconia composites, Metallurgical and Materials Transactions A, https://doi.org/10.1007/s11661-024-07426-4, 2024

Boron nitride nanosheets by cryo-milling

Contributors: *S. Sudhakara Sarma, Balaji Padya, B. V. Sarada, V. Akhila, Chandra Gowthami, and Joydip Joardar*

Hexagonal boron nitride (h-BN), is well-known to have many beneficial qualities, like outstanding heat conductivity, remarkable resistance to oxidation, high mechanical strength, and high-temperature lubrication. Weak van der Waals forces hold the h-BN layers together, and covalent bonds bind the boron and nitrogen atoms in each layer. The h-BN's lubricating qualities are caused by the layers sliding over one another due to the weak van der Waals force. The lubricating characteristics are greatly attributed to the two-dimensional structure of the hBN since it allows for better dispersion with smaller amounts of hBN. The production of 2d-hBN in large quantities from bulk hBN has proven to be a difficult undertaking. The 2D hBN was produced in scalable quantity using the cryo-milling process at ARCI. The thickness of the cryo-milled boron nitride nanosheets is in the range of 15- 25 nm as shown in the figure.



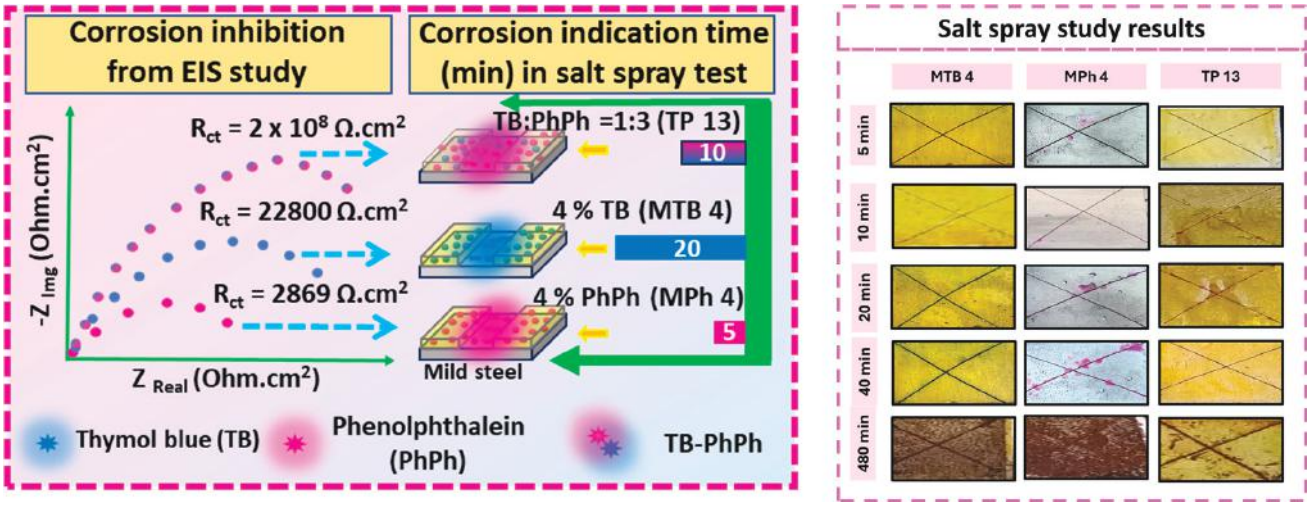
(a) Cryo-milled 2D-hexagonal boron nitride nano sheets, (b) XRD patterns of coarse m-hBN, 2D-hBN, (c) Raman patterns of coarse m-hBN, 2D-hBN after cryo-milling

Reference: Sreedhara Sudhakara Sarma , Balaji Padya, Bulusu Venkata Sarada, Vasamsetti Akhila, Chandra Gowthami , Pasam Vamsi Krishna, Joydip Joardar, Journal of Nano particle Research ,26:80, https://doi.org/10.1007/s11051-024-05992-7,2024

Development of dual functional smart coatings for metals/alloys

Contributors: *R. Subasri, Ramay Patra (SRF), and M. Santosh (Project student)*

Smart coatings, integrating corrosion indicators and inhibitors, provide an efficient and cost-effective solution against corrosion. Thymol blue (TB) and phenolphthalein (PhPh) are reported to be promising active agents for developing these coatings. Our recent study compares effectiveness of sol-gel coatings along with these materials in sensing and inhibiting mild steel corrosion. TB-based coatings showed 8 times better inhibition than PhPh-based ones, while PhPh-based coatings were 16 times more sensitive in corrosion sensing. However, a 1:3 ratio of TB and PhPh enhanced both detection sensitivity and inhibition on mild steel, offering valuable insights in choosing suitable active agents for smart coatings (Fig 1).



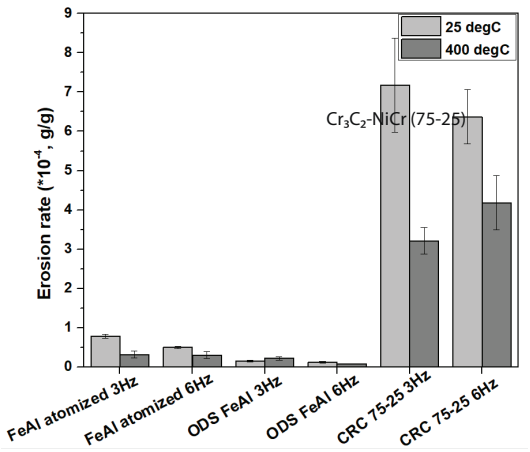
1 (a) Comparison of charge transfer resistance (Rct) and corrosion indication time and (b) results of salt spray tests for different coatings

Reference: Patra R, Santhosh M, Kauveri GV, Subasri R. Effectiveness of Thymol Blue and Phenolphthalein in Sol-Gel Coatings for Sensing and Inhibiting Corrosion on Mild Steel. Langmuir. 40(11):6035-6050. doi: 10.1021/acs.langmuir.4c00269,2024

Development of iron aluminide (FeAl) coatings by detonation spray technique: an addition to conventional thermal spray powders

Contributors: *D Vijaya Lakshmi, P Suresh Babu, L Rama Krishna, R Vijay, and D Srinivasa Rao*

Even though thermal spraying of iron aluminides (FeAl) offers a cost-effective means of protecting the underlying substrate against various forms of external surface damage mechanisms such as erosion these have not replaced commercial Cr_3C_2-NiCr coatings due to poor ductility of FeAl coatings. To enhance the ductility properties of iron-aluminides, addition of 5% Cr, 0.3% Zr, 0.35 Y_2O_3 was carried out through mechanical milling. Later, the powder (referred to as ODS FeAl) was sprayed using detonation spray technology with 6 Hz process pulse frequency. The ODS FeAl coatings were subjected to solid particle impingement erosion test using alumina as erodent and electrochemical corrosion in three different aqueous media (namely NaCl, H_2SO_4 and Na_2SO_4). The results indicated that the ODS FeAl coatings exhibited 4 to 5 times improved erosion wear resistance than that of Cr_3C_2–25NiCr coatings at room temperature and 1.5 to 2.5 times improved resistance at a higher temperature (400 ◦C). However, the overall electrochemical corrosion resistance was inferior to that of Cr_3C_2–25NiCr coatings in acid media.



Erosion Wear

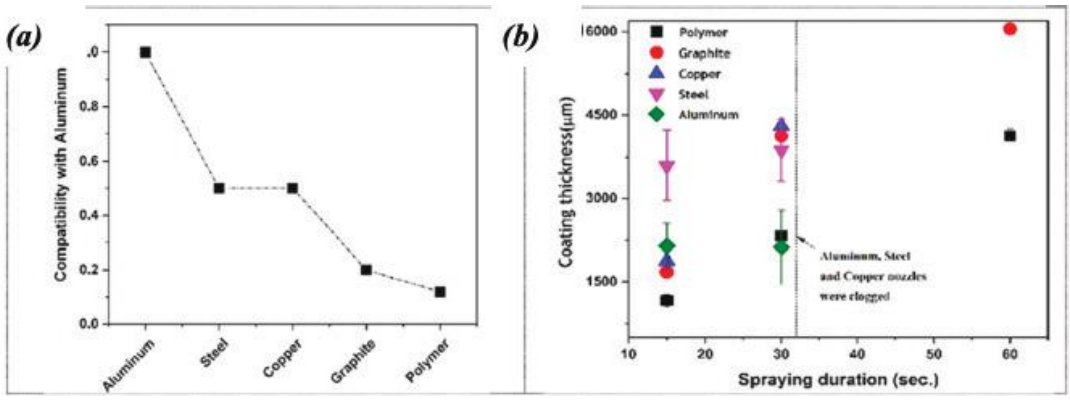
This study provided valuable insights on microstructural aspects of corrosion and erosion phenomena, demonstrated a leap step towards the development of novel thermal spray grade feedstock materials as an alternative to industrially well-known Cr_3C_2–25NiCr coatings and opens up a new avenue of techno-economic benefits that can further be explored.

Reference: D Vijaya Lakshmi, P Suresh Babu, L Rama Krishna, P Vijaya Durga, R Vijay, D Srinivasa Rao, Electrochemical corrosion and solid particle erosion response of Y_2O_3 dispersed FeAl coatings deposited by detonation spray, Intermetallics, 155, 107844, 2023

Anticlog nozzles for cold spraying clog prone materials

Contributors: *S. Kumar, K. Yogeswar, and N.M. Chavan*

Cold spraying of soft metals such as aluminium and its alloys often leads to clogging at nozzle throat affecting the productivity. Attempts were made to address clogging which includes a proper selection of nozzle material and nozzle cooling. Polymer based materials which has process temperature limitation (400 C) are widely used to deposit aluminium. In this work, a systematic study was carried out using different nozzle materials and clogging is correlated with the wettability of feedstock. High-density graphite is identified as a materials solution which can replace expensive polybenzimidazole as nozzle material for depositing soft materials.



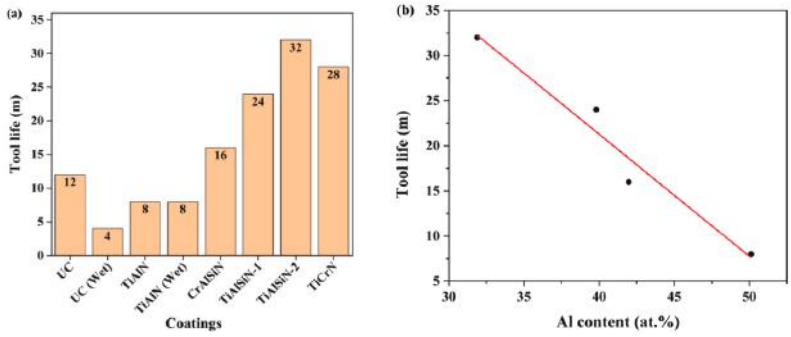
(a) Compatibility of aluminium with different nozzle materials and (b) average coating thickness as a function of spraying duration.

Reference: K. Yogeswar, S. Kumar and N.M. Chavan Manufacturing Letters 40 ,22–25,2024

Development of Wear resistant coatings for effective machining of Ti-6Al-4V

Contributors: *Aditya Kumar and Krishna Valleti*

This study provides valuable insights into the effectiveness of carbide tools coated using CAPVD technique in extending the tool life when face milling Ti-6Al-4V. For the purpose of determining the optimal machining settings, coated and uncoated carbide tools were tested in both dry and wet environments. An uncoated Tungsten Carbide (WC) tool had a tool life that was up to three times longer in dry settings compared to wet situations. Compared to their uncoated counterparts, coated tools had a tool life that was 33–166 percent longer. A study of their efficiency showed that the tool life was inversely proportional to the 'Al' content in coating.



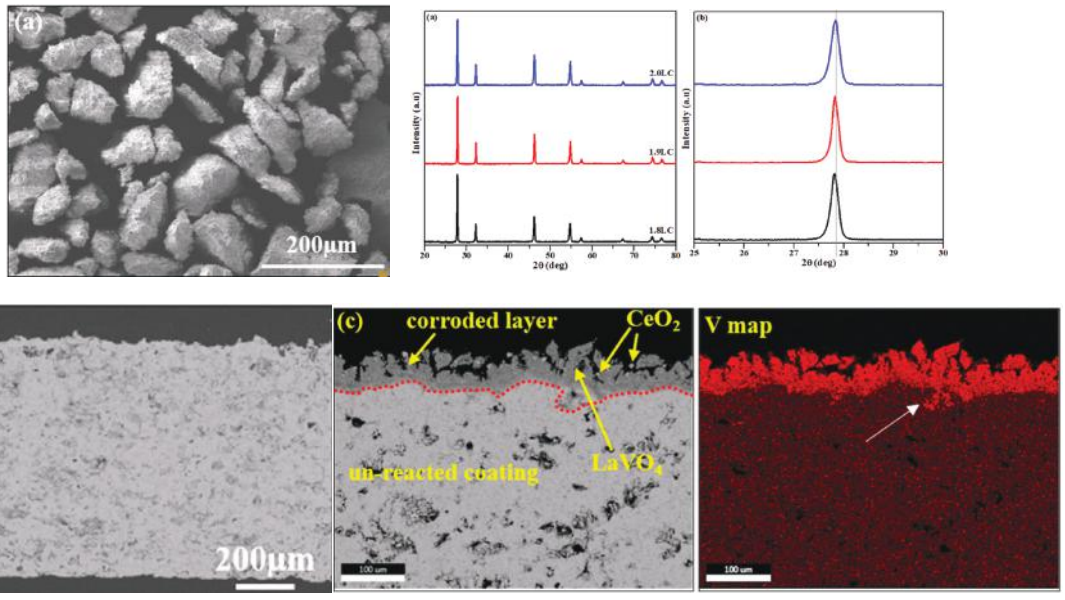
(a) Tool life of different coated tools in dry and wet machining conditions (b) Tool life vs Al content of deposited coatings.

Reference: An assessment of machining performance of CAPVD-Coated carbide tools in face milling of Ti-6Al-4V" Aditya Kumar, Nitin Tandekar, A. Venu Gopal, Krishna Valleti, Ceramics International 50 ,16639,2024

Indigenous development of advanced Thermal Barrier Coatings (TBCs) with enhanced performance

Contributors: *Praveen Kandasamy, Bhavani Kandala, and Govindarajan Sivakumar*

Elevated temperature corrosion by salts, formed from low quality fuels, is one of the serious threats to the integrity of coatings in turbines and yet another important factor in determining the durability of the coatings. Yttria stabilized zirconia containing 7-8 wt % yttria is limited to operating below 1200^{0}C. indigenously synthesized cubic $La_2Ce_2O_7$ (LC) was found to exhibit enhanced thermochemical corrosion with improved performance. High-temperature phase stability test indicated that the coatings are stable up to 1400^{0}C for 100 h without any degradation or new phase formation. Improved corrosion performance, as found to be dependent upon the stoichiometric conditions, is highly influenced by the processing conditions as well.



Indigenously developed $La_2Ce_2O_7$ powder, the respective plasma sprayed coating microstructure and phase constituent and hot corrosion performance

Reference: Praveen Kandasamy, Bhavani Kandala, Min Wook Lee, Govindarajan Sivakumar, Phase stability and initial phase high-temperature corrosion behavior of non-stoichiometric lanthanum cerium oxide thermal barrier coatings, Ceramics International, 50 (9), Part A, 14458-14468,2024 (Impact factor: 5.2)

Ni-W multi-layered architecture coatings to reduce residual stresses and friction for effective reduction in wear

Contributor: *NP Wasekar*

Heavy energy loss and failure of moving machine parts, especially gears in automobiles, are attributed to friction and wear. During sliding wear process, the formation and removal of oxide layer due to frictional heating decides the wear rate of coated surface. The effective dissipation of frictional heat during sliding wear can result in compact and adherent oxide film that can reduce friction coefficient and hence the wear rate. For this purpose, Ni-W multilayers (Fig. 1(a)) with alternate layers of high (high W) and low thermal diffusivity (low W) was envisaged using a new ecofriendly pulsed electrodeposition process.

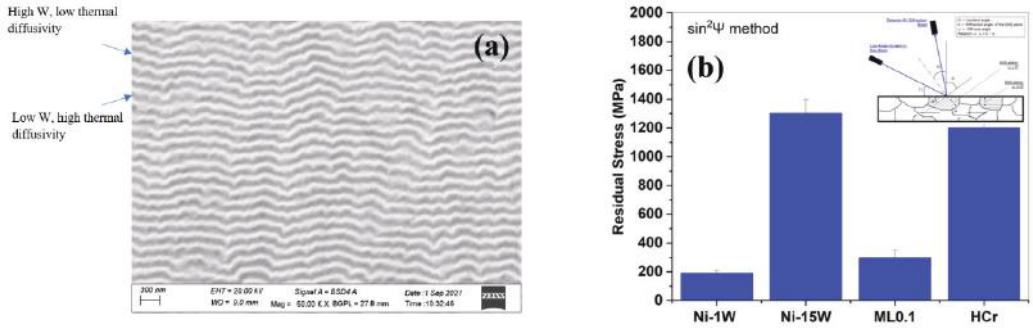


Fig. 1. (a) Ni-W alloy with multilayered architecture coating depicting 100 nm each layer of high W (bright layer) and low W (gray layer). (b) Surface residual stresses present in Ni 1at%W (low W), Ni 15at%W (high W), Ni-W multilayer with 100 nm layer thickness (MLO.1) and HCr (hard chrome coatings)

The multilayer architecture developed in this work resulted in 80-90 % reduction in tensile residual stresses (Fig. 1 (b)) compared to monolithic Ni-W coatings having high W content as well as hard chrome (HCr) with similar hardness i.e. 8 GPa. Upon pin on disc wear tests (Fig. 2(a)), the wear rate of multilayered coatings (with 100 nm layer thickness) was almost ½ of monolithic Ni-W and 1/3rd of conventional hard chrome (HCr) coatings. The reduction in wear rate was attributed to reduction in friction coefficient (Fig.2 (b)) due to formation of thin and adherent

WO_3 oxide film. This was achieved by multilayered architecture wherein heat generated in wear facing high W layer (with low thermal diffusivity 1.38×10^{-2} cm^2/sec) is effectively dissipated through presence of low W layer (with high thermal diffusivity 7.28×10^{-2} cm^2/sec) as depicted in Fig. 2(c).

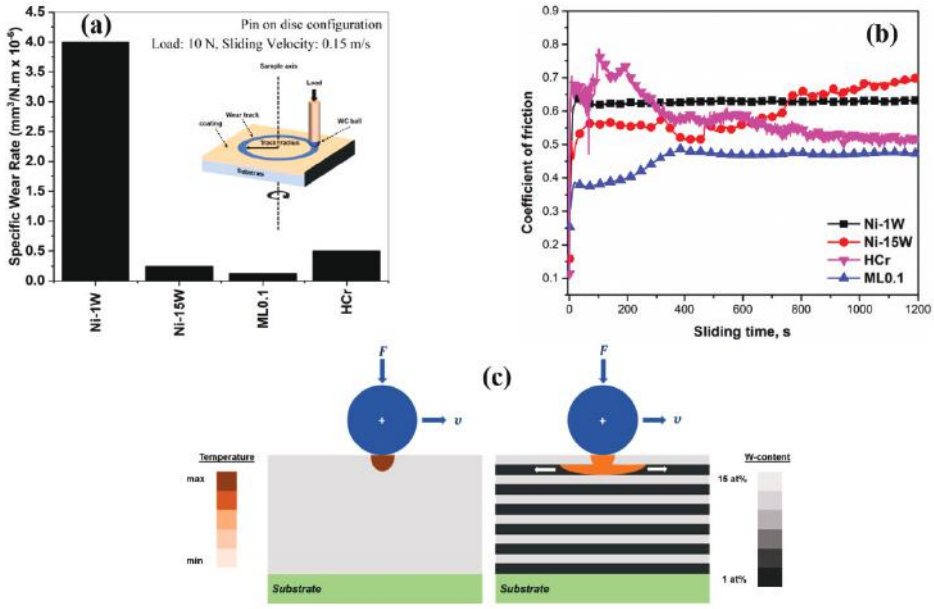


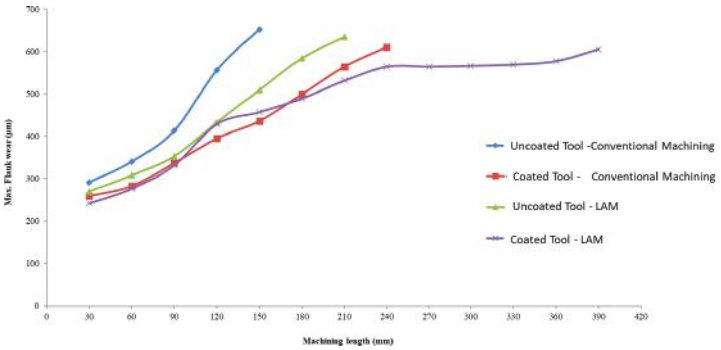
Fig. 2. Specific wear rates (a) and friction coefficient (b) for Ni 1at%W (low W), Ni 15at%W (high W), Ni-W multilayer with 100 nm layer thickness (ML0.1) and HCr (hard chrome coatings). (c) Mechanism of frictional heat generation in Ni-high W and its dissipation through Ni low W layer (Schematic)

Reference: L Bathini, M Prasad, NP Wasekar, Compositionally modulated Ni-W multilayer coatings: A facile approach to enhance the tribological performance, Tribology International, 179 ,108145,2024

Laser assisted machining (turning and milling) for hard to machine alloys used in boiler applications

Contributors: *B. Amarendhar Rao, Manish Tak, and Ravi Bathe*

Ni based superalloys are extensively used in aerospace and advance ultra-super critical power plant applications due to enhanced performance. However, machining of Ni based superalloys is challenging due to work hardening during machining. The laser assisted machining technology can be very useful in improving the machining performance of such hard to machine alloys. In Laser Assisted Machining (LAM), material is locally heated to create thermal softening before machining to minimize tool wear and thereby increasing the productivity.



Tool-life curves for uncoated & CrAlSiN Coated tools in conventional and laser assisted machining (LAM)

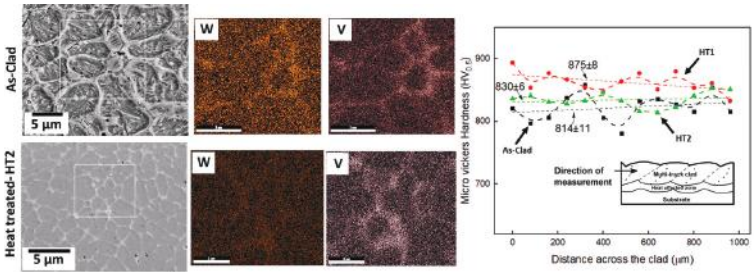
A laser assisted machining facility was setup at ARCI where a 4-axes CNC turn-mill system was integrated with a high-power diode laser. The setup is equipped with piezo-electric dynamometer and high-speed pyrometer to observe cutting forces and surface temperature during laser assisted machining process. Laser assisted turning and milling processes were developed on IN625 alloys and performance was compared with conventional turning and milling. CrAlSiN nano composite coated tools were also used for further enhancing the tool life. The tool life assessment was carried out and it was observed that LAM increased the tool life of an uncoated tool by 40% and CrAlSiN nano composite coated tool by 62.5% in comparison with the conventional machining with respective tools.

Reference: B. Amarendhar Rao, Manish Tak, R. N. Rao and Ravi Bathe; Developing Laser-Assisted Machining Process for Nickel Based Superalloy IN625 Using Experimental and Statistical Analysis Lasers in Manufacturing and Materials Processing, 10, 681–701, 2023

Laser Direct Metal Deposition of High-Speed Steel- M2 Tool Steel

Contributors: *Dr Gururaj Telasang, and Dr. Ravi Bathe*

Using the laser direct metal deposition (L-DMD)/ laser cladding facility at ARCI, HSS M2 tool steel is deposited on a mild steel plate, a process that involves the spontaneous melting of the steel powder fed co-axially/off-axis at the focused high-power laser beam on the surface of the base metal and subsequent rapid solidification (of cooling rate of 103-5 K/s) of the deposited clad layer due to self-quenching.



FE-SEM micrograph and hardness plots showing detailed microstructural features, elemental segregation, and micro-hardness distribution across multi-track clads.

Such rapidly solidified as-deposited HSS clad/deposit with dendritic and saturated metastable microstructure was heat treated to obtain the microstructure having tempered martensite and eutectic carbides at the interdendritic region with a large degree of refinement, with significant reduction of elemental segregation thereby increasing (Fig. 1) mechanical and wear properties required for critical applications. Due to high hardness and wear resistance, the L-DMD of HSS M2 alloy is widely used in building and refurbishing worn-out cutting tools and hot rollers.

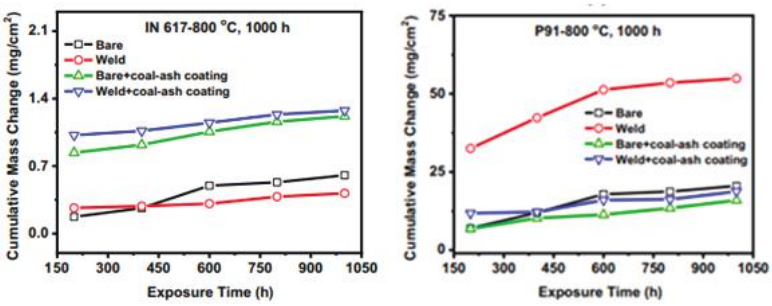
References:

1. **Gururaj Telasang and Ravi Bathe, Laser Direct Metal Deposition of HSS M2 tool steel, conference on Advances in Laser & Arc Cladding Technologies – ALACT-2023, the Indian Institute of Welding (IIW) – Jamshedpur, on 3-4 Nov 2023.**
2. **Gururaj Telasang and Ravi Bathe, Technical Article: Exploration of Metal Additive Manufacturing for Components Realization, IIM METAL NEWS, Vol. 26, No. 5, Page 10-19, URL: https://iim-india.net/storage/iim-metal-news/mn_may-23.pdf , May 2023**

Hot corrosion studies under simulated thermal power plant environment of laser-MIG hybrid weldments of IN617 and P91 alloys

Contributors: *S M Shariff, Md. Aqeel, Sharma Paswan, and Raghuvir Singh*

Degradation of thermal power plant components such as boilers, turbines, heat exchangers etc. due to high-temperature corrosion principally demands for assessment of hot corrosion life cycles. Furthermore, boiler components such as super-heater and re-heater tubes require suitable weld joints with high resistance to high temperature oxidation and corrosion. These weld joints, either similar or dissimilar relay on proper filler materials used for welding as well as welding method itself to, sustain in varying high temperature and pressure conditions.



Hot corrosion kinetic plots for laser-hybrid welds as well as bare metals exposed to flue gas environment

Hybrid laser-arc welding employing Laser and MIG for thicker boiler steels or superalloy materials has gained widespread importance owing its high gap bridgability and improved weld microstructure. Study assessing influence of synthetic coal ash in flue gas environment at high temperature of 600 – 800°C of bare and laser-hybrid welded weldments of P91 Steel and IN617 superalloy revealed that mass loss was lower in base as well as welded IN617 than P91 (Figure 1 illustrate hot corrosion kinetic plots for bare and welded specimens exposed at 800°C for 1000 hours in flue gas environment). Indeed, post-characterization of oxide scales indicated formation of non-protective Fe_2O_3 that allowed oxygen to pass through and thereby yielding much thicker oxide scales with higher mass gains for P91 as compared to protective NiO/Cr_2O_3 oxide scales in IN617 yielding low scale thicknesses with mass gains.

Reference: S Paswan, L K Meena, K Guguloth, S M Shariff, Raghuvir Singh, Oxidation and Hot Corrosion Studies of Laser Hybrid Welded IN617 and P91 Alloys, Transactions of IIM, 77(5), 1275-1286,2024

Technology Transfer and Commercialization Strategy for the Advanced Materials R & D

Contributor: *Sanjay Bhardwaj*

Success chances of the technology transfer and commercialization in the advanced materials domain can be enhanced by adopting practices such as making R & D upscaling roadmaps, embracing flexible collaborative strategy, and by forging early stage partnerships with appropriately identified organizations.

R&D upscaling roadmaps: Upscaling roadmaps should be prepared keeping in view the manner in which an R & D project passes through different Technology Readiness Levels (TRLs) for target application(s). Questionnaire, customized for each of the TRLs, should be used to identify gaps. Such gaps are to be addressed either by developing internal organisational strengths or by accessing required resources and capabilities from other stakeholders in the ecosystem. Subsidies, incentives and other supports provided by the government should be indicated at different TRLs.

Flexible collaborative strategy: Innovation strategy, aiming at optimum utilisation of capability available with an R & D laboratory, should possess flexibility w.r.t. (a) possibilities to foster collaborations in all stages of R&D upscaling, (b) capturing diverse motivations of industry, academia and R&D, and (c) convergence of divergent technologies for making useful products/devices.

Early stage partnerships: Collaborative efforts of an R & D laboratory and the industrial organisation(s) are required from the point of initiating partnership to technology transfer. The efforts of the R & D laboratory shall be more effective if the commercialising organization gets associated with the technology development in the early stages.

Reference: Sanjay Bhardwaj, and Karuna Jain, Commercialising the Advanced Materials R&D in the Indian Ecosystem, Asia-Pacific Journal of Management Research and Innovation, https://doi.org/10.1177/2319510X241238872, 2024

Facilities Created during 2023-24

Low Expansion Glass Ceramic Production Facility

Low expansion glass-ceramic (LEGC) production facility was installed to produce lithium aluminosilicate based glass-ceramic blocks of dimension 350mm x 350mm x 150mm. This facility includes melter unit, rapid cooling chamber, preheating, annealing & ceramization furnaces, batch mixer, etc.

Technical Details:
Capacity to produce blocks of maximum size: 380mm x 380mm x 150mm
Melt casting technique is used to produce glass ceramics
Used to produce Ring Laser Gyros and Space Mirrors

Make: M/s Glamaco GmbH, Germany

Dilatometer Facility

Dilatometer facility was installed for measuring thermal expansion of ceramic, metallic, glass-ceramic samples in the wide temperature range from -80^{o}C to 1450^{o}C.
Technical Details:
Heating Rate: 5-10^{o}C/min
Atmosphere: Inert/Air
Samples holder: Alumina/Fused Silica
Sample type: ceramic/metallic/glass-ceramic

Make: Netzsch GmbH, Germany
Model: DIL402 Expedis Select)

Shadowgraphy Facility

Stereo Zoom Microscope was installed for measuring the defects/inclusions and their dimensions present in the low expansion glass-ceramic blocks being developed at ARCI.

Technical Details:
Working distance: 100mm
Magnification Range: 7X to 45X
Field of View: 4.4 to 28.6 mm

Make: Nilpa Consultancy, India
Model: SZM6445

Mortar-Grinder

Mortar Grinder was installed to prepare the pastes of SOFC cathode and cathode functional layer using agate mortar. The instrument has a capability to mix different powders and also making into pastes suitable for screen printing.

Technical Details:
Capacity: 10 to 200 ml
Final fineness: < 5 micron
Speed Setting: 50-130 rpm

Make: Lab India

Heating stage microscopy

Heating stage microscope (HSM) facility not only provides qualitative observations but also quantitative studies of sintering kinetics. Characteristic shapes and corresponding temperatures pertaining to softening, sphere, half-sphere and melting points can be extracted from the HSM experiments with the help of in-line image recorded during experiment. Such data are indeed very much useful for the applicability of glass / glass-ceramic based sealant for SOFC application.

Spot Welding Machine for Battery Assembly

The welding machine is used to join the tabs (leads) to the active Li-ion cells and connect the cells in series/parallel configuration for making the battery packs. The machine shall be suited for using cylindrical Lithium-ion cells of size 18650/26650/21700/32700.

Make: Amada Weld Tech, Japan
Power Supply: Miyachi MD-A8000B
Weld Checker: Miyachi MM400 A

Spot Welding Machine for Lithium-ion Cell Assembly (Twin Head)

This machine has two heads (parts). Through the first head (left), the tabs (leads) are welded to the substrate (electrode foils) for making cylindrical Lithium-ion cells of sizes 18650 /26650 / 21700 /32700. This head is also used to attach the negative tab to the cell container.

Using the second head (right), the positive tab is connected to the header assembly of the cell

Make: Amada Weld Tech, Japan
Power Supply: Miyachi MD-A8000B
Weld Checker: Miyachi MM400 A

Turbo Mixer/Tumble Mixer

Mixing and homogenizing the active materials together with the conductive additives are important steps in the process of "Mixing" for making the electrodes for Lithium-ion cells. Since the surface area and the particle sizes of the powders are significantly different, this process is better achieved by the turbo mixer or tumble mill. Due to the tumbling action, the materials are mixed and homogenized well in the dry condition.

Make: Insmart, India

Particle Analyzer

Zeta potential measurements are required to measure the slurry stability in the electrode fabrication process.

This equipment measures zeta potential, molecular mass, and refractive index.

Make : Anton Parr
Model : Litesizer DLS500

Environmental Chamber

To study the performance of Lithium-ion cells, fabricated in-house, at various temperatures and humidities for optimizing the cell designs. This equipment is provided with the EUCAR -6 Safety Level complying to the international standards.

Technical Details:
Temperature Range : -30 ^{0}C to + 100 ^{0}C
Humdity Range : RH 20 % to 90%

Make : Envisys, Bangalore, India
Model : ETB 150

2 Port Glove Box

Glove Box is required for the fabrication of lithium-Ion/ sodium-ion coin and Swagelok cells under inert atmosphere conditions. It is also used to store the electrolyte and lithium/sodium metal under inert conditions

Make : RANVAC Technologies
Model : LABPRO 1250

Industrial Robot of 45 kg capacity for the Cold spray equipment

This equipment was installed and commissioned to augment the cold spray facility. Major function is manipulation of the gun in X-Y-Z coordinates and interfacing/integrating with the job manipulator(s) already existing at the facility. It has a payload of 45 kg.

Make: ABB Robots and
Model:IRB4600

Electrochemical workstation multichannel potentiostat/galvanostat

This equipment can perform electroplating, corrosion, impedance, voltammetry etc for coatings as well as bulk materials. Installation of workstation is completed.

Make: Autolab M204 multichannel potentiostat/galvanostat

Model: AUTM204. S.

Laser 3D-scanner with robotic arm

A laser 3D-scanner with a portable robotic arm facility was procured and commissioned. The facility is equipped with a blue laser scanning head (AS1 scanning head) mounted on a portable 7-axes robotic arm. The equipment is capable of scanning any 3D component/object and comparing it with the parent 3D CAD model to evaluate the dimensional and geometrical accuracies of the component. The equipment is supported by software that can analyze various geometrical features and generate a report. The scanner can also convert the scanned file into a .stl file that is suitable for additive manufacturing.
Make: Hexagon AB

High Performance Compact Pyrometers

Two high-performance compact pyrometers with laser spot marking and without interference of laser wavelength range (800 – 1200 nm) assembled with water-cooling jackets and compressor air purging bodies along with digital/analog outputs with software data analysis software installed and integrated to the Robot-integrated high power diode laser system with following technical specifications:

CTLM-3HCF4-C8 (MICRO-EPSILON Make): Temperature Range: 100^{o}C – 600^{o}C; Optical resolution: 100:1; Spectral Range: 2300 nm; Response time: 1 ms; Temperature resolution: 0.10C with +/-0.3% system accuracy and +/-0.1% repeatability; Multi-mode channel signal processing, LCD display with controller and data acquisition and analysis with installed software connected to computer

CTRM-2H1SF100-C8 (MICRO-EPSILON Make): Temperature Range: 500^{o}C – 3000^{o}C; Optical resolution: 100:1; Spectral Range: 1450 – 1750 nm; Response time: 1 ms; Temperature resolution: 0.1K with +/-0.5% system accuracy and +/-0.3% repeatability; 0.800 – 1.200 adjustable slope, Multi-mode channel signal processing, LCD display with controller and data acquisition and analysis with installed software connected to computer

Two Roller Type Pot Jar Mill

Two roller type pot jar mills are conventionally used to reduce the particle size of metal, ceramic and composite powders from micrometre size to sub micrometre size. It has three variable parameters for operation such as clock wise rotation/anticlockwise rotation, RPM and run time setting. Manual adjustable roller gaps are provided to handle smaller and bigger jars with 3 kg to a maximum of 20 kg charge. VFD controller to vary speed upto 250 RPM. It has 2 lt, 5 lt and 10 lt capacity stainless steel pots and 10 kg 10 mm dia. stainless steel grinding media.

Events, Data and 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, 2023. Dr. Kaliyan Hembram, President ARCI SC/ST Employees Welfare Association welcomed the gathering. Director, Associate Directors along with ARCI SC/ST Employees Welfare Association members 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 their speeches on the occasion.

National Technology Day

National Technology Day was celebrated at ARCI on May 11, 2023. The programme began with opening remarks by Dr. R. Easwaramoorthi, Scientist "F" followed by Welcome Address by Dr. P.K. Jain, Associate Director and Chairman, AKAM Committee. Dr. Roy Johnson, Associate Director briefed about the achievements of Indian Scientists and the importance of National Technology Day celebrations every year in the country. Dr. O. P. Bahl, FNASc., President, Indian Carbon Society Former Director Grade Scientist, National Physical Laboratory, New Delhi delivered a lecture on “Development of Carbon Technologies for Indian Strategic Sectors”. The programme was well attended by Scientists, staff, research students etc.

Dr. G. Padmanabham Memorial Lecture

The Dr. G. Padmanabham Memorial Lecture, organized by the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), was started in 2022 to honor the memory of late Dr. G. Padmanabham, a distinguished scientist and technologist. Renowned for his efforts in fostering collaboration between researchers from India and abroad across academia, research institutions, and industry, Dr. Padmanabham played a pivotal role in addressing numerous technology-driven challenges globally.

The second lecture in this series was delivered on June 5, 2023, by Dr. G. Madhusudhan Reddy, former Director of the Defence Metallurgical Research Laboratory (DMRL), DRDO. His presentation, titled Innovative Approaches in Joining of Advanced Materials, offered valuable insights into novel techniques in material joining processes. Aimed at inspiring young researchers, the lecture emphasized the importance of innovation in research and development, particularly in the context of strategic applications.

Dr. Reddy's lecture was both engaging and thought-provoking, capturing the attention of scientists and students alike. His focus on the relevance and practical applicability of innovative approaches in advanced materials development made a lasting impact on the audience.

Release of SRUJAN Magazine

In promotion and dissemination of Official Language implementation, one of the efforts of ARCI is to publish the annual Hindi in-house magazine ‘Srujan’. Through this magazine, it is our endeavor to enreach the general public on the research being carried out by our organization for the development of the nation. Hence, 6th edition of annual Hindi magazine “SRUJAN” was released by Smt. A. Dhanalakshmi, Joint Secretary, Department of Science & Technology on 19th June, 2023 during Technical Hindi Workshop.

Smt. A. Dhanalakshmi, Joint Secretary, Department of Science & Technology & members of OLIC publishing the 6th issue of the annual Hindi in-house magazine 'Srujan'

International Day of Yoga

ARCI celebrated International Day of Yoga (IDY) on 21st June, 2023 at Hyderabad & Chennai Centres. This year's IDY theme was "Yoga for Vasudhaiva Kutumbakam"with a Domestic Tagline of "Har Aangan Yog". Accordingly, ARCI Hyderabad organized Yoga Training session from 07.00 am to 09.00 am at ARCI Premises under the guidance of Mr. R. Ajay Kumar, Senior Yoga Instructor, Gandhi Gyan Mandir Yoga Center, Hyderabad. The function started with the welcome address and brief introduction of the speaker by Mrs. S. Nirmala, Scientist-E and Member, Welfare Committee. Thereafter, Director Dr. Tata Narasinga Rao and Associate Directors addressed the gathering.

The training session mainly focused on basic asanas and breathing exercises that can be easily practised by the participants. Staff, researchers and students participated enthusiastically in this session. After the session, the participants were served nutritious breakfast consisting of millets, sprouts and vegetable salads.

The Yoga Day celebrations were also held at ARCI Chennai centres on June 21. 2023 to commemorate International Yoga Day. Ms. Anupama, Yoga Instructor, and lifestyle coach spoke about the importance of Yoga for a sound mind and sound body in line with the theme of the year "Yoga for Vasudaiva Kudumbakam" or "Yoga for the Welfare of All as One World-One Family".

On the occasion of International Yoga Day, all the participants performing yoga asanas at Hyderabad and Chennai Centers

Independence Day

Dr. Tata Narasinga Rao, Director, ARCI hoisted the National Flag followed by march past by the security personnel. Director and Associate Directors addressed the gathering at the 76th Independence Day celebrations held on 15th August, 2023. All the staff members and research students actively participated in the celebrations.

Dr. Tata Narasinga Rao, Director, ARCI hoisting the National Flag

Staff celebrating Independence Day at Chennai centres

Official Language (Hindi) Implementation

The Official Language Implementation Committee (OLIC) under the Chairmanship of Dr. Tata Narasinga Rao, Director has been successful in the implementation and progressive use of Hindi at ARCI. Quarterly OLIC meetings were conducted to review the progressive use of Hindi at ARCI. 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 in terms of proper and progressive implementation of official language.

Along with regular rajbhasha lectures in quarterly workshops, scientific & technical lectures in Hindi are also delivered by ARCI Scientists/research students. During the Technical workshops, Dr. Sanjay Bhardwaj, Scientist – G, Centre for Technology Acquisition and Transfer, Dr. N Ravi, Centre for Materials Characterization and Testing & Shri M.R. Renju, Information Technology Service Centre delivered remarkable and informative lectures on 'Technology Commercialization', 'Mechanical Characterization of Materials', & 'Cyber Security Awareness' respectively. The motive of OLIC in introducing these scientific lectures in Hindi workshops is to motivate the scientists to present their original R&D works in Hindi.

ARCI Scientists and officials delivering Technical lectures during Technical Hindi Workshops

Smt. A. Dhanalakshmi, Joint Secretary, Department of Science & Technology delivered who was Chief Guest for the Technical Hindi Workshop delivered on 19th June, 2023 briefed about the rules and regulations related to Official Language implementation and emphasized on the use of various translation tools.

Smt. A. Dhanalakshmi, Joint Secretary, Department of Science & Technology delivering the lecture

ARCI has also been imparting regular training in Hindi to its employees under the Hindi Teaching Scheme. Employees who have successfully completed Prabodh, Praveen, Pragya and Parangath were given cash awards and incentives as per norms. Shri Rajesh Kumar Verma, Assistant Director, Hindi Teaching Scheme, Secunderabad, Department of Official Language, Ministry of Home Affairs, Government of India delivered a lecture on 'Typing Training on Computer'.

Shri Rajesh Kumar Verma, Assistant Director, Hindi Teaching Scheme delivering lecture on 'Typing Training on Computer'

To encourage the employees to carry out their day-to-day official works in Hindi, a cash incentive scheme is in place and nine employees received cash awards, during the year for carrying out official works in Hindi. Cash award scheme is in place for the articles submitted by the employees, research students, etc., in regional language/mother tongue and Hindi which are published in annual hindi magazine "SRUJAN". As a part of Human Resource Development in Hindi, a "Post Graduate Training Scheme" was introduced during the year. Under this scheme, a student is trained with an attractive monthly stipend for a period of one year in implementation of official language.

Hindi Saptha Celebrations

ARCI celebrated "Hindi Saptha" during September 20-29, 2023 (5 days). Competitions in Essay, Writing, Poetry, Elocution, Typing, Translation, Technical/General Article Presentation and Quiz etc., were conducted in which employees and students participated enthusiastically. Dr. Sanjay R. Dhage, Vice-Chairman, Official Language Implementation Committee gave the welcome speech and introduced the chief guest. Shri A. Srinivas, Member Secretary, OLIC administered 'Official Language Pledge' and also presented the report on the achievements of official language implementation related works being done in ARCI. Dr. Tata Narasinga Rao, Director and Dr. P. K. Jain, Associate Director addressed the gathering. Dr. Ashok N. Selvatkar, Assistant Director, Commission for Scientific and Technical Terminology, Ministry of Education (Department of Higher Education), New Delhi was the Chief Guest for the programme.

Director, ARCI welcoming the Chief Guest on behalf of ARCI

He encourage and boosted the morale of the participants with his inspiring thoughts and praised the Hindi work being done by ARCI. Apart from this, he gave detailed information about various translation related terminologies and their uses. Employees and Research students actively participated in the Hindi Saptha celebrations which concluded on September 29, 2023. All the winners were given prizes.

Glimpses of various programs organized during Hindi week celebrations

Upgradation of Medical Room, Annual Medical Check-up and Health Talks

The existing medical facility room in ARCI campus was revamped and upgraded to meet the present day needs and requirements. New facilities like Electrocardiogram (ECG), a stretcher, a wheel chair etc. were added to the existing ones.

During the year, Annual Medical Check-up (AMC) programme for ARCI employees was conducted during 17th & 18th October, 2023. The employees were classified under two age groups i.e. below 45 years and above 45 years and the prescribed medical tests were also conducted for them. Apart from the prescribed medical tests, special tests like 2D Echo, “Prostate Specific Antigen test” for male employees, and Folic Stimulating Hormone (FSH)”, Serum Ferritine and “Total Iron Binding Capacity (TIBC) tests for female employees aged 45 years and above were also conducted. Annual medical check-up was also conducted for the employees in Chennai and Gurugram.

As a part of continuous effort in keeping the staff members, research students abreast on latest health related issues, the Welfare Committee has arranged a series of health talks viz., on 19th July, 2023 a talk on “Gynecological Issues" was delivered by Dr. Sirisha Mahi, Consultant Gynecologist, Diya Hospitals, Hyderabad. On 12th December, 2023 Dr. CV Murali Krishna, Senior Consultant Neurologist, Care Hospitals, Hyderabad delivered a talk on "CVA Brain Stroke". These interactive talks were well attended by all at ARCI, Hyderabad and through live telecast by Chennai & Gurugram staff.

Annual Medical Check-up Camp for Officers/Staff

Vigilance Awareness Week

ARCI observed "Vigilance Awareness Week" from 30th October to 05th November, 2023. The theme of this week was "Say No to Corruption; Commit to the Nation". Messages from Hon’ble President, Hon’ble Vice President and Central Vigilance Commission (CVC) were shared with the staff, project staff and researchers. On 30th October, 2023, the Director and Vigilance Officer administered the oath of integrity in the central lawn of the campus. Employees were encouraged to take the Integrity Pledge online/e-Pledge by visiting CVC website. An awareness was spread among the staff members about "Complaints under PIDPI (Public Interest Disclosure and Protection of Informers) Resolution 2004". As part of Vigilance Awareness Week, on 1st November, 2023, Shri CH Narendra Dev, Additional Superintendent of Police, CBI, ACB delivered an inspirational and informative lecture on this year's Vigilance theme. During the week, posters on vigilance awareness were displayed at the entrance of the inner gate.

Participants celebrating Vigilance Awareness Week at ARCI and Chennai Centre

Clean India Special Campaign 3.0

Swachh Bharat “Special Campaign 3.0” was observed by ARCI, Hyderabad and Chennai Centres and Gurugram Office from 2nd October 2023 to 31st October 2023. The Special Campaign began with "Swachhata Pledge" administered by Director, Associate Directors and Heads of Centres of Excellence/Centres. As a part of campaign, ARCI mainly focused in nearby Government School and organised "Awareness programme on cleanliness for School Children", "Drawing Competitions" "Installation of GreenDispo for disposal of used sanitary pads in schools, distribution of dustbins etc., Mass Cleaning was carried out in ARCI campus, old files were weeded out, obsolete scraps/redundant items were disposed off and the campus was made a Plastic Free Zone. Shri D. Ramesh Security, Fire & Safety Officer who was nominated as Nodal Officer has taken up all the above activities with the support of the staff members.

Officers/employees taking cleanliness pledge at Hyderabad office

Officials/employees taking cleanliness pledge at Chennai centres

Rashtriya Ekta Diwas (National Unity Day)-2023

As a part of "Meri Maati Mera Desh" campaign, which aimed to honour the brave freedom fighters who sacrificed their lives for our independence, and to spread the message of national unity and the spirit of Rashtriya Ekta, the National Unity Week was observed at ARCI from 25th 31st October, 2023. To reinforce our dedication to preserve and strengthen the security, unity and integrity of our country and commemorating the birth anniversary of Shri Sardar Vallabhbhai Patel, the architect of national integration of independent India, Rashtriya Ekta Diwas (National Unity Day) was celebrated at ARCI on 31st October, 2023. Director, Associate Directors, Heads of Centres of Excellence/Centres/Sections administered the Rashtriya Ekta Diwas pledge for the staff members, research students etc.

Internal Committee (IC)

The Internal Committee (IC), ARCI organized various events during the period from 04th to 09th December, 2023 to create awareness about the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act and Rules, 2013 ("the Law") and women safety etc. 'Essay Writing Competition' on the topic 'Your views on safety of women at workplace' was organized trilingually i.e. English, Hindi or Telugu in which men and women participated actively. The winners were also rewarded for expressing their views. During the events, on 6th December, 2023, Mrs. Priya Anish Mathews, Scientist E & Member Secretary IC, ARCI delivered an informative lecture on the topic "Prevention, Prohibition and Redressal: Sexual Harassment of Women at Workplace" for the research students, trainees and project staff. The lecture was in hybrid mode which was well attended by research students, trainees and project staff from ARCI Hyderabad, Chennai Centres and Gurugram office.

On 8th December, 2023, Shri. G. Venkatesham, Assistant Commissioner of Police, Cyber Crime, Rachakonda, Hyderabad delivered an impressive lecture on the topic 'Cyber Crimes and Women's Safety'. Police personnel form the Women's Safety Team interacted with the participants and provided helpful tips on how to safeguard themselves against various forms of cybercrime, staying secure, as well as emergency contact numbers were shared.

Apart from the above, IC members have organised a counselling session exclusively for women staff and research students regarding POSH Act. A platform was provided to them to share any concerns related to harassment or any other issues they might have faced/facing and no such concern was brought to the notice of the IC members by the participants.

Mr. G. Venkatesham, Assistant Commissioner of Police, Cyber Crime, Rachakonda, Hyderabad along with all the participants

27th Annual Day Celebrations

ARCI celebrated its 27th Annual Day on December 29, 2023. The programme commenced with a tug of war organised for the employees and their family members, students and other staff. The programme formally began with Dr. Amit Das, Scientist 'B' welcoming all the dignitaries and eminent personalities on to the Dias. Annual Day Celebrations began with auspicious lighting of lamp by the dignitaries followed by an Invocation song. Dr. Nitin P. Wasekar, Scientist 'F' and Chairman, Annual Day Committee, while giving his welcome address, gave detailed information about the various programmes organized during the Annual Day Celebrations. Thereafter, the Director and all the Associate Directors addressed the gathering and briefed about the achievements of ARCI during the past year and also shared their views about the future vision of ARCI. Employees who completed 25 years of service in ARCI were honoured with mementos. ARCI ECTCS awarded cash prizes to the all the meritorious children of employees who have excelled in class 10th and 12th board examinations held during the year 2022-2023. After the inaugural ceremony, various cultural programmes were organized in which ARCI employees, their children and students participated enthusiastically. The cultural programmes concluded with distribution of prizes to the participants. ARCI Chennai Centres and Gurugram Office celebrated annual day on February 08, 2024.

Annual day celebrations at ARCI

Republic Day

ARCI celebrated 75th Republic day on 26th January, 2024 and Dr. Tata Narasinga Rao, Director, ARCI hoisted the National Flag. Director and Associate Directors addressed the gathering. Staff members and research students etc., enthusiastically participated in the celebrations.

Dr. Tata Narasinga Rao, Director, ARCI hoisting the National Flag

Dr. Tata Narasinga Rao, Director, ARCI along with all the staff

National Science Day

On 27th February, 2024 National Science Day (NSD) was celebrated at ARCI which was in line with this years' NSD theme: "Indigenous Technologies for Viksit Bharat". Dr. P.K. Jain, Chairman and Associate Director of National Science Day Committee welcomed everyone and gave information about the programs organized at ARCI and in his address he highlighted the relationship between life and science. Dr. M. Buchi Suresh, Convener-National Science Day Committee presented brief introduction of the guests. ARCI Director Dr. Tata Narasinga Rao highlighted the major achievements of ARCI and how the institution is contributing towards Aatmanirbhar Bharat, especially ARCI's role in indigenization of Technologies for Viksit Bharat. Associate Directors of ARCI, Dr. Roy Johnson and Shri D. Srinivasa Rao addressed the gathering and emphasized on importance of ARCI contributions in the field of Science & Technology.

As part of the celebrations ARCI organised talks by two eminent professionals. In the forenoon, Dr. Sai Gautam Gopalakrishnan, Assistant Professor, Indian Institute of Science (IISc.) Bangalore delivered an informative lecture on the topic "Materials Design using Computational Techniques for Energy Applications". In the afternoon, Dr. Komal Kapoor, Chairman& Chief Executive, Nuclear Fuel Complex, Hyderabad delivered an interesting lecture on "Advances in NDE of Nuclear Fuel and Structural Components at NFC". The programme concluded with the vote of thanks by Dr. Papiya Biswas, Scientist-E.

ARCI celebrating National Science Day

International Women's Day Celebrations -2024

Internal Committee (IC) at ARCI, Hyderabad celebrated International Women's Day Celebrations on 8th March, 2024. The celebrations were organised in line with United Nations Theme "Invest in Women: Accelerate Progress". The celebrations began with a fascinating programme "Ideathon (Inspiring to Innovate): Competition on "Start-up" Ideas by Her or For Her or With her" followed by motivational talk by Dr. Zahoorullah, Chief Innovation Officer, ALEAP, We-Hub & Atal Incubation Centre, Hyderabad on various government schemes for "Start-ups" and encouraging entrepreneurship.

The programme began with welcome address by Mrs. Priya Anish Mathews, Scientist E & Member Secretary IC. Dr. Neha Y. Hebalkar, Scientist "F" and Presiding Officer addressed the gathering and briefed about the various activities taken by IC at ARCI. Dr. Tata Narasinga Rao, Director and Shri D. Srinivasa Rao, Associate Director have emphasised the importance of women and their contribution in overall development of a family, organisation and nation as a whole. Dr. Prabhjot Kaur, Co-founder, Esmito Solutions Pvt. Ltd., was the Chief Guest for the celebrations of IWD-2024. She delivered an inspirational talk on "Challenging fears towards better future – Perspective from Woman's life". The IC honoured ARCI's Women Achievers for the year and prizes were distributed to the winner of Ideathon. Later the programme concluded with an interactive session among the women employees and research students.

Internal Committee at Chennai Centres celebrated International Women's Day Celebrations on 11th March, 2024. The programme started with an activity for women employees on a theme: "Invest in Women: Accelerate progress inclusivity in the society".

Dr. M.B. Sahana, Senior Scientist and Member IC welcomed the gathering. Dr. K. Ramya, Head CFCT and Presiding Officer and Dr. R. Prakash, Head CAEM addressed the gathering. On the occasion Ms. Rajani Seshadri, Co-Founder indePenn, Chennai delivered an interesting talk on "Inspire, Inclusion-Invest in Women: Accelerate Progress". All the project staff research students have attended the celebrations and actively participants in the activities.

Dr. K. Ramya, Head CFCT with Ms. Rajani Seshadri, Co-Founder indePenn, Chennai

Dr. Prabhjot Kaur, Co-Founder Estimoto Solutions Pvt Ltd., the Chief guest delivered insightful and motivational lecture on "Challenginh fears towards better future – perspective from a women's life" the occasion of International Women's Day at ARCI, Hyderabad.

Dr. Zahoorulla S, Chief Innovation Officer ALEAP & Atal Innovation Centre, Hyderabad was invited as the expert to the 'Ideathon –Inspiring to Innovate' a start up idea competition and he also delivered talk on 'Various Schemes available for start-ups and Encouraging Entrepreneurship' on the occasion of IWD 2024 at ARCI-Hyderabad.

Annual Sports Day

During the year, the Annual Sports at ARCI witnessed overwhelming response from enthusiastic contestants with a substantial increase in participation by 26 % in comparison to previous year. Nearly 175 contestants including Employees and Students participated in the event. 13 different sports events (both individual and team) were conducted which lasted for nearly two months. Among those events, Women-cricket was also included which made the overall event interesting. Based on expertise and degree of understanding of the players in team games such as Cricket, Volleyball and Football, Captains and Vice-captains were appointed from employees and students respectively, and the teams were formed using Auction process. All team games were played on round robin format. During the year, as part of Inter-lab games with nearby organizations, few cricket matches were organized with CDAC, Hyderabad during 2023-24.

ARCI celebrating Annual Sports Day

Safety Day

ARCI celebrated National Safety Week during 4-10 March, 2024. As part of 53rd National Safety Day celebrations was held on 6th March, 2024. Smt. S. Nirmala, Scientist 'E' & Coordinator, Safety Committee and Shri D. Ramesh, Security, Fire & Safety Officer administered the Safety and Health Pledge in Hindi and English respectively at the central lawn of the campus. Thereafter, Dr. Roy Johnson, Co-Director and Chairman, Safety Committee welcomed the participants and in his address and highlighted that ARCI has a policy of giving high priority to safety, health and environment. And emphasized on the safety norms, procedures and protocols to be followed by every employee. On this auspicious occasion, Shri D. Ramesh, Security, Fire and Safety Officer presented the report on the activities undertaken by the ARCI Security Committee. Shri V.V. Mahesh Kumar, Deputy Chief Executive (Safety, HPU, TLD & HR), Nuclear Fuel Complex, Hyderabad delivered the Safety Day address on this year's theme 'Focus on Safety Leadership for Environmental, Social and Governance Excellence'. The programme concluded with activities on the theme "Preparedness for Emergency" led by Shri S.K. Sharma, Deputy Chief Fire Officer, Nuclear Fuel Complex, Hyderabad.

All participants celebrating Safety Day at ARCI

First All India Scientific & Technical Rajbhasha Seminar

For the first time, ARCI has initiated a proposal with Department of Science & Technology (DST) for organizing "All India Scientific & Technical Rajbhasha Seminar of DST Autonomous Institutes". It was also proposed to organize this as an annual event every year in each of the DST Autonomous Institutes across the country.

Under the auspices of the Department of Science and Technology, Ministry of Science and Technology, Government of India, ARCI has organized two-days' First "All India Scientific and Technical Rajbhasha Seminar-2024" on the theme of "Role of DST Autonomous Institutes in Self-Reliant India" during March 21-22, 2024 at ARCI, Hyderabad.

ARCI organized two-days First "All India Scientific and Technical Rajbhasha Seminar-2024" during March 21st-22nd, 2024

The seminar was inaugurated by Joint Secretary, Department of Science and Technology, Smt. A. Dhanalakshmi and Director, ARCI, Dr. Tata Narasinga Rao. Heads of various autonomous institutes of DST and participants were present on this occasion. In his inaugural address, Dr. Tata Narasinga Rao has described this initiative of ARCI as unique and hoped that it will be continued in future as well. In his speech, he also underlined the important role of science and technology in achieving the goal of self-reliant India. In her speech, Smt. A. Dhanalakshmi emphasized the need for such events and called this initiative of making scientific and technological achievements available in official language an important step towards realizing the dream of self-reliant India. This seminar was attended by about 90 participants from 24 autonomous institutes of DST. 30 participants have presented their papers showcasing their research results and achievements of their institutions in official language Hindi. On the second day of the symposium, Secretary, DST, Prof. Abhay Karandikar released the ARCI In-House Magazine and the symposium souvenir. In his address, he described it as a platform for sharing scientific and technological initiatives rather than just calling it a Rajbhasha seminar. Prof. Karandikar underlined the need to present such innovations in regional languages as well. Thereafter, the best performing institutions in two categories related to official language were awarded by the Secretary on behalf of DST.

ARCI was awarded “DST Excellence” – “1st Prize” (at institute level) among DST Autonomous Institutes for Implementation & Promotion of Official Language.

Dr. Tata Narasinga Rao, Director-ARCI receiving award from Prof. Abhay Karandikar, Secretary, DST

Dr. Rambha Singh JTO receiving award from Prof. Abhay Karandikar, Secretary, DST

Dr. Rambha Singh Junior Translation Officer was awarded “1st Prize” (under individual category) for her commendable contributions and best execution of the Official Language Policy of the Union at ARCI.

ARCI published Annual Hindi Magazine “SRUJAN” was awarded “1st Prize” under best publication of Hindi Magazine among DST Autonomous Institutes.

Dr. Rambha Singh, Junior Translation Officer received “1st Prize” under Magazine category for her commendable contributions for bring-out best Hindi Magazine.

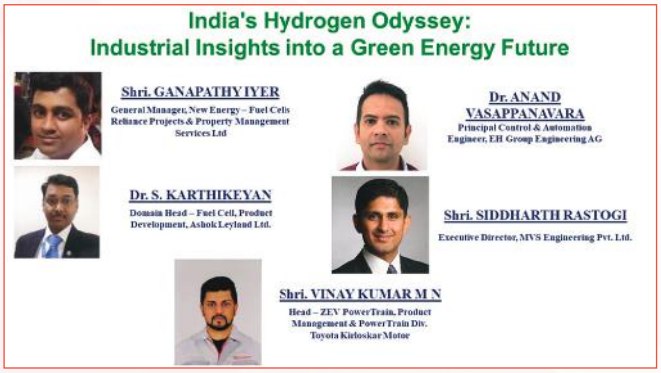
Seminars/ Workshops/ Conferences etc. Organized by ARCI

National Symposium on Electrochemical Sciences and Technology (NSEST- 2023)

The National Symposium on Electrochemical Science and Technology (NSEST-2023) with the theme 'Towards Self-Reliance in Electrochemical Technologies', was jointly organized by Electrochemical Society of India (ECSI) and ARCI at ARCI, Hyderabad on August 17 and 18, 2023. Dr N. Kalaiselvi (DG, CSIR and Secretary, DSIR) was the chief guest and Dr T.N. Rao (Director, ARCI) was the Guest of Honor. A total of approximately 200 persons participated. Twelve exhibition stalls were put up by various industries with approximately sixty delegates from Industries specializing in Electrochemical Technologies like batteries, electric vehicles etc. During NSEST-2023, Dr N. Kalaiselvi (DG, CSIR) and Dr T.N. Rao (Director, ARCI) were inducted as Fellows of ECSI. Four technical sessions: 1) Batteries & Supercapacitors; 2) Hydrogen technologies: fuel cells, hydrogen evolution reaction (HER), oxygen evolution reaction (OER), Electrocatalysis & photocatalysis; 3) Surface engineering: corrosion and coatings; 4) Sensors, were organized and more than 100 contributed papers, 50 each oral and poster presentations were presented by research scholars from all over India. In addition, two keynote lectures, five invited lectures, seven award lectures and three memorial lectures were delivered by experts from academia and industries on various topics of electrochemical technologies.

Hydrogen Day Workshop

The sixth workshop on Hydrogen Day was conducted on October 4, 2023 with the theme titled "India's Hydrogen Odyssey: Industrial Insights into a Green Energy Future". Speakers from various companies from different Industry sectors as well as policymakers shared their experience on adopting hydrogen technology in India. This workshop was conducted to commemorate the 'National Hydrogen and Fuel Cell Day' created to raise awareness of a clean energy technology based on Hydrogen. Globally, October 8 was chosen as National Hydrogen and Fuel Cell Day in reference to the hydrogen's atomic weight (1.008 amu). This workshop aims to encourage, develop, and promote hydrogen energy and fuel cells and their applications in the country.



A panel discussion on the topic "What Ails Commercialization of Hydrogen & Fuel Cells" was held, to understand the current status of fuel cell technologies as part of the workshop. The panel members were drawn from various industries working on applications relevant to hydrogen technology.

ARCI-ICDD Workshop on Materials Characterization Using Powder X-ray Diffraction

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) - International Centre for Diffraction Data (ICDD) Workshop was conducted on 'Materials Characterization Using Powder X-ray Diffraction' on December 4-5, 2023. The workshop was inaugurated by Dr. Tata Narasinga Rao, Director, ARCI in the presence of Shri D.S. Rao and Dr. P.K. Jain, Associate Directors, ARCI. Dr. Soorya N Kabekkodu, Editor-in-Chief at the International Centre for Diffraction Data (ICDD), USA, was the trainer during the workshop. Emeritus Prof. TN Guru Row of Indian Institute of Science and Prof. Arun Umarji of Indian Institute of Science delivered lectures on 'Powder X-ray Diffraction Method and Applications' and 'Data Collection Strategies for Materials Characterization' respectively. The workshop was attended by more than 60 participants. Participants expressed their satisfaction with the workshop, highlighting the very interactive and hands-on nature of the sessions that enriched their knowledge.

Participants during the ARCI-ICDD workshop

Workshop on Advanced X-ray Techniques for Powder Metallurgy and Particulate Materials (AXT-PM2)

Workshop on Advanced X-ray Techniques for Powder Metallurgy and Particulate Materials (AXT-PM2) was jointly organized by ARCI and PMAI (Powder Metallurgy Association of India) at ARCI, Hyderabad during January 17-19, 2024. The Workshop, was a part of the Golden Jubilee Year Celebration of PMAI and was convened by Dr. Malobika Karanjai, Dr. Joydip Joardar and Dr. Koppoju Suresh. It was attended by participants from several academic institutes (University of Hyderabad, Osmania University, JNTU-Hyderabad, BITS-Pilani, Mahindra Ecole, GITAM, BHU, IITs (Hyderabad, Bombay, Roorkee, Ropar, Kharagpur), NIT-Warangal, MGIT), R&D Organizations (DMRL, RCI, NSTL, ARCI) and Industries (HINDALCO, Midhani, Aditya Birla, Malvern-Panalytical, IRTech-Rigaku, Innomate, Marc Omicron).

Participants during the AXT-PM2 workshop

Human Resource Development

ARCI-IIT Fellowship Programme

ARCI continues to sponsor fellowship programmes at Indian Institute of Technology (IITH) – Hyderabad. As part of these ARCI-IIT Fellowships, 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 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 projects being undertaken is follows:

Project	Collaborating Institute	Name of the Fellow	Date of admission	Status
Development of More Efficient Cathode Matrix from Hard Carbon as 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 recognized 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 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 – Hyderabad
05. Indian Institute of Technology – Madras
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 2023-24:

S.No.	Name of the Project Scientist/Fellow	Topic	Ph.D. Registered at	Degree Awarded on
01	Peddi Mahender	Layered Oxide Cathode Materials and Electrodes in Lithium-ion Batteries for Electric Vehicle Applications: A Process-Structure-Property Correlation	Indian Institute of Technology, Madras	03.05.2023
02	Puppala Laxman Manikanta	Scalable Synthesis of Nasicon Type Sodium Vanadium Phosphate and Its Derivative for Sodium Ion Battery Applications	Indian Institute of Technology, Madras	08.05.2023
03	Pothula Vijaya Durga	Effect of Ti/Zr and Nano Oxide Dispersion on Microstructure, Mechanical Properties and Corrosion Behaviour of Fe3Al Intermetallic	Indian Institute of Technology, Madras	21.07.2023
04	Vikrant Trivedi	CO4SB12 - Skutterudite Thermoelectric Materials for Waste Heat Energy Harvesting Applications	Indian Institute of Technology, Madras	21.07.2023
05	M. Tarun Babu	Microstructure Property Studies of Cold Sprayed Aluminium alloy Coatings	Indian Institute of Technology, Madras	06.01.2024
06	V P Madhurima	Synthesis of Carbon Nano Materials and their Composites	National Institute of Technology, Warangal	09.02.2024

S.No.	Name of the Project Scientist/Fellow	Topic	Ph.D. Registered at	Degree Awarded on
07	Battula Ramyakrishna	Engineering Perovskite Absorber Layer for Stable and Efficient Perovskite Solar Cells	Indian Institute of Technology, Madras	19.02.2024
08	K K Phani Kumar	Nanocomposite based Solar Selective Absorber Coatings	Indian Institute of Technology, Bombay	24.02.2024
09	Bathini Lava Kumar	Mechanical and Electrochemical Behaviour of Pulse Electrodeposited Functional Gradient Ni and Ni-W Coatings	Indian Institute of Technology, Bombay	24.02.2024
10	Sreeraj P	Revitalizing Fuel Cells/Electrolysers: Sustainable Recycling of Polymer Membrane through Effective Degradation Analysis, Screening, and Reuse Strategies	Indian Institute of Technology, Bombay	24.02.2024
11	Muni Bhaskar Siva Kumar	Combined Microstructure and Magnetic Property Correlation in Grain Boundary Engineered, Nb Alloyed, Nd-Fe-B Melt-Spun Ribbons	Indian Institute of Technology, Madras	28.02.2024
12	Jyoti Gupta	Investigation of Efficient and Stable Nanostructured Mo based Chalcogenides Electrocatalysts for Hydrogen Evolution Reaction	University of Hyderabad	06.03.2024

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	01
SERB-TARE Fellowship	03
Post Doctoral Fellows/Research Scholars	08
Junior Research Fellows	40
Senior Research Fellow	01
Post Graduate Trainees	09
Graduate and Diploma Trainees	10
M. Tech. Project Students	16
B. Tech. / M.Sc. / Diploma Projects Students	45
Summer Research Interns	33

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

S.N	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	G. Vijayaraghavan	Microstructure-Property Correlation of High Performance Sm-Fe-N Permanent Magnetic Materials	Indian Institute of Technology, Madras
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)

S.No.	Name of the Student Mr./Ms.	Ph. D. Topic	Ph.D. Registered at
1	B. Priyadarshini	Synthesis and Characterization of Magnesium Silicide and Zinc Anti Monide based Thermoelectric Materials Applications	National Institute of Technology, Tiruchirappalli
2	Keerthi Sanghamitra Kollipara	Study of Thermo-physical Properties of Aerogel Products for Thermal Insulation Application	National Institute of Technology, Warangal
3	Narendra Chundi	Development of Anti Soiling Coating and their Evaluation for Applications of Photovoltaic Modules	Indian Institute of Technology, Bombay
4	V. Sai Harsha Swarna Kumar	Aspects of PEM based Electrolysers for Hydrogen Production	Indian Institute of Technology, Madras
5	A. B. Aravind	Development of Materials for Aluminium Air Batteries.	National Institute of Technology, Tiruchirappalli
6	D. Nazeer Basha	Laser Surface Texturing of Automotive Engine Components using Ultrafast Laser	Indian Institute of Technology, Madras
7	K. Sriram	Development of Non-Noble Electro catalyst for Alkaline Electrolyzer Application	Indian Institute of Technology, Madras
8	M. Venkatesh	Development of Low Cost and High specific Capacity Cathode Materials for Sodium – Ion Battery Applications	Indian Institute of Technology, Madras
9	P. Raju	Investigations on the Applicability of Pressure Slip Casting and 3D – Printing for Al2O3 and Al2O3-TiO2 Systems.	National Institute of Technology, Warangal
10	D. M. Santoshsarang	Design and Modelling of Residual Stresses of additive Manufacturing	Indian Institute of Technology, Madras
11	B. Amarendhar Rao	Laser Assisted Machining of Nickel based Super Alloys	National Institute of Technology, Warangal
12	Kanchi Anjali	Mechanical and Microstructural Behaviour of Refractory High Entropy Alloy	University of Hyderabad, Hyderabad
13	Rahul Jude Alroy	A study on Structure-Property Correlation of High Velocity Air -Fuel Sprayed CrC - NiCr Coatings for Improved Corrosion and Erosion Resistant.	Indian Institute of Technology, Madras
14	Aarti Gautam	Self Healing Corrosion Protection Coatings on Mild Steel	National Institute of Technology, Warangal
15	K. Reshma Dileep	Carbon based Perovskite Solar Cell	Indian Institute of Technology, Bombay
16	Guduru Neelima Devi	Cold Spray Deposition of Nickel based Alloys	National Institute of Technology, Warangal
17	Harita Seekala	Measuring the Size and Rate Dependence of Strength at Small Scales	Indian Institute of Technology, Madras
18	Nowduru Ravikiran	Synthesis of Carbon 2D Hybrid Materials for Friction and Wear Reduction	University of Hyderabad, Hyderabad
19	Kumaar Swamy Reddy. B	Solution – Processed Photo Detector	Indian Institute of Technology, Hyderabad
20	Rentala Jayasree	Development of Functionally Graded Materials for Bio Applications	Indian Institute of Technology, Kharagpur
21	D. Vijaya Lakshmi	A Comprehensive Study on High Velocity Thermal Sprayed Thin Coatings for Wear and Corrosion Resistant Applications	Indian Institute of Technology, Bombay
22	Baswanta Sainath Patil	Additive Manufacturing of 15-5 PH Stainless Steel	Indian Institute of Technology, Hyderabad

S.No.	Name of the Student Mr./Ms.	Ph. D. Topic	Ph.D. Registered at
23	P. Sankar Ganesh	Development of Laser Surface re-engineering Process on Automotive Structural Steels for Improved Forming and Manufacturability	Indian Institute of Technology, Hyderabad
24	Chandra Gowthami	Synthesis, Characterization and Validation of Modified Electrode Materials for Battery Applications	National Institute of Technology, Warangal
25	Ramay Patra	Corrosion Sensing and Self-Healing Smart Nano composite Coatings	National Institute of Technology, Warangal
26	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
27	Ch. Phani Nookarajendra	Micro Arc Oxidation on Valve Metals	Indian Institute of Technology, Madras
28	Shivangi Tewatia	Cathode Materials for Lithium Sulphur Batteries	Indian Institute of Technology, Madras
29	Sivakanali	Course work ongoing	Indian Institute of Technology, Madras
30	Yuva Keerthana	Course work ongoing	Indian Institute of Technology, Hyderabad
31	Amgothu Chinna Mathru Naik	Course work ongoing	Indian Institute of Technology, Madras
32	Priya Indulkar	Course work ongoing	National Institute of Technology, Warangal

Visits by Students and Faculty to ARCI

1. **32** Students and Faculty from Indian Institute of Hyderabad, Hyderabad visited ARCI on 18th April, 2023.

2. **44** B.Sc. Students and Faculty from St. Francis College for Women, Hyderabad visited ARCI on 12th September, 2023.

3. **27** participants and faculty from various Institutions participating in Two Week Refresher Course on Materials Science" organized by "UGC-Human Resource Development Centre", Osmania University visited ARCI on 14th September, 2023.

4. **23** 10th Students and Faculty from Tatva Global School, Hyderabad visited ARCI on 29th September, 2023.

5. **33** Students and Faculty from Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad visited ARCI on 6th October, 2023.

6. **18** Students and Faculty from RGM College of Engineering and Technology, Nandyal visited ARCI on 6th October, 2023.

7. **45** participants from various Institutions participating in Faculty Development Program (FDP) under AICTE training and Learning organized (ATAL) organized by "ICFAI Foundation for Higher Education, Hyderabad visited ARCI on 27th December, 2023.

8. **60** Students and Faculty from Defence Laboratories School, RCI, Hyderabad visited ARCI on 27th December, 2023.

9. **70** M.Sc. Students and Faculty from Loyola Academy Degree & PG College, Hyderabad visited ARCI on 24th January, 2024.

10. **100** B.Sc. Students and Faculty from Government Degree College, Hyderabad visited ARCI on 16th February, 2024.

11. **45** M. Tech. Students and Faculty from National Institute of Technology, Warangal visited ARCI on 5th March, 2024.

12. **60** B. Tech. Students and Faculty from Institute of Aeronautical Engineering College, Hyderabad visited ARCI on 19th March, 2024.

Summer Research Internship Programme 2023-24

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 2023. 33 students, who were selected, have attended the programme from 16th May, 2023 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.

Regular Appointments

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

Employee Name	Designation	Date of Joining
Ms. KS Athira	Scientist "B"	12.12.2023
Mr. Gyan Prakash Sahoo	Scientist "B"	15.12.2023
Mr. Kukunuri Dhananjee Rao	Technician "A"	19.12.2023
Mr. Jadhav Balwant Rangrao	Technician "A"	15.03.2023

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 eligible employees and the following were promoted during the years 2022-23 and 2023-24 respectively:

Name of the Promotees	Effective Date	Promotion for the post:	
		From	To
Ms.Uma Venkateshwaran	October 1, 2022	Technical Officer "D"	Technical Officer "E"
Mr. Ch. Sambasiva Rao	October 1, 2022	Technical Officer "C"	Technical Officer "D"
Mr. K. Naresh Kumar	October 1, 2022	Technical Officer "B"	Technical Officer "C"
Mr. M. Ilaiyaraja	October 1, 2022	Technical Officer "B"	Technical Officer "C"
Mr. J. Shyam Rao	October 1, 2022	Technical Assistant "A"	Technical Officer "A"
Mr. A. Ramesh	October 1, 2022	Technician "D"	Technician "E"
Mr. B. Subramanyeswara Rao	October 1, 2022	Technician "D"	Technician "E"
Mr. G. Anjan Babu	October 1, 2022	Technician "C"	Technician "D"
Mr. Mothe Lingaiah	October 1, 2022	Technician "B"	Technician "C"
Mr. A. Srinivas	May 1, 2023	Admin. & Pers. Officer	Sr. Admin. & Pers. Officer
Mr. Pudi Dharma Rao	May 1, 2023	Officer "A"	Officer "B"
Mr. Poduri Venugopal	May 1, 2023	Officer "B"	Officer "C"
Ms. K. Madhura Vani	May 1, 2023	Assistant "B"	Officer "A" (Adhoc)
Mr. Narendra Kumar Bhakta	May 1, 2023	Assistant "B"	Officer "A"
Mr. Sudheendra	December 20, 2023	Assistant "A"	Assistant "B"
Mr. Pagadala Shiva Prasad Reddy	December 20, 2023	Assistant "A"	Assistant "B"
Mr. Ch. Venugopal	December 20, 2023	Assistant "A"	Assistant "B"
Mr. Edunuri Ramesh	December 20, 2023	Assistant "A"	Assistant "B"

Name of the Promotees	Effective Date	Promotion for the post:	
		From	To
Kum. K. Madhura Vani	January 1, 2024	Assistant "B"	Officer "A"
Dr. P. Suresh Babu	January 12, 2024	Scientist "E"	Scientist "F"
Dr. Krishna Valleti	January 12, 2024	Scientist "E"	Scientist "F"
Dr. M. Buchi Suresh	January 12, 2024	Scientist "E"	Scientist "F"
Dr. Srinivasan Anandan	January 12, 2024	Scientist "E"	Scientist "F"
Dr. Karuppiah Murugan	January 12, 2024	Scientist "E"	Scientist "F"
Dr. Dulal Chandra Jana	January 12, 2024	Scientist "E"	Scientist "F"
Dr. Amit Das	January 12, 2024	Scientist "B"	Scientist "C"
Mr. B. Laxman	February 5, 2024	Officer "A"	Officer "B"
Mr. M. Srinivas	February 7, 2024	Technical Officer "C"	Technical Officer "D"
Mr. P.V.V. Srinivas	February 7, 2024	Technical Officer "B"	Technical Officer "C"
Mr. A. Praveen Kumar	February 7, 2024	Technician "D"	Technician "E"
Mr. B. Hemanth Kumar	February 7, 2024	Technician "D"	Technician "E"
Mr. Dasari Kutumba Rao	February 7, 2024	Technician "D"	Technician "E"
Mr. Kona Vigneswara Rao	February 7, 2024	Technician "D"	Technician "E"
Mr. Shaik Ahmed	February 7, 2024	Technician "C"	Technician "D"
Mr. K. Ashok	February 7, 2024	Technician "C"	Technician "D"
Mr. E. Yadagiri	February 7, 2024	Technician "C"	Technician "D"

Superannuation/VRS

Employee Name	Designation Held	Date of Superannuation
Mr. P. Nagendra Rao	Senior Staff Officer to Director	30.04.2023
Mr. J. Nagabhushana Chary	Technical Officer "C"	31.05.2023
Mr. K. Ramesh Reddy	Technical Officer "B"	31.07.2023
Mr. P. Ashok	Driver "B" (MACP)	18.08.2023 (VRS)
Mr. Aoula Satyanarayana	Technician "E"	31.10.2023
Mr. Pothuri Venkata Ramana	Officer "B"	31.12.2023
Mr.Turpati Satyanarayana	Driver "C"	31.01.2024
Dr. Nukala Ravi	Scientist "F"	29.02.2024
Mr. Pudi Dharma Rao	Officer "B"	29.02.2024
Dr. Roy Johnson	Associate Director	31.03.2024
Shri P. Rama Krishna Reddy	Technical Officer "D"	31.03.2024

Resignations

Employee Name	Designation Held	Date of Relieving
Mr. Pakanati Ashoka Reddy	Assistant "A"	31.08.2023
Mr. Rasikanta Maharana	Technician "A"	31.01.2024
Dr. P. Sudharshan Phani	Scientist "F"	06.03.2024

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 SC is 21%, S.T is 6.12%, OBC is 27.89% and that of persons with disabilities is 2.72% as on March 31, 2024.

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 and delivered motivational talks/science talks for the benefit of the school students. On invitation by reputed government/private engineering colleges, scientist 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. Takeshi Shimizu, Manager, Global Business Development, Nagase Co Ltd, Japan visited on December 20, 2023

2 Mr. Erez Schreiber, Founder and Chief Executive Officer (CEO), 3D Battery, Israel and Mr. Meytal Lerner, Chief Technology Officer (CTO), 3D Battery, Israel visited on February 05, 2024

Foreign visits by ARCI personnel

1 Mr. Muni Bhaskar Siva Kumar (Dr. D. Prabhu) visited Japan to participate and to deliver a talk on “BG-03 (WOB-01): Restricted grain growth and role of Nb precipitates in Nd-Fe-Nb-B melt spun ribbon” in the scientific event entitled “IEEE International Magnetics Conference, INTERMAG 2023 in Japan during May 15-19, 2023.

2 Dr. Madireddy Buchi Suresh visited to Germany for Pre-dispatch inspection and training on the dilatometer equipment at M/s Netzsch GmbH, Germany during June 18-23, 2023.

3 Mr. Manchala Venkatesh visited to Singapore to participate and present a paper titled “Biomass-derived hard carbon as an anode material for sodium-ion battery application” in the scientific event entitled 11th International Conference on Materials for Advanced Technologies –IUMRS-ICAM & ICMAT – 2023 during June 26-30, 2023.

4 Dr. Srinivasan Anandan visited to United Kingdom (UK) to discuss with technical teams of WMG, UKBIC, Coventry, UK and other esteemed industry to explore the equipment/technology/techniques being used in United Kingdom (UK) for the optimization of electrode properties and designing of Li-ion cells using ARCI developed LFP material during July 9-13, 2023.

5 Dr. Tata Narasinga Rao and Dr. Pawan Kumar Jain visited Russia to have a detailed discussion on the Carbon Fiber Technology and to collaborate with UMATEX to establish a Carbon Fiber pilot plant at ARCI, Hyderabad. Technology discussions will also be held with RAIN, RUSAT and GIREDMET for Carbon fiber, Additive Technology & Rare Earth Technologies during July 15-23, 2023.

6 Dr. Naveen Manhar Chavan visited South Africa to participate in “the 8th BRICS Young Scientists Forum (BRICKS-YSF) and Innovator prize competition” as part of the Indian delegation during July 31 – August 3, 2023.

7 Dr. Koppoju Suresh visited Australia to participate and paper presentation on title “Precipitation behavior of additively manufactured 15-5 precipitation hardened steels” in “the 26th Congress and General Assembly of the International Union of Crystallography (IUCr)” during August 19-26, 2023.

8 Ms. Aarti Gautam (Dr. R. Subasri) visited Brussels to participate and present a paper titled “Slow and Sustained Release of Corrosion Inhibitors to Prolong the Corrosion Protection of Mild Steel” in “the EUROCORR the Annual Congress of the European Federation of Corrosion (EUROCORR 2023)” during August 27-31, 2023.

9 Dr. D. Prabhu visited to participate and present a poster title “Coercivity enhancement through grain boundary diffusion in sintered Nd-Fe-B magnet using DyF3” in the 27th International Workshop on Rare Earth and Future Permanent Magnets and Their Application REPM 2023” during September 3-7, 2023.

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10 Dr. Manjusha Battabyal visited to Prague, Czech Republic to participate and present a paper on “Temperature dependent Evolution of Optical Phonon Modes and Thermoelectric Properties in Polycrystalline Bi2Te3” in the “19th European Conference on Thermoelectrics” during September 17-21, 2023.

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11 Mr. N Ravi Kiran (Dr. P K Jain) visited Gothenburg, Sweden to present a paper on “A Novel and Large-Scale Rapid Green Synthesis of Few-Layer and Multi-Layer Graphene” at the ‘244th ECS Meeting’ organized by The Electrochemical Society, Gothenburg, Sweden during October 8-12, 2023.

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12 Dr. R. Vijay visited United Kingdom (UK) to participate in the technical workshops in Universities of Birmingham and Manchester as part of “Critical Minerals Industry Academia Delegation during November 5-9, 2023.

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13 Ms. Kanchi Anjali (Dr. G. Ravi Chandra) visited Hsinchu, Taiwan to participate and present a paper on “Enhancing the plasticity of refractory multicomponent alloys Nbx (MoTaW)(1-x) (x=0.4,0.55 and 0.7) by adjusting the chemical composition” in the scientific event entitled Materials Research Society Taiwan International Conference (MRSTIC – 2023) during November 17-20, 2023.

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14 Dr. M Buchi Suresh visited Portugal to attend the ‘International Conference on Nanotechnology Research and Innovation’ organized by University of Aveiro, Portugal and delivered an invited talk on “Solid Oxide Cells (SOFC/SOEC): An energy efficient clean & green technology for the generation of Power and H2” during November 20-24, 2023.

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15 Dr. Hembram Kaliyan and Mr. Tak Manish visited to Berlin, Germany to have discussion on the joint project of India-German Science and Technology Centre(IGSTC), ARCI, German partners Charite University, KCS Europe GmBH and Indian Industry partner WIPRO 3D titled Development of Biodegradable Alloys and AM Processes for Soft Tissue Anchors during November 20-24, 2023.

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16 Mr. N Ravi Kiran (Dr. P K Jain) visited Singapore to present a paper on “Sustainable Kilogram-scale Conversion of Tire Pyrolysis Waste into Nanosized Onion-like Carbons with Extraordinary Lubricant-Additive Properties” at the ‘Global Conference for Decarbonization of Energy and Materials (GC-DEM 2023) organized by NUS Singapore during December 27-31, 2023.

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17 Dr. Tata Narasinga Rao and Dr. Manjusha Battabyal visited to Tashkent, Uzbekistan to facilitate discussions on the extension of the ongoing project and plans to strengthen the collaboration between the two institutes during January 27 – February 3, 2024.

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18 Ms. Harita Seekala (Dr. P. Sudharshan Phani) visited to Orlando, Florida, USA to participate and present a paper on “Mechanical Behavior at the Nanoscale VII” in the scientific event entitled TMS 2024(153rd Annual Meeting and Exhibition) during March 3-7, 2024.

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19 Dr. R Prakash visited USA to attend the 'Global Energy Meet (GEM 2024)’ held at Los Angeles and delivered an invited lecture on “Temperature Derived Fe Dissolution of a LiFePO4/Graphite Cell under fast Charging Condition” during March 4-8, 2024.

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20 Dr. Tata Narasinga Rao visited to Rio-de Janeiro – Brazil to participate as Indian delegation in the 8th Edition of the Science Engagement Group – S20 inaugural meeting during March 11-12, 2024.

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21 Mr. Manish Tak visited to Sweden, Germany to attend level 2 training of Electron Beam Melting system of OEM training academy of Sweden during March 11-14, 2024.

Papers Presented at Indian Conference/Symposia

1 Mr. V Sri Harsha (Dr. K Ramya) presented a paper on “Influence of Operating Parameters on Performance of PEM based ECMR for Hydrogen Generation under Pressurised Condition” at the ‘National symposium on Electrochemical science and technology' jointly organized by The Electrochemical Society of India and ARCI during April 17-18, 2023

2 Ms. Anjali Kanchi (Dr. G. Ravi Chandra) made a poster presentation on “Oxidation and Corrosion Behavior on MoNbTaW Refractory High Entropy Alloy” at “International Workshop on High Entropy Materials (IWHEM-23)” organized by “The Indian Institute of Metals-Mumbai Chapter & Materials Research Society India-Mumbai Chapter” at Bhabha Atomic Research Centre (BARC), Trombay, Mumbai during April 23-25,, 2023

3 Mr. B Amarendhar Rao (Mr. Manish Tak) presented a paper on "Experimental and Laser Heating Approach for Laser-assisted Turning of IN625 Alloy" at the '1st International Conference on Mechanical Engineering: Researches & Evolutionary Challenges-2023' organized by National Institute of Technology, Warangal during June 23-25, 2023

4 Dr. Amit Das made a poster presentation on “High performance SrMg0.1Mo09O3-d/GD0.1Ce0.9O2-d based Composites for Anode Application in Solid Oxide Fuel Cells” at the ‘National Symposium on Electrochemical Science & Technology (NSEST-2023)’ organized by The Electrochemical Society of India and ARCI, Hyderabad during August 17-18, 2023

5 Mr. S Ramakrishnan presented a paper on “Laser Nitride Titanium bipolar plates for PEM Fuel Cell Application – Preliminary Studies” at the ‘National Symposium on Electrochemical Sciences and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18, 2023

6 Dr. Debdyuti Mukherjee (Dr. K Ramya) presented a paper on “Designing Next Generation Sustainable Energy Conversion and Storage Systems using Two-Dimensional Organic-Inorganic Layered Hybrid Catalysts” at the ‘National Symposium on Electrochemical Sciences and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18, 2023

7 Dr. C Priji presented a poster on “Electrochemical Nitrogen Reduction to Ammonia under Ambient condition using Bismuth-Carbon Nanocomposite-based Electrocatalysts” at the ‘National Symposium on Electrochemical Sciences and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18, 2023

8 Mr. Sreeraj (Dr. K Ramya) presented a poster presentation on “Screening of Spent Polymer Electrolyte Membrane from Fuel Cells & Electrolyzers from the Perspective of Recycling” at the ‘National Symposium on Electrochemical Sciences and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18,2023

9 Ms. Aarti Gautam (Dr. R Subasri) presented a paper on “Anti-Corrosion Sol-Gel Coating Using Layer-By-Layer Nanocontainer for Mild Steel Corrosion Protection” at the 'National Symposium on Electrochemical Science and Technology (NSEST)-2023' jointly organized by The Electrochemical Society of India and ARCI during August 17-18, 2023

10 Mr. Ramay Patra (Dr. R Subasri) made a poster presentation on “Smart Coating with Autonomous Corrosion Indication and Active Corrosion Protection Function on Mild Steel” at the ‘National Symposium on Electrochemical Science and Technology (NSEST-2023)’ jointly organized by The Electrochemical Society of India and ARCI during August 17-18, 2023

11 Mr. Shivangi Tewatia (Dr. B. V. Sarada) presented a paper on “Enhancement in Performance of Lithium-Sulfur Batteries by Doping MnO2 into Carbon-Sulfur Composite” at the ‘National Symposium on Electrochemical Science and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18,2023

12 Shreyas J Kashyap (Dr. S Anandan) presented a paper on “Engineering High-Rate-Performing Li-ion Cathode Materials: A case study of Novel Carbon-Coated Ni2+ Doped LiFePO4" at the ‘National Symposium on Electrochemical Science and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18,2023

13 Ch. Gowthami (Dr. S Anandan) presented a paper on “Development of High Tap Density C-LFP from Low-Cost Iron Precursors for High Energy Density and High-Power LIB Applications" at the 'National Symposium on Electrochemical Science and Technology (NSEST-2023)' jointly organized by The Electrochemical Society of India and ARCI during August 17-18,2023

14 Dr. Raman Vedarajan made a paper on “Screening of Spent Polymer Electrolyte Membrane from Fuel Cells & Electrolyzers from the Perspective of Recycling” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad at ARCI, Hyderabad during August 17-18, 2023

15 Dr. V V N Phani Kumar made a paper on “Investigation of Different Morphologies of Lithium Ion Phosphate Cathode using Aqueous Binders for Lithium-ion Batteries” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad” at ARCI, Hyderabad during August 17-18, 2023

16 Ms. Anjali Kanchi (Dr. G. Ravi Chandra) made a poster presentation on “Electrochemical Corrosion Behavior of Nbx(MoTaW)(1-x)(x=0.4, 0.55, and 0.7) Novel Refractory Multicomponent Alloys” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad” at ARCI, Hyderabad during August 17-18, 2023

17 Ms. G Neelima Devi (Dr. S. Kumar) made a paper on “Effect of Feedstock on the Corrosion Performance of Cold Sprayed Nickel Coatings” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad” at ARCI, Hyderabad during August 17-18, 2023

18 Ms. D. Vijaya Lakshmi (Dr. P. Suresh Babu) made a paper on “Insight into the Electrochemical Corrosion Response of the Thin Cermet Coatings Deposited by AC-HVAF” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad” at ARCI, Hyderabad during August17-18, 2023

19 Mr. Baswanta Sainath Patil (Dr. K. Suresh) made a poster presentation on “Corrosion Behaviour of CoCrFeMnNix(x=5, 10, 15 and 20 at %) High Entropy Alloys” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad” at ARCI, Hyderabad during August 17-18, 2023

20 Mr. Hitesh Kumar (Dr. Kaliyan Hembram) made a poster presentation on “Development and Degradation Studies of Biodegradable Mg-Zn-Zr Alloys” at “National Symposium on Electrochemical Science and Technology (NSEST-2023)” organized by “The Electrochemical Society of India, Indian Institute of Science Campus, Bengaluru & ARCI, Hyderabad” at ARCI, Hyderabad during August 17-18, 2023

21 Dr. Balaji Padya presented a paper on “Ultrasonic-assisted Dispersion of Nanocarbon in Oil, Solvents, and Polymers for Multifunctional Applications” at the ‘5th Asia-Oceanic Sonochemical Society International Conference (AOSS-5, 2023)’ organized by National Institute of Technology (NIT), Warangal during September 28-30, 2023

22 Ms. Manaswi Pulijala (Dr. Sanjay Dhage) presented a paper on "Solution Processed ZnO Nanostructure Application in Sensor" at the '5th Asia-Ocenia Sonochemical Society 2023 International Conference (AOSS-5, 2023)' organized by National Institute of Technology (NIT), Warangal during September 28-30, 2023

23 Mr. N Ravi Kiran (Dr. P K Jain) presented a paper on “Ultrasonically Dispersed 0-dimensional Nano-carbons as Tribo-additives in 15W40 Motor Oil” at the ‘5th Asia-Oceania Sonochemical Society International Conference (AOSS-5, 2023)’, organized by National Institute of Technology (NIT), Warangal during September 28-30, 2023

24 Mr. V Harikrishnan Nampoothiri (Dr. Mani Karthik) presented a paper on “Performance Evaluation of Photovoltaic/Thermal (PV/T) System: A Study of Flow Characteristics Using 3D Transient Thermal Analysis” at the ‘Indo-South Korea-Thailand 3rd International Conference on "Nanoscience and Nanotechnology for Energy Environment and Biomedical Applications (iNEEBA-2023)" Organized by Kirupananda Variyar Arts and Science College, Salem, Tamilnadu, during October 1-2, 2023

25 Mr. N Ravikiran (Dr. P K Jain) made a poster presentation on “A Novel and Large-Scale Rapid Green Synthesis of Few-Layer and Multi-Layer Graphene” at “244th Electrochemical Society (ECS)” held at Gothenburg, Sweden during October 8-12, 2023

26 Mr. Ramay Patra (Dr. R Subasri) presented a paper on “Optimization of Benzotriazole Loading into Halloysite Nanotube-Based self-Healing Sol-Gel Coatings on Mild Steel” at the ‘CORCON 2023' Organized by the NACE International India, Mumbai during October 25-28, 2023

27 Mr. M. Tarun Babu (Dr. K. Suresh) made a paper on “Effect of Feedstock Power State on Precipitation Behaviour of Cold Sprayed Al7075 Alloy” at “Asian Thermal Spray Conference & Expo 2023 (ATSC 2023)” organized by “Indian Institute of Technology Madras with Asian Thermal Spray Society & Indian Thermal Spray Association” at IIT Madras, Chennai during November 2-4, 2023

28 Mr. Rahul Jude Alroy (Dr. G. Siva Kumar) made a paper on “On Improving Wear Performance of Inner Diameter-High Velocity Air Fuel Sprayed (ID-HVAF) Cermet Coatings by Altering Throat-Nozzle Configuration” at “Asian Thermal Spray Conference & Expo 2023 (ATSC 2023)” organized by “Indian Institute of Technology Madras with Asian Thermal Spray Society & Indian Thermal Spray Association” at IIT Madras, Chennai during November 2-4, 2023

29 Ms. Madugula Swarna (Dr. G. Siva Kumar) made a paper on “Comparative study on Tribological Behaviour of T-400 & stellite-6 coatings sprayed using HVAF, plasma & Laser Cladding Techniques” at “Asian Thermal Spray Conference & Expo 2023 (ATSC 2023)” organized by “Indian Institute of Technology Madras with Asian Thermal Spray Society & Indian Thermal Spray Association” at IIT Madras, Chennai during November 2-4, 2023

30 Dr. P. Manoj Kumar (Dr. G. Siva Kumar) made a paper on “The Influence of Ceramic Additives on Te Sliding Wear Performance of Plasma-Sprayed Cr2O3 Composite Coating” at “Asian Thermal Spray Conference & Expo 2023 (ATSC 2023)” organized by “Indian Institute of Technology Madras with Asian Thermal Spray Society & Indian Thermal Spray Association” at IIT Madras, Chennai during November 2-4, 2023

31 Ms. G. Neelima Devi (Dr. S. Kumar) made a paper on “Correlation of In-Flight Powder Energy with Inter-Splat Bonding in Cold Sprayed Coatings” at “Asian Thermal Spray Conference & Expo 2023 (ATSC 2023)” organized by “Indian Institute of Technology Madras with Asian Thermal Spray Society & Indian Thermal Spray Association” at IIT Madras, Chennai during November 2-4, 2023

32 Ms. D. Vijaya Lakshmi (Dr. P. Suresh Babu) made a paper on “Effect of Fine Particle Size and Microstructure on the Erosion and Nano-Impact Behaviour of HVAF Sprayed WC CoCr” at “Asian Thermal Spray Conference & Expo 2023 (ATSC 2023)” organized by “Indian Institute of Technology Madras with Asian Thermal Spray Society & Indian Thermal Spray Association” at IIT Madras, Chennai during November 2-4, 2023

33 Dr. Gururaj Telasang delivered a contributory talk on “Laser Direct Metal Deposition of High-Speed M2 Tool Steel” at a conference on 'Advances in Laser & Arc Cladding Technologies – ALACT-2023' organized by IIW – Jamshedpur during November 3-4, 2023

34 Mr. B Amarendhar Rao (Mr. Manish Tak) presented a paper on "Experimental Analysis of Conventional and Laser assisted Turning for IN625 with CrAlSiN Coated Tungsten Carbide Inserts" at the '77th Annual Technical Meeting of The Indian Institute of Metals (IIM-ATM2023)' organized by Kalinga Institute of Industrial Technology (KIIT), Bhubaneswar during November 22-24, 2023

35 Dr. Koppoju Suresh made a paper on “Microstructure and Mechanical Properties of Additively Manufactured 15-5 PH Stainless Steel” at “77th Annual technical Meeting of the Indian Institute of Metals (IIM-ATM 2023)” organized by “IIM Sambalpur Chapter, IIM Angul Chapter, IIM Bhubaneswar Chapter and Hindalco Industries Limited” at KIIT, Bhubaneswar during November 22-24, 2023

36 Dr. P. Suresh Babu made a paper on “Fireside Corrosion Behaviour of Indigenous IN617 and IN625 Power Coatings Deposited on T91 Boiler Tube Material using APS and HVAF Spray Techniques” at “77th Annual technical Meeting of the Indian Institute of Metals (IIM-ATM 2023)” organized by “IIZ`M Sambalpur Chapter, IIM Angul Chapter, IIM Bhubaneswar Chapter and Hindalco Industries Limited” at KIIT, Bhubaneswar during November 22-24, 2023

37 Mr. Baswanta Sainath Patil (Dr. K. Suresh) made a paper on “A Novel Approach of Step-Wise Process Parameter Optimization for Precipitation Hardened Stainless Steel by SLM” at “77th Annual technical Meeting of the Indian Institute of Metals (IIM-ATM 2023)” organized by “IIM Sambalpur Chapter, IIM Angul Chapter, IIM Bhubaneswar Chapter and Hindalco Industries Limited” at KIIT, Bhubaneswar during November 22-24, 2023

38 Dr. Ravi Kali (Dr. P. K. Jain) made a paper on “Enhanced Capacity Performance of Polyaniline/grapheme Nanosheets Composite as Anode Material for Lithium Ion Batteries” at “Indian Conference on Carbon Materials 2023” organized by “Indian Carbon Society, Maharashtra Chapter” Technical association with Materials Group and Bhabha Atomic Research Centre” held at Mumbai during November 30– 2nd December 2, 2023

39 Dr. Balaji Padya presented a paper on “Development and Characterization of Functional Nanocomposites for Thermal and Capacitive Energy Storage Applications” at the ‘Indian Conference on Carbon Materials 2023 (ICCM-2023)’ organized by DAE Convention Centre, Mumbai during November 30 - December 2, 2023

40 Mr. N Ravi Kiran (Dr. P K Jain) presented a paper on “A Novel Green Process of Making Multi/few Layers Graphene and Their Application as Lubricant Additive” at the ‘Indian Conference on Carbon Materials 2023 (ICCM-2023)’ organized by The Indian Carbon Society at BARC, Mumbai during November 30-December 02, 2023

41 Manaswi Pulijala (Dr. Sanjay R Dhage) presented a paper on "Development of New Application of Carbon Nanotubes" at the 'Indian Conference on Carbon Materials (ICCM-2023)' organized by Bhaba Atomic Research Centre (BARC), Mumbai during November 30 - December 02, 2023

42 Mr. Shivangi Tewatia (Dr. B V Sarada) presented a paper on “MnO2 at Porous Carbon as an Efficient Sulfur Host in Lithium-Sulfur Batteries” at the '2nd International Meeting on Energy Storage Devices and Industry-Academia Conclave (IMESD-2023)' organized by IIT Roorkee during December 7-10,2023

43 R. Yuva Keerthana (Dr. B. V. Sarada) presented a paper on “Development of Hard Carbon as Anode Material with Enhanced Electrochemical Performance for Sodium Ion Batteries” at the '2nd International Meeting on Energy Storage Devices and Industry-Academia Conclave (IMESD-2023)'organized by IIT Roorkee during December 7 -10, 2023

44 Ms. Nagmani (Dr. S Anandan) presented a paper on “Petroleum Coke Derived Scalable and Sustainable Disordered Carbon as Anode for Sodium-ion Batteries" at the '2nd International Meeting on Energy Storage Devices and Industry-Academia Conclave (IMESD-2023)' organized by IIT Roorkee during December 7-10, 2023

45 Ms. S Sivakanali (Dr. S Anandan) presented a paper on “Cobalt free Advanced High Voltage Cathode (LiMn1-xFexPO4) Material for High Energy Lithium-ion Battery Applications" at the '2nd International Meeting on Energy Storage Devices and Industry-Academia Conclave (IMESD-2023)' organized by IIT Roorkee during December 7-10, 2023

46 Ms. Chandra Gowthami (Dr. S. Anandan) made a poster presentation on “Development of High tap Density C-LFP using Low-cost Iron Precursors for High Energy Density Li-ion Battery Applications” at “International Meeting on Energy Storage Devices (IMESD) 2023 & Industry Academia Conclave” held at Indian Institute of Technology (IIT), Roorkee, Utharakhand during December 7-10, 2023

47 Dr. V V N Phanikumar made a paper presentation on “Micron-sized Lithium Iron Phosphate as Cathode using Eco-friendly Binders for Lithium-ion Batteries” at “International Meeting on Energy Storage Devices (IMESD) 2023 & Industry Academia Conclave” held at Indian Institute of Technology (IIT), Roorkee, Utharakhand during December 7-10, 2023

48 Mr. D Nazeer Basha (Dr. Ravi Bathe) presented paper on “Enhancing Tribological Performance of Gray Cast Iron by Femtosecond Laser Surface Textured Micro-Crosshatch Patterns” at the '1st International Conference on Materials Processing using Lasers and Surface Engineering (IMPULSE 2023)' at IIT Chennai, during December 14-15, 2023

49 Dr. P. Suresh Babu made a paper on “Influence of Substrate Properties on Cyclic Impact Response of CA-PVD TiN Thin Films” at “7th International Indentation Workshop (IIW7)” at University of Hyderabad (UoH), Hyderabad during December 17-21, 2023

50 Dr. Naveen Manhar Chavan made a paper on “Grain Refinement in Cold Sprayed Coatings and Structure-property Correlations at Micrometer Length Scale using Advanced Indentation Techniques” at “7th International Indentation Workshop (IIW7)” at University of Hyderabad (UoH), Hyderabad during December 17-21, 2023

51 Ms. Harita Seekala (Dr. P. Sudharshan Phani) made a paper on “A Unified Approach to Quantity the Indentation Size Effect” at “7th International Indentation Workshop (IIW7)” at University of Hyderabad (UoH), Hyderabad during December 17-21, 2023

52 Ms. Anjali Kanchi (Dr. G. Ravi Chandra) made a paper on “Micro-Nano Mechanic Behaviour of Novel refractory Multicomponent Alloys” at “7th International Indentation Workshop (IIW7)” at University of Hyderabad (UoH), Hyderabad during December 17-21, 2023

53 Dr. B P Saha, presented a paper on “Silicon Carbide-based Mirror and Radiator Assembly for Heat Dissipation in Visible Emission Line Coronagraph (VELC) Onboard ADITYA-L1 Mission” at the ‘International Conference on Exploring The Emerging World of Ceramics and Glass (ICEECG 2023)’ organized by The Indian Ceramic Society Kolkata during December 19-21, 2023

54 Dr. D C Jana, Dr. S P Singh, Dr. P Barick, Dr. P Biswas, Dr. M B Suresh, Dr. B P Saha and Dr. Roy Johnson, presented a paper on “Technological Aspects in Development and Processing of Lithium Aluminosilicate (LAS)-based Low-expansion Glass-Ceramics (LEGC)” at the ‘International Conference on Exploring The Emerging World of Ceramics and Glass (ICEECG 2023)’ organized by The Indian Ceramic Society, Kolkata during December 19-21, 2023

55 Dr. Prasenjit Barick made a paper on “Temperature and Time Dependent Densification and Crystallization of BaO-CaO-Al2O3-SiO2 based Glass Sealant System” at “International Conference on Exploring The Emerging World of Ceramics and Glass (ICEECG 2023)”organized by “The Indian Ceramic Society, Kolkata Chapter” held at CSIR-Central Glass and Ceramic Research Institute, Kolkata during December 19-21, 2023.

56 Dr. Sanjay Bharadwaj made a paper on “Translational Research in Sonochemistry” at “International Conference IIChE-CHEMCON 2023” organized by “Indian Institute of Chemical Engineers” at Heritage Institute of Technology, Kolkata during December 27-30, 2023.

57 Dr. Koppoju Suresh presented a paper on “Small Angle X-ray Scattering (SAXS) for Microstructural Studies” at the ‘PMAI-ARCI Workshop on Advanced X-Ray-Techniques for Powder Metallurgy & Particulate Materials’ organized by ARCI, Hyderabad during January 17-19, 2024

58 Ms. Ch Gowthami (Dr. S Anandan) presented a paper on “Development of High Tap Density C-LFP from Low-Cost Iron Precursors for High Energy Density and High-Power LIB Applications" at the 'Research Scholars Confluence' organized by NIT Warangal on February 17, 2024

59 Dr. Koppoju Suresh presented a paper on “Heat-Treated Gas-Atomized Al7075 Alloy Powders: Microstructure and Precipitation Analysis” at the ‘International Conference on Powder Metallurgy and Particulate Materials’ organized by Powder Metallurgy Association of India (PMAI), Pune during February 25-28, 2024

60 Dr. Joydip Joardar made a paper on “Sintering and Mechanical Behavior of Ultrafine Cr2A1C Max Phase-based Composite” at International Conference on Powder Metallurgy & Particulate Materials + Exhibition and 49th Annual Technical Meeting of PMAI” at Hyatt Regency, Pune during February 25-28, 2024

Lectures Delivered by ARCI Personnel

1 Dr. Mani Karthik delivered an invited talk on "Advanced Materials for Energy Storage Applications", organised by SRM University, Chennai on April 3, 2023

2 Dr. Mani Karthik delivered an invited talk on "Energy Storage Materials and Technologies: An Overview" at the Technical Seminar on 'Energy Storage for Electrical Vehicles', organised by Vellore Institute of Technology (VIT-Chennai) and University of Chennai, on April 4, 2023

3 Dr. R Prakash delivered an invited lecture on “Advantages of Centralized Cell Fabrication and Testing Facilities on Consortium Mode” at the 'State EV Consortium Conclave Series- 2023 on LTO Batteries and its BMS' organized by Kerala Development and Innovation Strategic Council (K-Disc), Thiruvananthapuram, on April 5, 2023

4 Dr. Srinivasan Anandan, delivered an invited lecture on “Lab to Fab Translation of Lithium Titanate Anode Material for Electric Vehicles Application” at 'State EV Consortium Conclave Series- 2023 on LTO Batteries and its BMS' organized by K-Disc, Thiruvananthapuram, on April 5, 2023

5 Dr. Sanjay Bhardwaj delivered an invited lecture on “Support System for Translational Research in India” at Indian Institute of Hyderabad (IIT) Hyderabad on April 5, 2023

6 Dr. B V Sarada delivered an invited lecture on “Electrochemical Synthesis of Nanostructured Materials for Energy and Healthcare" at 'International Conference on Women in Electrochemistry (ICWEC-2023)' organized by the Electrochemical Society of India (ECSI) at Indian Institute of Science (IISc), Bengaluru during April 7-8, 2023

7 Dr. Debdyuti Mukherjee delivered an invited lecture on “Designing Next Generation Sustainable Energy Conversion and Storage Systems Using Two-Dimensional Layered Materials and Highly Conducting Ionomer Membranes” at the ‘International Conference on Women in Electrochemistry (ICWEC-2023)’ organized by The Electrochemical Society of India at IISc, Bengaluru, during April 7-8, 2023

8 Dr. R Subasri delivered an invited talk on “Nanocontainer-Based Smart Coatings for Prolonged Corrosion Inhibition” ‘International Conference on Women in Electrochemistry (ICWEC-2023)’ organized by The Electrochemical Society of India at IISc, Bengaluru, during April 7-8, 2023

9 Dr. Gururaj Telasang delivered an invited talk on “Powder Bed Fusion: Materials and Case Studies” at the ‘Workshop on Recent Advances in Additive Manufacturing – RAAM -2023' organized by SEST, University of Hyderabad on April 10, 2023

10 Dr. R Balaji delivered an invited lecture on "The Journey of Hydrogen- Fuel Cell Activities at ARCI-CFCT" at 'National Workshop on Hydrogen Based Integrated Energy Systems' organized by G.H. Raisoni College of Engineering & Management, Pune, on April 11, 2023

11 Dr. Sanjay Bhardwaj conducted a Webinar / Workshop on “Technology Readiness Levels (TRLs) and Technology Upscaling Roadmaps to Realize the Commercialization Potential” for startups being incubated under the NIDHI-EIR scheme of Department of Science and Technology, Government of India at Deshpande Startups, Karnataka on April 11, 2023

12 Dr. Naveen Manhar Chavan delivered a lecture on “Microstructure Evolution in High Strain rate Cold Spray Impact- Influence of Process Material Characteristics” as part of ‘ARCI Colloquium Series’ organized by ARCI on April 12, 2023

13 Dr. Sanjay Bhardwaj delivered an invited lecture on “Innovation Ecosystem in India” during Inter-college Competitions organized by Chaitanya Bharathi Institute of Technology (CBIT) and Indian Institute of Chemical Engineers – Hyderabad Regional Centre on April 13, 2023

14 Dr. R Balaji delivered an invited lecture on "An Outline of Hydrogen Generation R&D Programmes" at the 'National Symposium on Green Hydrogen Technology: Harnessing the Power of Renewables 'organized by Hindustan University, Chennai on April 20, 2023

15 Dr. Sanjay Bhardwaj delivered an invited lecture on “Case Studies in Technology Transfer and Commercialization” at IIT Hyderabad on April 26, 2023

16 Mr. M Ramakrishna delivered a lecture on “Electron Microscopy at ARCI: Journey so far" as part of ‘ARCI Colloquium Series’ organized by ARCI on April 26, 2023

17 Dr. Ravi N. Bathe delivered an invited talk on “Additive Manufacturing of Complex Parts” at the ‘National Level Seminar on Recent Advances and Challenges in Additive Manufacturing of Nano-Structured Materials' organized by National Engineering College, Kovilpatti, Tamilnadu, during April 28-29, 2023

18 Dr. R Easwaramoorthi delivered an invited lecture on the “Latest in Solar Photovoltaic Technologies” at the 'National Technological Day Celebration' organized by Directorate of Special Projects, Hyderabad on May 12, 2023

19 Dr. Rambha Singh delivered a lecture on “Problems and Solutions Faced While Filling the Parliamentary Questionnaire on Implementation of Official Language” organized by Department of Science and Technology (DST), New Delhi during May 18-19, 2023

20 Dr. Balaji Padya delivered a lecture on “Processing and Industrial Applications of Functional Carbon Materials” as part of ‘ARCI Colloquium Series’ organized by ARCI on May 24, 2023

21 Dr. S Kumar delivered an invited talk on “Repair and Refurbishment Possibilities using Cold Spraying” at the ‘Defence Research and Innovation Summit - 2023’ organized by Madanapalle Institute of Technology & Science, Madanapalle on May 25, 2023

22 G. Sivakumar delivered an invited talk on “Self-Reliance through Thermal Spray Processes for Augmented Performance, Refurbishment, Life Extension of Strategic Components” at the ‘Defence Research and Innovation Submit - 2023’ organized by Madanapalle Institute of Technology & Science, Madanapalle on May 25, 2023

23 Dr. Gururaj Telasang delivered an invited talk on “Powder Bed Fusion: Materials and Case Studies” at the 'Defence Research and Innovation Summit – 2023' organized by the Madanapalle Institute of Technology & Science, Madanapalle, on May 26, 2023

24 Dr. R Balaji delivered an invited lecture on "Alane as Hydrogen Storage Media- Synthesis & its Applications” at the Defence Research and Innovation Summit - 2023' organized by Madanapalle Institute of Technology and Science, Madanapalle, on May 28, 2023

25 Dr. Gururaj Telasang delivered an invited talk on “Latest Developments of Additive Manufacturing Materials and Applications” at the ‘Seminar & Workshop on Metal 3D Printing for Aerospace and Defence Applications’, jointly organized by Additive Manufacturing Society of India (AMSI) and Society of Indian Aerospace Technologies and Industries (SIATI) at Aeronautical Society of India, Bengaluru, on June 2, 2023

26 Dr. Sanjay Bhardwaj delivered an invited lecture (as Chief Guest) on “Technology Readiness Levels (TRLs) and Simulation” at the ‘Workshop on Process Simulation’ organized by Birla Institute of Technology and Science (BITS) Pilani – Hyderabad campus on June 2, 2023

27 Mr. K V Phani Prabhakar delivered a talk on "Laser Processing of Materials" organized by M.V.S.R Engineering College, Hyderabad on June 6, 2023

28 Dr. R Prakash delivered a technical talk on “Lithium ion Battery Materials and Components in India: Availability and Requirement” at the 'Stakeholder Consultation on Battery Energy System Solution' (Indo-UK Experts), organized by NITI Aayog at New Delhi on June 6, 2023

29 Mr. S Sudhakara Sarma delivered colloquium lecture on "Cryo-Milling for Nanomaterials Advantages and Applications" organized by ARCI on June 7,2023

30 Dr. Raman Vedarajan delivered an invited lecture on "Materials in Proton Exchange Membrane Fuel Cell - PART 1" organized by Nanoscience Department, University of Madras, Chennai on June 9, 2023

31 Dr. D Prabhu delivered an invited talk on “Primer to Magnetism and Magnetic Materials” at the ‘Internship Programme on Advanced Nanomaterials for Energy’, organized by Entrepreneurship and Career Hub, Rashtriya Uchchatar Shiksha Abhiyan (RUSA 2.0), University of Madras, Chennai on June 12, 2023

32 Dr. Gururaj Telasang delivered an expert talk on “Additive Manufacturing –Materials and Applications” at the ‘SERB High-End Workshop on Material Science in Additive Manufacturing' organized by National Institute of technology (NIT) Warangal during June 12-18, 2023

33 Dr. R Balaji delivered an invited lecture on “The Hydrogen Colour Spectrum- Materials Perspectives” organized by Nanoscience Department, University of Madras, Chennai on June 13, 2023

34 Dr. Manjusha Battabyal delivered an invited lecture on "Nanostructured Thermoelectrics for Energy Harvesting" at the 'Theme of Advanced Nanomaterials for Energy' organized by Entrepreneurship and Career Hub, Rashtriya Uchchatar Shiksha Abhiyan (RUSA 2.0), University of Madras, Chennai, India on June 14, 2023

35 Dr. M B Sahana delivered an invited talk on “Advances in Materials for High-Performance Lithium-Ion Batteries, Advanced Nanomaterials for Energy", organized by 'Entrepreneurship and Career Hub, Rashtriya Uchchatar Shiksa Abhiyan (RUSA 2.0), University of Madras, Chennai on June 14, 2023

36 Dr. Sanjay Bhardwaj delivered an invited lecture on “Technology Commercialization” at ‘Technical and Rajbhasha Workshop’ organized by ARCI, Hyderabad on June 19, 2023

37 Dr. V Ganapathy delivered lecture on “Stable and Cost-Effective-Carbon based Perovskite Solar Cells” at the ‘International Conference on Energy Conversion and Energy Storage-2023 (IC-ECS 23)' organized by Amrita Vishwa Vidyapeetham Coimbatore, during June 21-23, 2023

38 Dr. Raman Vedarajan delivered an invited lecture on "Reuse and Screening of Spent Polymer Electrolyte Membrane from Fuel Cell" at the 'International Conference on Energy Conversion and Storage' organized by Amrita University, Coimbatore on June 23, 2023

39 Dr. Mani Karthik delivered an invited talk on “Differential Scanning Calorimetry (DSC): Basic Principles, Instrumentation and Analysis” at the ‘Workshop on Advanced Analytical Testing for Materials Characterization’ jointly organized by NIT Tiruchirappalli and NIT Warangal sponsored by DST at NIT Tiruchirappalli on June 23, 2023

40 Dr. Srinivasan Anandan, delivered an invited lecture on “Design, Development and Demonstration of Indigenous Li-ion Battery and Supercapacitor Materials for Electric Vehicles Applications” organized by B.S. Abdur Rahman Crescent Institute of Science and Technology Chennai, Tamilnadu. on June 23, 2023

41 Dr. Tata Narasinga Rao delivered an invited talk on “"Translational Research in Materials Chemistry...a Step Towards Atmanirbhar Bharat" at ‘M.P. Chary Memorial Lecture 2022-2023’ organized by Indian Institute of Chemical Engineers-Hyderabad Regional Centre (IIChE - HRC) on June 24, 2023

42 Dr. Rambha Singh delivered an invited lecture on "Responsibility of the Employee in the Development of Official Language Policy and the Method of its Execution” organized by Centre for Nano and Soft Matter Sciences (CeNS), Bangalore on June 28, 2023

43 Dr. Sanjay Bhardwaj delivered an invited lecture on “Technology Commercialization” at ‘National Webinar on Startups in India’ organized by Swamy Vivekanand Subharti University, Meerut on June 28, 2023

44 Dr. Mani Karthik delivered an invited talk on "Advanced Materials and Prototype System for Solar Thermal Energy Storage Applications" at the ‘National Conference on Challenges and Opportunities for Green Hydrogen in India' organized by the ‘Indian Institute of Information Technology Design and Manufacturing (IIITEM)’ Kurnool, Andhra Pradesh, on June 29, 2023

45 Dr. Mani Karthik delivered an invited talk on "Design and Development of Low-Cost Scalable Materials and Prototype System for Solar Thermal Energy Storage Applications" at Vellore Institute of Technology, Vellore, Tamilnadu, on July 6, 2023

46 Dr. Raman Vedarajan delivered an invited lecture on "Materials in Proton Exchange Membrane Fuel Cell - PART 2" organized by Nanoscience Department, University of Madras on July 7, 2023

47 Dr. Mani Karthik delivered an invited talk on "Advanced Materials and Technology for Energy Harvesting Conversion and Storage" organised by Vellore Institute of Technology, Vellore, Tamilnadu, on July 7, 2023

48 Dr. R Subasri delivered an invited talk on “Wet Chemical Derived Nanocomposite Coatings for Diverse Applications” organized by Saint Gobain Research India, IITM Research Park, Chennai on July 17, 2023

49 Mr. R Vijaya Chandar delivered a lecture on "National Knowledge Resource Consortium (NKRC): An Overview" as part of ‘ARCI Colloquium Series’ organized by ARCI on July 19, 2023

50 Dr. Raman Vedarajan delivered an invited lecture on "Chemistry of Materials in Proton Exchange Membrane Fuel Cell" at 'Recent Research Developments in Chemistry' organized by Eashwari College of Engineering on July 24, 2023

51 Dr. V Ganapathy delivered lecture on “Carbon vs Gold in Perovskite Solar Cells” at 'The 5-Day Lecture Series on Energy Storage and Conversion (FDP)' at VIT- AP University , Andhra Pradesh during July 24-28, 2023

52 Dr R Easwaramoorthi delivered an invited lecture on “Materials for Sustainable Energy” at the event 'Sustainable India-2023' organized by Sustainability and Energy Practitioners Association, Coimbatore during July 24-25, 2023

53 Dr. Raman Vedarajan delivered an invited lecture on "Recent Advancements in Polymer Electrolyte Membrane Fuel Cells" organized by Dr. MGR Research and Education Institute, Maduraivoyil, Chennai on August 4, 2023

54 Dr. Rambha Singh delivered a talk on “Official Language Policy and Rules and Various Tools used for Translation” organized by North East Centre for Technology Application & Research (NECTAR), New Delhi during August 7-11, 2023

55 Dr. D. Prabhu delivered an invited talk on “Magnetism and Magnetic Materials” at the 'Continuing Education Program' organized by Defence Metallurgical Research Laboratory (DMRL), Hyderabad on August 8, 2023

56 Dr. Sanjay Bhardwaj delivered an invited lecture on “R & D Collaborations, Technology Transfer and Commercialization” organized by Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra on August 8, 2023

57 Dr. D Prabhu delivered and invited talk on “Strategies for Enhancing the Operating Temperature of Nd-Fe-B Magnets” at the 'International Conference on Rare Earths for Energy Security (REES 2023)’ organized by India Rare Earth Limited, Goa during August 17-18, 2023

58 Dr. M. Buchi Suresh delivered an invited talk on “Effect of Buffer Layer and Current Collector Area on Polarization Resistance of SMMO-GDC Anode Based Symmetric Cell for IT-SOFC Application” at the ‘National Symposium on Electrochemical Science & Technology (NSEST-2023)’ organized by The Electrochemical Society of India and ARCI, Hyderabad during August 17-18, 2023

59 Dr. Prasenjit Barick delivered an invited talk on “SrO Based Glass Sealant for SOFC Application” at the ‘National Symposium on Electrochemical Science & Technology (NSEST-2023)’ organized by The Electrochemical Society of India and ARCI, Hyderabad during August 17-18, 2023

60 Ms. Priya Anish Mathews delivered an inaugural address on ‘Role of IPR in Global Innovation Index’ at the launch of ‘Two-week Certificate Course on Intellectual Property Rights (IPR) in Pharmacy’ at RBVRR College of Pharmacy for Women, Hyderabad on August 21, 2023.

61 Ms. Priya Anish Mathews delivered lectures on “Innovation and Intellectual Property Rights: Roles, Types, and Timelines” and “Patent process: Insights into patentability requirements, acquiring patent rights, and consequences under the Indian Patent Act” as a part of the Two-week Certificate Course on Intellectual Property Rights (IPR) in Pharmacy’ at RBVRR College of Pharmacy for Women, Hyderabad during August 21-22, 2023.

62 Dr. Gururaj Telasang delivered a talk on “Challenges in Powder Bed Fusion and Case Studies” at the 'Inauguration of Indigenous Pilot Spheroidization Plant by MATRI-NANO' organized by National Centre for Additive Manufacturing (NCAM), Hyderabad on August 23, 2023

63 Dr. S Sakthivel delivered a Special lecture on "Indian Research Perspective in Solar PV and Solar Thermal Research at Sustainable India – 2023" organized by Sustainability and Energy Practitioners Association (SEPA), Chaitanya Bharathi Institute of Technology, Hyderabad during August 23-24, 2023

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64 Dr. Mani Karthik delivered an invited talk on "Advanced Materials and Prototype System for Energy Storage and Conversion" organized by Department of Physics, Sri Satya Sai Institute of Higher Learning, Puttaparthi, Andhra Pradesh on August 26, 2023

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65 Dr. Pandu Ramavath delivered a lecture on "Single Step Shaping of Ceramics through Vacuum Encapsulation followed by Hot Isostatic Pressing" as part of 'ARCI Colloquium Series' organized by ARCI on August 30, 2023

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66 Dr. Tata Narasinga Rao delivered an oration talk on "Nanomaterials Based Technologies for Energy, Health and Environment" at '3rd Annual Memorial Oration at the Annual Awards Function', organized by Dr. K. V. Rao Scientific Society on September 01, 2023

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67 Dr. P Suresh Babu delivered an invited talk on "Mechanical Properties and Testing of Materials" at the 'Refresher Course on Materials Science' organized by Union Grants Commission - Human Resource Development Centre (UGC - HRDC), Osmania University, Hyderabad during September 1-16, 2023

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68 Dr. Nitin P Wasekar delivered an invited talk on 'Pulsed Electrodeposition' at 'Refresher Course on Materials Science' organized by UGC HRDC, Osmania University, Hyderabad during September 1-16, 2023

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69 Dr. Gururaj Telasang delivered an expert talk on "Powder Bed Fusion: Challenges and Applications" at the 'International Conference on Fabrication of Advanced Materials [PFAM 29]' organized by IIT Tirupati on September 5, 2023

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70 Dr. S Kumar delivered an invited lecture on "Cold Spraying" organized by UGC HRDC, Osmania University, Hyderabad on September 6, 2023

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71 Dr. Srinivasan Anandan, delivered an invited lecture on "Design, Development and Demonstration of Indigenous Li-ion Battery and Supercapacitor Materials for Electric Vehicles Applications" at 'Refresher Course on Materials Science' organized by the UGC– HRDC, Osmania University on September 11, 2023

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72 Mr. Arun Seetharaman delivered a lecture on "Identifying Entrepreneurs for Commercialization of Advanced Materials Technologies" as part of 'ARCI Colloquium Series' organized by ARCI on September 13, 2023

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73 Dr. R. Subasri delivered an invited talk on "Creating Nature Inspired Surfaces to Achieve Multi-Functionalities" organized by Institute for Aeronautical Engineering, Dundigal on September 14, 2023

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74 Dr. Raman Vedarajan delivered an invited lecture on "Powering the Future: Polymer Electrolyte Membrane Fuel Cell Technology" at 'Technology Day Celebrations' organized by Technip Energies Private Ltd on September 19, 2023

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75 Dr. R. Balaji delivered an invited lecture on "An Overview on Hydrogen-Fuel Cell Technology and its Recent Developments at Nation" at the 'Recent Trends in Physical Science Research with a Mathematical Approach' organized by Sri Akilandeswari Women's College, Vandavasi, Tamilnadu on September 25, 2023

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76 Dr. R Prakash delivered an invited lecture on "Lithium ion Battery Ecosystem at ARCI-System to Device to Materials" at the 'National Workshop on Coating Technologies for Industrial Application' organized by Sathyabama Institute of Science and Technology, Chennai, during September 26-27, 2023

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77 Dr. Amit Das delivered a lecture on "Development of High-Performance Mg-Doped SrMoO3/GDC-Based Anode Materials for the Application in SOFCs" as part of 'ARCI Colloquium Series' organized by ARCI on September 27, 2023

78 Dr. Malobika Karanjai delivered an invited lecture on “PM Biomaterials and Tissue Engineering” at the 'Powder Metallurgy Short Course PMSC- 2023' organized by Powder Metallurgy Association of India (PMAI), Pune during October 3-6, 2023

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79 Dr. Malobika Karanjai delivered an invited lecture on “Friction Material Composites” at 'Powder Metallurgy Short Course PMSC-2023’ organized by Powder Metallurgy Association of India (PMAI), Pune during October 3-6, 2023

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80 Dr. Mani Karthik delivered a lecture on "An Overview of Thermal Energy Storage: Development of Low-Cost Materials and Prototype System" as part of ‘ARCI Colloquium Series’ organized by ARCI on October 11, 2023

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81 Dr. Tata Narasinga Rao delivered a keynote address on “"Green Hydrogen Production, Storage & Utilization Technologies: An Indian Perspective" at the ‘World Hydrogen Energy Summit & Expo 2023’ jointly organized by Energy And Environment Foundation, Ministry of New and Renewable Energy, and NITI Aayog during October 16-17, 2023

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82 Dr. Sanjay Bhardwaj delivered an invited lecture on “Innovations in Technology Transfer and TRL” at the Workshop on ‘TRL Assessment Techniques for Technology Commercialization’ organized by GB Pant University of Agriculture and Technology, Pantnagar on October 18, 2023 (Virtual)

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83 Dr. Tata Narasinga Rao delivered an invited lecture on "Translational Materials Research (from Powder to Product)" at the ‘International Conference on Metallurgical Engineering and Centenary Celebration (METCENT 2023)’ organized by Indian Institute of Technology, BHU during October 26-28, 2023

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84 Dr. Gururaj Telasang delivered a talk on “Additive Manufacturing: Laser Beam Powder Bed Fusion” organized by Wipro, Hyderabad on October 26, 2023

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85 Dr. Naveen Manhar Chavan delivered an invited talk on “Surface Engineering and Beyond” at Mahatma Gandhi Institute of Technology, Hyderabad on November 01, 2023

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86 Dr. S Kumar delivered an invited lecture on “Effect of Powder Temperature on Bonding Mechanism in Cold Spraying” at ‘Asian Thermal Spray Conference (ATSC 2023)’ organized by Indian Institute of Technology (IIT), Madras during November 2-4, 2023

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87 Dr. B V Sarada delivered an invited lecture on "Nanostructured Materials for Li-S Batteries at School of Engineering Science and Technology" organized by University of Hyderabad on November 3, 2023

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88 Dr. Ravi Bathe delivered a keynote talk on “Laser Cladding Technology for Engineering Component Repairs” at the ‘conference on Advances in Laser & Arc Cladding Technologies – ALACT-2023' organised by Indian Institute of Welding (IIW) – Jamshedpur during November 3-4, 2023

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89 Dr. Gururaj Telasang delivered a contributory talk on “Laser Direct Metal Deposition of High-Speed M2 Tool Steel” at a conference on 'Advances in Laser & Arc Cladding Technologies – ALACT-2023' organized by IIW – Jamshedpur during November 3-4, 2023

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90 Dr. Naveen Manhar Chavan delivered an invited talk on “Cold Spray - Structure Property Correlations in Cold Sprayed Coatings” at ‘12th Asian Thermal Spray Conference’ organized by Indian Institute of Technology (IIT) Madras on November 4, 2023

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91 Dr. L Rama Krishna delivered a lecture on "Surface Engineering: Fundamentals and Applications" at ‘Tow-day Workshop on Metallurgy for Non-Metallurgists: Industrial Practices’ organized by The Indian Institute of Metals, Hyderabad Chapter on November 07, 2023

92 Dr. Mani Karthik delivered an invited talk on "Emerging Application of Advanced Materials for Energy Storage and Conversion" organized by Department of Mechanical Engineering V.R. Siddhartha Engineering College (VRSEC) Vijayawada, Andhra Pradesh, on November 9, 2023

93 Dr. M Buchi Suresh delivered an invited talk on “Solid Oxide Fuel Cell Development at ARCI” at the ‘One Day Workshop on Advanced Semiconductor Materials for Renewable Energy’ organized by IIT Jabalpur on Nov 10, 2023

94 Dr. B V Sarada delivered an invited lecture on "Nanostructured Materials for Energy Storage and Biomedical Applications" at 'International conference on Advanced Materials and Fluid Mechanics' organized by VTI, Bengaluru during November 23-24, 2023

95 Dr. V Ganapathy delivered lecture on “Emergence of New Solar Cells and its future Perspectives”, at 'The National Conference on Materials Science and Sustainable Energy’ Organized by Crescent Institute of Science & Technology , Chennai during November 27-28, 2023

96 Dr. R. Balaji delivered an invited lecture on "Low Temperature PEM fuel Cell Advancement" at the 'Entrepreneurship Skill Development Programme Department of Renewable Energy' organized by Gandhigram University, Dindigul, Tamilnadu on November 28, 2023

97 Dr. Srinivasan Anandan, delivered an invited lecture on “Lab to Semi-Pilot Scale: Indigenous Energy Storage (Li-ion Battery and Supercapacitor) Materials for Electric Vehicles Applications” at the 'National Conference on Functional Materials for Sustainable Energy & Information Technology (FuMSEIT – 2023)' organized by B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai on November 28, 2023

98 G. Sivakumar delivered an invited talk on “Identifying the Optimum Hardware and Processing Conditions to Demonstrate High-Velocity Air-Fuel Sprayed Cr3C2-NiCr Coatings for High Temperature Wear-resistant Applications” at the ‘Asian Thermal Spray Conference 2024’ organized by Indian Institute of Technology (IIT), Madras on December 03, 2023

99 Dr. Raman Vedarajan delivered an invited lecture on "Circular Solutions: Giving New Life to Polymer Electrolyte Membranes from Fuel Cells and Electrolysers" at the ‘Energy Summit Workshop’ organized by IIT Madras, Chennai on December 6 2023

100 Dr. M B Sahana delivered an invited talk on "The Impact of Carbon Binder Domain Networks on the Electrochemical Performance of Lithium-Ion Battery Electrodes" at the ‘Energy Summit Workshop' organized by IIT Madras, Chennai on December 6, 2023

101 Dr R Easwaramoorthi delivered keynote lecture on “Perovskite Solar Cells: Current Status and Future Prospective” in '4th International Conference on Advanced Functional Materials for Sustainable Energy Application' organized by KL University, Guntur during December 6-8, 2023

102 Dr. M B Sahana delivered an invited talk on "Impact of Rheological Properties of Composite Slurry on the Characteristics of Electrode Laminate in Lithium-Ion Batteries" organized by IIT Roorkee on December 7, 2023

103 Dr. Mani Karthik delivered an invited talk on "Advanced Materials and Technologies for Solar Thermal Energy Conversion Storage and Utilization" at the ‘National Conference on New and Renewable Energy Resources for Sustainable Future (NREERSF-2023)’ organised by Yogi Vemana University, Kadapa, Andhra Pradesh, during December 7-8, 2023

104 Dr. S Sakthivel delivered an invited lecture on "Functional Materials and Coatings for Solar Thermal and PV Applications" at the ‘National Conference on New and Renewable Energy Resources for Sustainable Future' organized by Yogi Vemana University, Kadapa, Andhra Pradesh during December 7- 8, 2023

105 Dr R Easwaramoorthi delivered a keynote lecture “Perovskite Solar Cells: Current Status and Future Prospective” and chaired a session in '4th International Conference on Advances in Renewable and Green Energy Technology' organized by Guru Ghasidas Vishwavidyalaya (A Central University), Chhattisgarh during December 7-8,2023

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106 Dr. Tata Narasinga Rao delivered a popular lecture on “Translational Materials Research for Energy Storage Applications (from Powder to Product)” at the ‘2nd International Meeting on Energy Storage Devices (IMESD 2023) and Industry-Academia Conclave’ organized by the Indian Institute of Technology (IIT), Roorkee during December 7-10, 2023

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107 Dr. R Prakash delivered a Keynote lecture on “Effect of Temperature on Cyclic Stability of Lithium Iron Phosphate Cathodes Derived by Eco-Friendly Process for Lithium-ion Batteries” at the '2nd International Meeting on Energy Storage Devices (IMESD-2023) and Defence-Industry-Academia Conclave' organized by IIT Roorkee, during December 7-10, 2023

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108 Dr. Srinivasan Anandan, delivered an invited lecture on “Lab to Fab Translation: Cost Effective and High-Performance Indigenous Materials for Energy Storage Applications” at ‘IMESD-2023 and Defence-Industry-Academia Conclave' organized by Indian Institute of Technology (IIT) Roorkee during December 7 -10, 2023

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109 Dr. V.V.N. Phani Kumar delivered an invited lecture on "Micron-sized Lithium Iron Phosphate as Cathode Using eco-Friendly Binders for Lithium-ion Batteries" at the ‘ IMESD-2023 and Defence-Industry-Academia Conclave’ organized by IIT Roorkee during December 7-10, 2023

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110 Dr. B. V. Sarada delivered an invited lecture on "Nanostructured Materials for Hybrid Super capacitor Applications" at 'IMESD-2023' organized by IIT Roorkee during December 7-10,2023

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111 Dr. Sanjay Bhardwaj delivered an invited lecture on “R & D Collaborations and Technology Transfer Process” at ‘National IP Workshop on IP Yatra’ organized by MLR Institute of Technology, Hyderabad during December 8-9, 2023

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112 Dr. R. Balaji delivered an invited lecture on "Hydrogen Energy Materials – The Hero for Net Zero” at the ‘International Conference on Advanced Materials and their Applications' organized by Department of Chemistry, VOC college, Tuticorin, Tamilnadu on December 12, 2023

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113 Dr. R Prakash delivered an inaugural address on “Indigenous Battery Technology Development for Atma Nirbhar Bharat initiatives“ at 'KPIT Sodium-ion Battery Technology Launch Program' organized by KPIT Technologies Ltd, Pune on December 12, 2023

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114 Dr. R Balaji delivered an invited lecture on “Hydrogen Fuel Cell Technology- A Sustainable Solution” at the ‘ATAL Faculty Development Program on Alternative Fuels – Hydrogen Energy and Environment' organized by Department of Automobile Engineering, MIT campus, Chennai on December 13, 2023

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115 Dr. K Ramya delivered a lecture on "Fuel Cell Vehicles- India Context" at the' International Transportation Electrification Conference- ITEC INDI', jointly organized by SAEINDIA and IEEE IAS, Chennai during December 13-15, 2023

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116 Dr. Ravi Bathe delivered a keynote talk on “Design and Fabrication of Multifunctional Surfaces by Ultrafast laser Processing” at the ‘1st International Conference on Materials Processing using Lasers and Surface Engineering (IMPULSE 2023)’ organized by IIT Madras Chennai, during December 14-15, 2023

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117 Dr. V Ganapathy delivered lecture on “How to Fabricate Perovskite Solar Cells” at the ‘Two-day Workshop on Perovskite Solar Cells' organized by Bharathidasan University, Tiruchirapalli during December 15-16, 2023

118 Dr. Raman Vedarajan delivered an invited lecture on the “A Gateway to Sustainable Solutions through Green Hydrogen” at the ‘International Symposium on Recent Trends in Sustainability in Chemical Sciences’ organized by Sri Sathya Sai Institute of Higher Learning, Puttaparti on December 16, 2023

119 Dr. B V Sarada delivered an invited lecture on "Nanostructured Materials for CIGS based Tin-film Solar Cells" at the 'XXII International Workshop on the Physics of Semiconductor Devices (IWPSD 2023)' organized by IIT Madras in collaboration with Society for Semiconductor Devices and Semiconductor Society (India) at Chennai during December 16-19, 2023

120 Dr. Nitin P Wasekar delivered an invited talk on “Tribological Properties of Electrodeposited Coatings, Composites and Multilayers” at the ‘Workshop on Surface Engineering and Tribological Challenges in Sustainable Manufacturing’ organized by Birla Institute of Technology Mesra, Ranchi during December 18-24, 2023

121 Dr. M Buchi Suresh delivered a talk on “Development of Ba0.5Sr0.5(Co0.2-xZnx)Fe0.8O3-δ (BSCZF) System and Performance Evaluation as a Cathode Material for IT-SOFC Application” at the ‘International Conference on Exploring the Emerging world of Ceramics and Glass’ organized by Indian Ceramic Society at CSIR-CGCRI, Kolkata during December 19-21, 2023

122 Dr. Naveen Manhar Chavan delivered an invited talk on “Cold spray-Microstructure and Indentation Studies” at the ‘7th International Indentation Workshop (IIW7)’ organized by University of Hyderabad (UoH), Hyderabad on December 20, 2023

123 Dr. Srinivasan Anandan delivered an invited lecture on “Advancing Cost-efficient High Performance Indigenous Materials for EV Applications from Lab Innovations to Semi-Pilot Scale Production” at the ‘International Conference on Advances in Applied Sciences (ICAAS-2023)' organized by Vasavi College of Engineering, Hyderabad during December 22-23, 2023

124 Dr. Gururaj Telasang delivered an expert talk on “Material Science in Additive Manufacturing” at the ‘AICTE-ATAL Faculty Development Program on Metal Additive Manufacturing' organized by IFHE University, Hyderabad on December 26, 2023

125 Dr. Srinivasan Anandan, delivered an invited lecture on “Indigenous Materials for Energy Storage Applications: Lab Innovations to Semi-Pilot Scale Production” at the ‘National Convention of Electrochemists (NCE-23)' organized by SRM Institute of Science and Technology, Chennai during January 4-5, 2024

126 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’ organized by Society for Advancement of Electrochemical Science and Technology (SAEST) at SRM Institute of Science and Technology, Tamilnadu during January 4- 5, 2024

127 Dr. Dibyendu Chakravarty delivered an invited lecture on “Spark Plasma Sintering: A Versatile Technique for Developing High Performance Components for Niche Applications” at the ‘International Conference on Functional Materials 2024' organized by IIT Kharagpur during January 9-11, 2024

128 Dr. Joydip Joardar delivered an Invited lecture on “Ultrafine Cr2AlC MAX Phase-based Composites: Microstructure and Deformation Behavior” at the 'Conference on Recent Advances in Materials and Manufacturing Processes (RAMMP 2024)' organized by MGIT Hyderabad, India on January 13, 2024

129 Dr. Malobika Karanjai delivered an expert lecture on “Sway of Characterisation Techniques in Particulate Materials” at the 'PMAI-ARCI Workshop on Advanced X-Ray Characterisation in Powder Metallurgy and Particulate Materials (AXT-PM2)' organized by ARCI, Hyderabad during January 17-19, 2024

130 Dr. Joydip Joardar delivered a lecture on “Two-dimensional (2D), High-Intensity Micro-Focus X-Ray Diffraction” at the 'Workshop on Advanced X-ray Techniques for Powder Metallurgy and Particulate Materials (AXT-PM2)' organized by ARCI Hyderabad during January 17-19, 2024

131 Dr. Joydip Joardar, delivered a Lecture on “Quantitative Phase Analysis from XRD Profile by Rietveld Method” at 'Workshop on Advanced X-ray Techniques for Powder Metallurgy and Particulate Materials (AXT-PM2)' organized by ARCI Hyderabad during January 17-19,2024

132 Dr. M Buchi Suresh delivered an invited talk on “Structural Ceramics: Technologies developed @ ARCI” organized by St Francis College for Women, Hyderabad on January 18, 2024

133 Dr. Sanjay Bhardwaj delivered an invited lecture on “Translational Research and Assessing the Technology Readiness Levels (TRLs) of R & D” organized by DST – Technology Enabling Centre at University of Hyderabad on January 24, 2024

134 Mr. S Sudhakara Sarma delivered an invited lecture on "High-Temperature Resistant Alloys by Powder Metallurgy" organized by the Military College of Electronic and Mechanical Engineering (MCEME), Secunderabad on January 25, 2024

135 Dr. Sanjay Bhardwaj delivered an invited lecture on “Collaborations and Technology Transfers to Promote Entrepreneurship” at the ‘National Faculty Development Program - Viksit Bharat 2047 – Role of the Engineering Faculty’ organized by Institution Innovation Councils of Anantha Lakshmi Institute of Technology and Sciences, Anantapuramu and Rajiv Gandhi University of Knowledge Technologies, Anantapur during January 29 – February 02, 2024

136 Dr. Srinivasan Anandan, delivered an invited lecture on “Indigenous Materials for Energy Storage Applications: Demonstration of Lab to Semi-Pilot Scale Production” organized by the Deptartment of Physics, Osmania University, Hyderabad on January 31, 2024

137 Dr. Srinivasan Anandan, delivered an invited lecture on “Indigenous Materials for Energy Storage Applications: Demonstration of Lab to Semi-Pilot Scale Production” at the '7th International Conference on Recent Trends in Applied Science and Technology - (ICRTAST-2024)' by the Department of Engineering Physics, Annamalai University, Tamil Nadu during February 2-3, 2024

138 Dr. Raman Vedarajan delivered an invited lecture on "Fuel Cell Technologies" at the 'ATAL-Faculty Development Program on Green Technologies' organized by National Engineering College, Kovilpatti on February 5, 2024

139 Dr. Gururaj Telasang delivered an expert talk on “Powder Bed Additive Manufacturing: Process and Applications” at the ‘Five-day FDP -Additive Technology Enhancement Program (ATEP)’, organized by NMAM Institute of Technology, Nitte University, Udupi, Karnataka during February 5-9, 2024

140 Dr. V Ganapathy delivered a lecture on “Semiconductors for Renewable Energy”, at 'The Industrial Lecture Series' organized by Indian Institute of Technology (IIT), Tirupati on February 12, 2024

141 Dr. Sanjay Bhardwaj delivered an invited lecture on “Fostering Effective Collaboration in the Advanced Materials Technology Domain for Energy and Environment Applications” at ‘2nd International Conference on Novel Materials and Technologies for Energy and Environmental Applications (NMTE2A)’ organized by Birla Institute of Technology and Science (BITS) Pilani, Hyderabad during February 17-18, 2024

142 Dr. B V Sarada delivered an invited lecture on "Problem Deinition Formulation and Design of Research" at JNTUH, Hyderabad on February 20, 2024

143 Dr. R Subasri delivered an invited talk on “Nanocomposite Coatings for Biofilm Inhibition and Antibacterial Applications” at the ‘Two-day National Conference on Innovations and Emerging Novel Technologies in Biological Sciences' organized by St Joseph’s College for Women (Autonomous), Visakhapatnam on February 22, 2024

144 Dr. Gururaj Telasang delivered an invited talk on “Additive Manufacturing of Tool Steels: Challenges and Case Studies” at the' International Conference on Powder Metallurgy & Particulate Materials and Exhibition' organized by Powder Metallurgy Association of India (PMAI), Pune during February 25-28, 2024

145 Dr. Malobika Karanjai delivered an invited lecture on “Novel Approach of Tuning of Ferrite based Magnetic Composites using Core-shell Powders for Improved Magnetic Flux density” at the ‘International Conference on Powder Material and Particulate Materials and Exhibition' organized by Powder Metallurgy Association of India (PMAI) at Pune during February 25-28, 2024

146 Dr. Malobika Karanjai delivered an invited talk on “Science for Sustainable Future in tune with the theme of Indigenous Technologies for Viksit Bharat” as Chief Guest on the occasion of National Science Day Celebrations held on February 28, 2024 at Little Flower Degree College, Hyderabad

147 Dr. Joydip Joardar delivered an invited lecture on “Sintering and Mechanical behavior of Ultrafine Cr2AlC MAX Phase-Based Composite” at the 'PMAI-PM24 Annual Conference' at Pune during February 25-29, 2024

148 Dr. Joydip Joardar delivered an invited lecture on “2D High Intensity Micro Focus X-Ray Diffraction Techniques” organized by 'Aditya Birla Science and Technology Center' at Taloja (Navi Mumbai), India on February 26, 2024

149 Dr. D Sivaprahasam delivered an invited talk on “Fabrication and Characterization of Rigid Thermoelectric Modules Composed of NaxPb1-xTe – Mg2Si1-xSnx, BixSb1-xSe-(Bi1-x-ySbxMy)Te3 Compounds” at ‘Indo-German Workshop on Thermoelectric Devices for Emerging Applications’ organized by IISER Thiruvananthapuram, during February 26-28, 2024

150 Dr R Easwaramoorthi delivered a invited lecture on “Materials and Device Concepts of Perovskite Solar Cells” and chaired a session in '4th International Conference on Advanced Functional Materials and Devices' organized by SRM Institute of Science and Technology, Chennai during February 26-29,2024

151 Dr. Srinivasan Anandan, delivered an invited lecture on “Indigenous Materials for Energy Storage Applications: From Lab Innovations to Semi-Pilot Scale Production” at the 'International Conference on Advanced Functional Materials and Devices – 2024’ organized by Nanotechnology Research Centre SRM Institute of Science and Technology, Kattankulathur, Chennai Tamil Nadu, India during February 26-29, 2024

152 Dr. M B Sahana delivered an invited talk on “Lithium-ion Batteries for Electric Vehicle Application" at the ' National Seminar on Sustainable Energy with Advanced Technology (SEAT -2024)’ organized by Department of Chemistry, Anna University, Chennai on February 27, 2024

153 Dr. R Balaji delivered an invited lecture on "Electrolysis – Carbon free Hydrogen Production Method” at the ‘SEAT-2024" organized by Department of Chemistry, Anna University , Chennai on February 27, 2024

154 Dr. Raman Vedarajan delivered an invited lecture on "Materials and Chemistry in PEM Fuel Cell" at the 'National Seminar on Sustainable Energy with Advanced Technology' College of Engineering Guindy, Anna University, Chennai on February 27, 2024

155 Dr. Raman Vedarajan delivered an invited lecture on "Chemistry of Materials in Proton Exchange Membrane Fuel Cell" at the 'Recent Advances in Materials Science (RAMS-2024)’ organized by SAS Engineering College, Chennai on February 28, 2024

156 Dr. D Prabhu delivered and invited talk on “Approaching Science – A Student’s Perspective” at the 'National Science Day Celebration' organized by Department of Chemistry, Anna University, Chennai on February 28, 2024

157 Dr. S Sakthivel delivered an invited lecture on "Indigenous Technology Development of Functional Coatings and Devices for Solar thermal & PV Applications" at the 'National Science Day' organized by Vasavi Engineering College, Hyderabad on February 28, 2024

158 Dr. Srinivasan Anandan, delivered an invited lecture on “Cost-efficient High Performance Indigenous Materials for EV Applications: Lab Innovations to Semi-Pilot Scale Production” at the 'International Conference on Emerging Nanomaterials in Biology, Chemical and Engineering Applications (INBCEA – 2024)' organized by Department of Chemistry, VELS University, Chennai during February 28-29, 2024

159 Dr Manjusha Battabyal delivered an invited talk on "Nanostructured Antimonides for Waste Heat Harvesting" at the 'International Conference on Advanced Functional Materials and Devices (AFMD-2024)’ organized by Nanotechnology Research Centre, SRMIST, Chennai on February 29, 2024

160 Dr. Raman Vedarajan delivered an invited lecture on "Sustainability in Electrocatalyst and Energy" at the 'International Conference on Emerging Nanomaterials in Biology, Chemical and Engineering Applications (INBCEA - 2024)’ organized by Vel Tech University on February 29, 2024

161 Dr. R Prakash delivered a plenary lecture on “Energy Storage: Lithium-ion Batteries Ecosystem @ ARCI”at the 'Sustainable Bharat-2024, Sustainability & Energy Practitioners Association (SEPA)’ organized by Andhra Chamber of Commerce, Chennai on March 1, 2024

162 G. Sivakumar delivered an invited talk on “Advanced Metallic Alloy Coatings through Thermal Spray Processing for Diverse Industrial Applications” at the ‘AMALGAM 2024’ organized by Indian Institute of Technology (IIT), Madras on March 3, 2024

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163 Dr. Tata Narasinga Rao delivered a lecture on “Translational Materials Research for Energy Storage applications (from Powder to Product)” organized by Indian Institute of Technology (IIT), Hyderabad on March 05, 2024

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164 Dr. Sanjay Bhardwaj delivered an invited lecture on “Enhancing Impact of Research Capability” for M.Tech. students and faculty from National Institute of Technology (NIT), Warangal on March 5, 2024

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165 Dr. Mani Karthik delivered an invited talk on "Synthesis Characterization and Properties of Stroage Materials for Energy Storage Applications" at the ‘National Seminar on Materials Science and Characterisation Techniques (NSMCT-2024)’ organised by Department of Physics, Acharya Nagarjuna University, Guntur during March 6-7, 2024

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166 Dr. G Sivakumar delivered an invited talk on “Wear Resistant Ceramic Composite Coatings through HVAF Spraying for Industrial Applications: New Directions” at the ‘International Conference on Ceramics for Frontier Sectors: Emerging Advances and Prospects (CerAP 2024)’ organized by Indian Institute of Technology (IIT), Roorkee on March 11, 2024

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167 Dr. B P Saha delivered an invited talk on “Advanced Ceramics for Aerospace Applications” at the ‘4th Global Ceramic Leadership Roundtable on Ceramics for Frontier Sectors: Emerging Advances and Prospects (CerAP2024)’ organized by IIT Roorkee, Uttarakhand during March 11-12, 2024

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168 Dr. Ravi Bathe delivered an invited talk on “Multifunctional Surface Structures by Ultrafast Laser Processing” at the 'Workshop on Advances and Challenges in Pulsed Laser Deposition (PLD) for Growing Heterostructures, 2D Layers and Nanostructures' organized by LAMDA Lab, National Centre for Nanosciences and Nanotechnology (NCNN), University of Mumbai during March 14-15, 2024

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169 Dr. R Senthil Kumar delivered a talk on “Recent Research Trends on Sustainable Ceramics” organized by Anna University, Chennai on March 18, 2024 (Virtual)

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170 Dr. Sanjay Bhardwaj delivered an invited lecture on “Technology Commercialization” for students and faculty members of Institute of Aeronautical Engineering, Hyderabad on March 19, 2024

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171 Dr. Sanjay Bhardwaj delivered an invited lecture on “Patenting, Technology Transfer and Commercialization” at the ‘Short Term Training Program (STTP) on Empowering Faculty in Research and Innovation’ organized by Ganpat University, Gujarat during March 19-23, 2024

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172 Dr. R. Subasri delivered an invited talk on “Bioinspired Nanocomposite Coatings for Diverse Applications” at the 'International Conference on Role of Women in Inspiring and Inclusive Growth of Society' organized by Government City College (A), Hyderabad on March 21, 2024

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173 Dr. Papiya Biswas delivered a talk on “Development of Transparent Ceramics at ARCI” at the ‘First All India Scientific and Technical Official Language Workshop’ organized by ARCI, Hyderabad during March 21-22, 2024

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174 Dr. Prasenjit Barick delivered a talk on “Development of Lithium Aluminosilicate Based Low Expansion Glass-ceramic – ARCI Perspective” at the ‘First All India Scientific and Technical Official Language Workshop’ organized by ARCI, Hyderabad during March 21-22, March, 2024

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175 Dr. Raman Vedarajan delivered an invited lecture on "From Lab to Market: Navigating the Translational Marathon for Research Success" organized by Dr. Paarivendhar Research Colloquium (DPRC- 2024) at SRM Institute of Science and Technology, Chennai on March 26, 2024

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176 Dr. R Balaji delivered an invited lecture on "Proficiency in Getting Research Funding in Hydrogen Energy Technologies for Maritime Application” organized by Indian Maritime University, Chennai on March 27, 2024

Participation in Training Programmes in India

1	Dr. Rambha Singh attended two days training programme on “Parliamentary Questionnaire on Implementation of Official Language” organized by Department of Science and Technology (DST), New Delhi during May 18-19, 2023.
2	Mr. R. Ranga Naik attended Management Development Programme on “Accounts of Autonomous Bodies” organized by “Arun Jaitley National Institute of Financial Management (AJNIFM)” at Faridabad, Haryana during June 12-14, 2023.
3	Mr. Sudheendra attended half-day online workshop on “Framing/Amendments of Recruitment Rules” organized by “Institute of Secretariat Training & Management (ISTM)” at Department of Personnel & Training (DPT), New Delhi on July 6, 2023.
4	Ms. Priya Anish Mathews attended “Intellectual Property Rights Workshop” at T-Hub, Hyderabad on July 18, 2023.
5	Mr. R. Sunil Naik attended three days online training programme on “Pay Fixation for Government Employees “organized by “Institute of Secretariat Training & Management (ISTM)” at Department of Personnel & Training (DPT), New Delhi during July 24-26, 2023.
6	Mr. A. Srinivas and Mr. Sudheendra attended online training programme on “Right to Information for Public Information Officers” (RTI-PIO-35) organized by “Institute of Secretariat Training & Management (ISTM)” at Department of Personnel & Training (DPT), New Delhi during September 25-27, 2023.
7	Mr. P. Sai Kishore and Mr. Ch. Venugopal attended online workshop on “Noting and Drafting” organized by “Institute of Secretariat Training & Management (ISTM)” at Department of Personnel & Training (DPT), New Delhi during September 25-26, 2023.
8	Mr. A. Balraj Yadav attended training programme on “Treasury Single Account (TSA) and Central Nodal Agency (CAN) Model 1” at INGAF, Chennai on October 16, 2023.
9	Dr. Dibyendu Chakravarty attended training programme on “Science & Technology: Global Developments and Perspectives” conducted by “National Institute of Advanced Studies (NIAS)” at Indian Institute of Science Campus (IISc), Bengaluru during 20th November to December 1, 2023.
10	Mr. Pokalkar Sai Kishore attended online workshop on “E-Procurement” organized by Institute of Secretariat Training & Management (ISTM), New Delhi during January 8-9, 2024.
11	Mr. K R C Soma Raju attended three day training program on “Industrial Corrosion and Its Control” organized by “The Electrochemical Society of India” through online during February 12-14, 2024.
12	Mr. B Amarendhar Rao (Mr. Manish Tak) attended the “International Virtual Faculty Development Programme (FDP) on Global Conversations in Mechanical Engineering: Bridging Innovation and Sustainability” organized by Madanapalle Institute of Technology & Science, Madanapalle, Andhra Pradesh during February 19-23, 2024
13	Mr. N. Srinivas and Mr. Anirban Bhattacharjee attended conference on “Recent Advances in Public Procurement” at Arun Jaitley National Institute of Financial Management (AJNIFM), Faridabad, Delhi on March 4, 2024.

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

1	Dr. Gururaj Telasang participated in the "National Technology Day 2023" organized by DST, New Delhi on May 11 ,2023
2	Mr. Manish Tak attended the "2nd National Conference on Medical Additive Manufacturing" organized by National Centre for Additive Manufacturing (NCAM), Hyderabad on May 19, 2023
3	Mr. Manish Tak attended “Hyderabad International Machine Tool & Engineering Expo (HIMTEX-2023)" organized by HITEX Exhibition Centre, Hyderabad during August 18-21, 2023
4	Mr. Manish Tak participated in a Luminary lecture on “Additive Manufacturing for Aerospace Applications - Opportunities and Challenges” organized by Institution of Engineers, Hyderabad on August 27, 2023
5	Dr. Sanjay R Dhage participated in the "Third All India Official Language Conference" organized by Hindi Section, Ministry of Home, Govt. of India at Pune during September 14-15, 2023
6	Dr. T Mohan participated in the “Town Hall Meeting on Stationary Energy Storage” organized by IESA, Chennai on September 28, 2023

7	Dr. L. Rama Krishna participated in "Defence & Space Conclave" organized by Confederation of Indian Industry (CII), Hyderabad Chapter on October 05, 2023
8	Ms. Aarti Gautam (Dr. R. Subasri) attended a workshop on “Metallurgy for Non-Metallurgists: Industrial Practices (MNM-2023)” organized by The Indian Institute of Metals, Hyderabad during November 6-7, 2023
9	Ch. Gowthami (Dr. S Anandan) attended a workshop on “Metallurgy for Non-Metallurgists: Industrial Practices (MNM-2023)” organized by The Indian Institute of Metals, Hyderabad during November 6-7, 2023
10	Mr. S Sankar Ganesh, Mr. K Naresh Kumar, Mr. M R Renju attended “CYBERSECURITY SUMMIT 2023” organized by CII Telangana, Hyderabad on November 10,2023
11	Dr. PK Jain, Dr. Sanjay R Dhage and Dr. Ravi Kali participated in the "Indian Conference on Carbon Materials (ICCM-2023)" organized by BARC, Mumbai during November 30 - December 02, 2023
12	Dr. Gururaj Telasang participated in the "AMTECH 2023 Exhibition and Conference" organized by CNT Exposition and Services, Hyderabad during December 1-2, 2023
13	Mr. S. Ramakrishnan participated the “ARCI-ICDD Joint Workshop on Materials Characterization using X-ray Diffraction” organized by ARCI and The International Centre for Diffraction Data (ICDD) during December 3-4,2023
14	Dr. Varsha John (Dr. Sahana) participated the “ARCI-ICDD Joint Workshop on Materials Characterization using X-ray Diffraction” organized by ARCI and the International Centre for Diffraction Data (ICDD) during December 3-4, 2023
15	Dr. P K Jain and Dr. Sanjay R Dhage participated in the "61st Joint Technological Conference" organized by Bombay Textile Research Association (BTRA) Mumbai during December 14-15, 2023
16	Ms. K S Athira attended the "Advanced Welding Technologies in National Mission Programs (AWTNMP – 2024)" jointly organized by the Indian Institute of Welding Hyderabad Branch and Defence Research and Development Laboratory (DMRL), Hyderabad during January 11-12, 2024
17	Ms. K S Athira and Mr. E Anbu Rasu participated in the workshop on ‘’Advanced Welding Technologies in National Mission Programs’’ organized by DRDL, Hyderabad during January 11-12, 2024
18	Ms. K S Athira attended the "Advanced X-ray Techniques for Powder Metallurgy and Particulate Materials (AXT-PM2)" jointly organized by Powder Metallurgy Association of India (PMAI) and ARCI, Hyderabad during January 17-19, 2024
19	Dr. Tata Narasinga Rao, Dr. Sanjay Bhardwaj, Dr. S. Anandan, Dr. Kaliyan Hembram, Dr. R. Balaji, Mr. Arun Seetharaman, and Dr. Raman Vedarajan participated in the "India International Science Festival (IISF-2023)" Exhibition organized by Ministry of Science and Technology, Ministry of Earth Sciences, Department of Space, Department of Atomic Energy, Government. of Haryana, and Vijnana Bharati, at DBT THISTI-RCB Campus, Faridabad during January 17-20, 2024
20	Mr. Ramay Patra (Dr. R. Subasri) attended a workshop on “Industrial Corrosion and Control (ICC 2024)” organized by the Electrochemical Society of India, Indian Institute of Science and NIT Surathkal during February 12-14, 2024 (Online)
21	Mr. K R C Soma Raju attended a workshop on “Industrial Corrosion and Control (ICC 2024)” organized by the Electrochemical Society of India, Indian Institute of Science, and NIT Surathkal during February 12-14, 2024 (online)
22	Dr. L. Rama Krishna attended a discussion meeting on "Light Weighting" organized by IIT Hyderabad on January 25, 2024
23	Dr. L. Rama Krishna attended a workshop on "Recent Advances in Materials and Manufacturing Processes (RAMMP), organized by Mahatma Gandhi Institute of Technology (MGIT), Hyderabad on February 13, 2024
24	Dr. T Mohan attended the ‘SAEISS Dr. G Padmanabham Memorial Electric Two Wheeler Design Competition 2024’ organized by Rajalakshmi Engineering College, Chennai., as a Judge for evaluating the "Electric Two Wheelers made by the participants” during February 17-18, 2024
25	Dr. Ravi Bathe attended a brainstorming meeting on “National Quantum Mission” organized by DST, New Delhi on February 20, 2024
26	Mr. Arun Seetharaman participated in the "International Engineering Sourcing Show (IESS-2023)" Exhibition organized by EEPC-India at Coimbatore during March 04-06, 2024

Panel Discussion

Name	Technical Session Topic	Event Name	Date
Dr. R Prakash	Prospects of LTO Batteries: Challenges in Manufacturing, Packaging, Protection, Safety and Marketing"	EV Consortium Conclave on LTO Batteries and its BMS, (Kerala Development and Innovation Strategic Council), Thiruvananthapuram	April 5, 2023
Dr. R Prakash	Requirement of Energy Storage System (ESS) Manufacturing-State and Central Aiding Policies/Schemes/Systems	EV Consortium Conclave on LTO Batteries and its BMS, (Kerala Development and Innovation Strategic Council), Thiruvananthapuram	April 5, 2023
Dr. S Anandan	LTO Batteries and its BMS	EV Consortium Conclave on LTO Batteries and its BMS, (Kerala Development and Innovation Strategic Council), Thiruvananthapuram	April 5, 2023
Dr. Sanjay Bhardwaj	The Quality of Scholarly Scientific Knowledge	Synergizing Global Efforts to Expand the Access to Scholarly Scientific Knowledge organized by RICH (Research and Innovation Circle of Hyderabad), Hyderabad S&T Cluster and Office of Principal Scientific Adviser (PSA) to Government of India	July 5, 2023
Dr. Sanjay Bhardwaj	Problems in Technology Commercialization	Session organized by ASPIRE-BioNEST at University of Hyderabad and TIFAC (Department of Science & Technology , Government of India)	July 12, 2023
Dr. S Sakthivel	Challenges and Opportunities in Solar Energy – A Research Perspective	Sustainable India – 2023, Conducted by Sustainability and Energy Practitioners Association (SEPA), Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad	August 23, 2023
Dr. BP Saha	Ceramics and Engineering & Machine Tools Industry	Ceramic Outlook-Challenges, Opportunities, and Way Forward	October 9, 2023
Dr. Sanjay Bhardwaj	Value-adding and Meaningful IP Strategies	World IP Forum Conference 2024 at Bengaluru	January 11, 2024
Dr. S Anandan	Advanced X Ray based Techniques for Powder Metallurgy and Particulate Materials (AXT-PM2)	PMAI-ARCI Workshop	January 17-19, 2024
Dr. Sanjay Bhardwaj	Evolving IP Licensing Strategies in Materials Science and Engineering	STEM Summit 2024	February 1-2, 2024
Dr. Sanjay Bhardwaj	National Innovation and Startup Policy – Benefits and Challenges for Academia and Startups	Webinar organized by DST – Centre for Policy Research at University of Hyderabad	February 12, 2024
Dr. R Balaji	Publication – Patent – Product	SAMAVESHA 24, A National Science Day Initiative conducted by National Institute of Technology (NIT), Trichy	February 28, 2024

SCI Publications – 2023

1 Krishna Valleti, Pooja Miryalkar, L Rama Krishna, “Efficacy of TiCrN/DLC Coatings for Service Life Enhancement of Stamping Dies”, Vacuum, Vol. 217, Art. 112534, 2023

2 D Vijaya Lakshmi, P Suresh Babu, L Rama Krishna, V Vijaya Durga, D Srinivasa Rao, “Electrochemical Corrosion and Solid Particle Erosion Response of Y2O3 Dispersed FeAl Coatings Deposited by Detonation Spray”, Intermetallics, Vol. 155, Art. 107844, 2023

3 G Neelima Devi, S Kumar, M Tarun Babu, G Vinay, M Naveen Chavan, A Venu Gopal, “Assessing Critical Process Condition for Bonding in Cold Spraying”, Surface & Coatings Technology, Vol. 470, Art. 129839, 2023

4 SB Chandrasekhar, M Ramakrishna, Nitin P Wasekar, Tata Narasinga Rao, BP Kashyap, “Grain Boundary and Grain Interior Strengthening in Nano-micron Grain Sized Cu-1wt.%Al2O3 Composite”, Materials Science and Technology, Vol. 39(11), p 1313-1321, 2023

5 G Neelima Devi, A Venu Gopal, S Kumar, “Investigations on Inter-splat Boundaries of Cold Sprayed Ni-Cr Coatings upon High Temperature Oxidation”, Surface & Coatings Technology, Vol. 467, Art. 129691, 2023

6 R Jayasree, K Raghava, M Sadhasivam, PVV Srinivas, R Vijay, KG Pradeep, Tata Narasinga Rao, D Chakravarty, “Bi-layered Metal-ceramic Component for Dental Implants by Spark Plasma Sintering”, Materials Letters, Vol. 344, Art. 134403, 2023

7 M Buchi Suresh, Papiya Biswas, BP Saha, Roy Johnson, “Fabrication of Optically Transparent MgAl2O4 Polycrystalline Ceramics and Evaluation of High Temperature Dielectric, Impedance Spectroscopy & AC Conductivity”, Journal of Materials Science – Materials in Electronics, Vol. 34(27), Art. 1877, 2023

8 K Reshma Dileep, R Easwaramoorthi, K Suresh, Sudhanshu Mallick, Tata Narasinga Rao, Ganapathy Veerappan, “Compositional Engineering and Surface Passivation for Carbon-based Perovskite Solar Cells with Superior Thermal and Moisture Stability”, Vol. 559, Art. 232645, 2023

9 B Jayachandran, T Dasgupta, D Sivaprahasam, “Highly Stable Metal-Na0.02Pb0.98Te Contacts for Medium Temperature Thermoelectric Devices”, ACS Applied Materials & Interfaces, Vol. 15(18), p 22231-22240, 2023

10 Naik, CA (Naik, Chavan Akash), KB Sarath Kumar, S Harita, S Roshan, S Janakiram, P Sudharshan Phani, JP Gautam, “Assessment of Structure-property Relationships at the Micrometer Length Scale in Dual Phase Steels by Electron Microscopy and Nanoindentation”, Materials Today Communications, Vol. 38, Art. 107696, 2023

11 N Ravikiran, Harita Pant, Balaji Padya, PK Jain, VVSS Srikanth, “Novel Top-down kg-scale Processing of 2D Multi-layered Graphene Powder and its Application as Excellent Lubricating Additives in Commercial Engine Oils”, Diamond and Related Materials, Vol. 141, Art. 110634, 2023

12 M Tarun Babu, S Kumar, G Phanikumar, K Suresh, “Cold Spraying of Al-aerospace Alloys: Ease of Coating Deposition at High Stagnation Temperatures”, Surface & Coatings Technology, Vol. 467, Art. 129703, 2023

13 Prasenjit Barick, BP Saha, “Mixed Particle Size Effect on Improvement of Mechanical Properties of Reaction Bonded B4C”, Transactions of the Indian Ceramic Society, Vol. 82(1), p 56-64, 2023

14 D Vijaya Lakshmi, P Suresh Babu, Rahul J Alroy, G Siva Kumar, MJNV Prasad, “Performance Evaluation of Thin Cermet Coatings Produced by HVAF Spray: A New Approach for Hard Chrome Replacement”, Journal of Thermal Spray Technology, Vol. 32(4), p 904-917, 2023

15 P Sudharshan Phani, BL Hackett, CC Walker, WC Oliver, GM Pharr, “High Strain Rate Nanoindentation Testing: Recent Advancements, Challenges and Opportunities”, Current Opinion in Solid State & Materials, Vol. 27(1), Art. 101054, 2023

16 Santosh Kumar, Minati Tiadi, Vikrant Trivedi, Manjusha Battabyal, DK Satapathy, “High-Performance Selenide-Based Flexible Thermoelectric Films”, ACS Applied Energy Materials, Vol. 6(20), p 10457-10466, 2023

17 P Sai Karthik, S Ganesh, PS Ninawe, Manjusha Battabyal, SB Chandrasekhar, R Vijay, “Microstructure and mechanical properties of austenitic ODS steel processed using Ni-20Cr”, Journal of Materials Research, Vol. 38(8), p 2179-2187, 2023

18 Chandra Gowthami, SJ Kashyap, S Sudhakara Sarma, BV Sarada, VV Ananthula, VV Ananthula, R Vijay, Tata Narasinga Rao, Srinivasan Anandan, “Enhanced Stability and High-yield LiFePO4/C Derived from Low-cost Iron Precursors for High-energy Li-ion Batteries”, Journal of Energy Storage, Vol. 72, Art. 108453, 2023

19 S Harita, B Lavakumar, Nitin P Wasekar, H Krishnaswamy, P Sudharshan Phani, “A Unified Approach to Quantify the Material and Geometrical Effects in Indentation Size Effect”, Journal of Materials Research, Vol. 38(6), p 1740-1755, 2023

20 Papiya Biswas, M Buchi Suresh, DC Jana, BP Saha, Roy Johnson, “Processing of Lithium Aluminium Silicate Glass-ceramics and Investigations of Fracture Behaviour and its Correlation with the Microstructural Feature”, Ceramics International, Vol. 50(3), p 4708-4714, 2023

21 M Sreekanth, B Ramya Krishna, Ganapathy Veerappan, R Easwaramoorthi, “A Promising Scalable Bar Coating Approach using a Single Crystal- derived Precursor Ink for High-Performance Large-area Perovskite Solar Cells”, Materials Today Chemistry, Vol. 29, Art. 101415, 2023

22 Ramay Patra, Aarti Gautam, KV Gobi, R Subasri, “Hybrid Silane Coatings Based on Benzotriazole Loaded Aluminosilicate Nanotubes for Corrosion Protection of Mild Steel”, Silicon, Vol. 15(16), p 6981-6996, 2023

23 R Archana, S Kavita, VV Ramakrishna, V Suresh Kumar, Pramod Bhatt, SM Yusuf, R Gopalan, “Successive, Overlapping Transitions and Magnetocaloric Effect in Te doped Ni-Mn-Sn Heusler Alloys”, Journal of Alloys and Compounds, Vol. 947, Art. 169434, 2023

24 Minati Tiadi, Vikrant Trivedi, Santosh Kumar, PK Jain, SK Yadav, R Gopalan, DK Satapathy, Manjusha Battabyal, “Enhanced Thermoelectric Efficiency in P-Type Mg3Sb2: Role of Monovalent Atoms Codoping at Mg Sites”, ACS Applied Materials & Interfaces, Vol. 15(16), p 20175-20190, 2023

25 K Nanaji, Tata Narasinga Rao, “A High-Performance Dual-Carbon Na-Ion Capacitor Fabricated from a Single Biowaste Precursor”, Energy Technology, Vol. 11(10), Art. 2300493, 2023

26 Rahul Jude Alroy, M Kamaraj, D Vijaya Lakshmi, K Praveen, P Suresh Babu, G Sivakumar, “Tailoring Microstructural Features of Cr3C2-25NiCr Coatings through Diverse Spray Variants and Understanding the High-temperature Erosion Behavior”, Tribology International, Vol. 188, Art. 108810, 2023

27 K Praveen, G Shanmugavelayutham, D Srinivasa Rao, G Sivakumar, “Thermal Cycling Performance Assessment of Double-layered Lanthanum Titanium Aluminate Thermal Barrier Coatings Developed using Plasma Spheroidized Powders”, Surface & Coatings Technology, Vol. 465, Art. 129588, 2023

28 Prasenjit Barick, Bhaskar Prasad Saha, “Effect of Sintering Parameters on the Densification, Microstructure, and Mechanical Properties of SrO-CaO-ZnO-Al_2O_3-B_2O_3-SiO_2-tio_2 based Glass Sealant”, Science of Sintering, Vol. 55(3), p 353-365, 2023

29 Rahul Sharma, Swastik Pradhan, Ravi N Bathe, “Comparison, Validation, and Prediction of Machinability Aspects of Textured and Nontextured Cutting Inserts”, Journal of the Brazilian Society of Mechanical Sciences and Engineering, Vol. 45(2), Art. 76, 2023

30 Aarti Gautam, KRC Soma Raju, KV Gobi, R Subasri, “Effect of Transition Metal and Different Rare-Earth Inhibitors-Based Sol-gel Coatings on Corrosion Protection of Mild Steel”, Metals and Materials International, Vol. 29(10), p 2909-2925, 2023

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33 Rahul Sharma, Swastik Pradhan, Ravi N Bathe, “Machinability Aspects of Non-textured and Micro-textured Cutting Inserts in Turning of Titanium GR 2”, Surface Review & Letters, Vol. 31(02), Art. 2450014, 2023

34 WS Chae, CW Ahn, KS Hong, JH Yoon, JS Bae, JP Kim, J Lee, WG Yang, PH Borse, HG Kim, “Improved Charge Transport Kinetics in PbBi2Nb2O9 Photocatalysts: Comparative Time-Resolved Recombination Study with N-doped TiO2”, Materials Chemistry and Physics, Vol. 311, Art. 128514, 2023

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38 NV Naga Vamsi, Nitin P Wasekar, B Lavakumar, L Ramakrishna, G Sundararajan, “Deciphering the Role of W content, Triple Junctions, and Heat Treatment on the Corrosion Performance of Ni-W Alloy Coatings used for Automotive Applications”, Materials Chemistry and Physics, Vol. 308, Art. 128305, 2023

39 Nitin Tandekar, Pooja Miryalkar, L Ramakrishna, Krishna Valleti, “Influence of Substrate Bias on Machining Performance of TiAlN-coated Drill Bits”, Materials and Manufacturing Processes, Vol. 39(4), p 518-528, 2023

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41 R Hamshini, B Tripathy, S Paul, S Narayanswamy, R Saha, PP Bhattacharjee, “Annealing-Mediated Microduplex Structure and Texture Evolution in Severely Cold Rolled Nanolamellar Pearlite: A Perspective on the Effect of Starting Inter-lamellar Spacing”, Metallurgical and Materials Transactions – A Physical Metallurgy and Materials Science, Vol. 54(4), p 1199-1212, 2023

42 KV Ashish Srivatsav, K Suresh, M Ramakrishna, N Narasaiah, B Srinivasarao, B, “Effect of Cu Content on the Microstructure and Mechanical Properties of FeNiMnCuxAl0.1Ti0.1 (x=0.5,1.0 and 1.5) High Entropy Alloy System”, Journal of Alloys and Compounds, Vol. 340, Art. 168819, 2023

43 B Kumaar Swamy Reddy, Smrutiranjan Panda, R Easwaramoorthi, G Veerappan, V Ganapathy, PH Borse, B Sushmee, “Exploring the Impact of Electron Transport Layer Thickness and Morphology on Perovskite Infiltration and Photoresponse in HTM-free self-powered photodetector”, Solar Energy, Vol. 265, Art. 112106, 2023

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2 Shiv Prakash Singh, Mohammed Reda Chellali, Torben Boll, Herbert Gleiter and Horst Hahn, “Nano-alloying and Nano-Chemistry of the Immiscible Elements Fe and Cu in a FeSc-Cu Nanoglass”, Materials Advances, Vol. 4(12), p 2604-2611, 2023

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Books and Book Chapters

1 A chapter on "Introduction to Green Supercapacitors: Fundamentals, Design, Challenges, and Future Prospects" authored by P Samhita, Tata Narasinga Rao, B V Sarada, K Nanaji in the book on 'Low-Carbon Supercapacitors: Towards Sustainability in Energy Storage Devices', (Eds.) M Basheer Ahamed, Chaudhery Mustansar Hussain, Kalim Deshmukh, ISBN: 978-1-83767-248-6, RSC, p 1-33, 2023

2 A chapter on “Nanomachining” authored by KS Srin, J Ramkumar and Ravi N. Bathe in the book on ‘Nature-Inspired Self-Cleaning Surfaces in the Nanotechnology Era’ (Ed.) Phuong V. Pham, ISBN: 978-1-83769-070-1, Intech, p 1-15, 2023

Other Articles Published Via Print, Digital or Electronic Media

1 Gururaj Telasang, Ravi Bathe, “Exploration of Metal Additive Manufacturing for Components Realization”, IIM METAL NEWS, Vol. 26(5), p 10-19, 2023

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Contributions to Professional Societies / Bodies / Committees

Name	Contribution / Role
Dr. R Vijay	• Member, Board of Studies, Department of Chemical Engineering, NIT Warangal • Member of Academic Council, Kamala Institute of Technology and Science, Huzurabad, Telangana • Member, Board of Studies, Department of Mechanical Engineering, MVGR Engineering College, Vizianagaram
Dr. R Subasri	• Member of the Research Advisory Board, PSG Institute of Advanced Studies, Coimbatore • Member, Governing Council, Electrochemical Society of India (ECSI)
Dr. BP Saha	• National Advisory Committee Member of 4th Global Ceramic Leadership Roundtable on 'Ceramics for Frontier Sectors: Emerging Advances and Prospects' (CerAP2024) held during March 11-12, 2024 at IIT Roorkee, in association with Northeast India chapter of the American Ceramic Society (ACerS) • Expert Committee Member for PDR of RCI Project KUSHA held on 21st March 2004 • Board Member for Radome Facility establishment at RCI
Dr. Sanjay Bhardwaj	• Member, KAPILA (Kalam Program for IP Literacy and Awareness) Committee, Research & Development Cell, University of Hyderabad from July 27, 2023 • Expert Member, Evaluation and Monitoring Committee for the review of Regional Technology Transfer supported under National Biopharma Mission, BIRAC (Department of Biotechnology, Government of India) (from Jan 2024) • Member of the Expert Review Committee to evaluate and shortlist VAIBHAV Fellowship proposals funded by DST • Member, Departmental Research Committee, Department of Chemical Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad • Member, University Technology Management Cell, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani
Dr. Joydip Joardar	• Member, Governing Council, Powder Metallurgy Association of India (2023-2024)
Dr. Malobika Karanjai	• Contributor in formulating the national policy document on “The way forward for E-mobility R&D Roadmap” in 2023-24 as a co-opted member of “Consultative Group on eMobility” constituted by Office of Principal Scientific Adviser, Government of India • Joint Secretary, Powder Metallurgy Association of India (PMAI) for 2024-27 • Co-convener of International Conference PM24, organized by Powder Metallurgy Association of India (PMAI) during February 25-28, 2024, Pune. • Acted as Convener and Chairperson of the session on “Industrial PM (Press & Sinter) Technology for Auto, Electrical and Machine Parts” in International Conference PM24, organized by PMAI, from February 25-28, 2024. • Editorial Board Member of “Transactions of Powder Metallurgy” published by PMAI, a non-SCI journal. • Nominated as Subject Expert Member on Engineering and Technology for WISE Fellowships committee , constituted by DST (2023-24)
Dr. Ravi N Bathe	• Member of the Expert Review Committee to evaluate and shortlist VAIBHAV Fellowship proposals funded by DST • Member of Work Group (WG) On “Additive Manufacturing” to Implement National Strategy for Additive Manufacturing by Ministry of Electronics and Information Technology (MeitY) • Member of the Board of Examiners for IIT Kanpur Ph.D. Thesis (Photonics Science and Engineering) • Member of the Expert Review committee for the National Centre for Additive Manufacturing (NCAM) being implemented by M/s NAM, Hyderabad funded by MeitY • Member of the Expert Review Committee for the Centre for Promotion of Additive Manufacturing– Agri & Food Processing (CPAM- A&FP), initiated at CDAC (Kolkata) in collaboration with CMTI (Bangalore), CFTRI (Mysore) and IIM-CIP(Kolkata) and funded by MeitY • Member of the Expert Review Committee for the “Additive Manufacturing based Cost Effective Optical Computing Chips”, being implemented by IISc, Bangalore and C-MET, Pune funded by MeitY • Domain Expert for procurement of "E-Beam Powder Bed Fusion Additive Manufacturing facility" at CSIR-Advanced Materials and Processes Research Institute, Bhopal

Name	Contribution / Role
Dr. SM Shariff	• Member – Board of Studies, Dept of Metallurgical Engg., JNTU, Hyderabad • Member – Board of Studies, Dept of Metallurgical Engg., RGUKT, Basar
Dr. B V Sarada	• Editorial Board Member of the journal Scientific Reports published by Springer-Nature
Mr. K V Phani Prabhakar	• Served as Joint Secretary, Indian Institute of Welding (IIW), Hyderabad
Dr. Neha Hebalkar	• Member of Board of Studies in Chemistry and Chemical Engineering, Shivaji University, Kolhapur
Dr. Sanjay R Dhage	• Elected as General Secretary of the Indian Carbon Society, Hyderabad Chapter (July 2023)
Dr. K Ramya	• Member, Performance Review Panel for Inspire Faculty Fellows, Department of Science and Technology, under the Materials Science subject area
Dr. Srinivasan Anandan	• As a sectional committee member of BIS, attended “Safety on EVs” meeting at National Institute of Training for Standardization (NITS), Noida on September 27, 2023 • Attended 24th meeting of Electrotechnology in Mobility Sectional Committee, ETD 51 on November 7, 2023 at New Delhi • Member of Research Advisory Board in MLR Institute of Technology, Hyderabad
Dr Gururaj Telasang	• Adjunct Professor (2023-24) at the School of Engineering Sciences and Technology (SEST), University of Hyderabad. Completed the responsibility of the Additive Manufacturing course of Postgraduate (M. Tech) in Advanced Manufacturing • Member since 2023 of the MTD 25-Powder Metallurgical Materials and Products Sectional Committee, Bureau of Indian Standards (BIS) – New Delhi. • As Convener organized a Workshop on “Recent advances in additive manufacturing – RAAM -2023” at SEST, University of Hyderabad, on 10th April 2023 • Doctoral Advisory Committee (DAC) member since 2023 for Ph.D in Additive Manufacturing at Vellore Institute of Technology (VIT), Vellore • As secretary of SAEINDIA Hyderabad division, organized a day Tier- 2, state-level engineering student competition at Engineering College, Osmania University Campus, Hyderabad on 27th Jan 2024 • As a member committee of the Programme Assessment and Quality Improvement Committee (PAQIC) - 2022-2024, for the Mechanical Engineering Department, CBIT College Hyderabad
Dr. R Bajaji	• Member, Industry Technology Advisory Board, Green Hydrogen and Hydrocarbon Tech Consortium, IIT Madras. Chennai • Member, Board of Studies for M.E course at Department of Automobile Engineering, MIT, and Department of Mechanical, Anna University, Chennai
Mr. N Ravi Kiran (Dr. PK Jain)	• Served as a Student Ambassador at the 244th ECS meeting held in Gothenburg, Sweden (October 2023) organized by The Electrochemical Society

Awards and Honours

1 Dr. E Anusha (Dr. S M Shariff) was awarded 'IGSTC Post-Doctoral Industrial Fellowship' for work on “Process Optimization of Adaptive Laser Welding with Development of Appropriate Artificial Intelligence Technique and Validation” during the period March 2023 – April 2024

2 Dr. Pramod H Borse was honoured as 'Fellow of Royal Society of Chemistry (FRSC)' by Royal Society of Chemistry, London , United Kingdom (UK) on June 6, 2023

3 Dr. Sanjay Dhage was honoured as the ‘Fellow of Maharashtra Academy of Sciences’ for his significant contributions in Chemical Sciences for the year 2023

4 Dr. Naveen Manhar Chavan was selected as 'Young Scientist' to represent Indian delegation at 8th BRICS-YSF held at Port Elizabeth-Qheberha, South Africa on August 02,2023

5 Dr. L Rama Krishna received the ‘Dr. K Elayaperumal National Award-2023’ for Excellence in Electrochemical Science and Technology from The Electrochemical Society of India (ECSI) on August 17, 2023

6 Dr. Nitin P Wasekar received the ‘N M Sampat National Award-2023' for outstanding services rendered to Electrochemical Science and Technology from The Electrochemical Society of India (ECSI) on August 17, 2023

7 Ms. Aarti Gautam (Dr. R Subasri) received 'Best Paper Award' in Oral Presentation for the Paper Entitled “Anti-Corrosion Sol-Gel Coating Using Layer-By-Layer Nanocontainer for Mild Steel Corrosion Protection” presented at National Symposium on Electrochemical Science and Technology (NSEST)-2023 organized by the Electrochemical Society of India and ARCI, Hyderabad during August 17-18, 2023

8 Mr. Ramay Patra (Dr. R. Subasri) received one of the 'Best Poster Presentation Award' by the Electrochemical society of India at "The National Symposium on Electrochemical Science and Technology [NSEST-2023]" organized by the Electrochemical Society of India and ARCI, Hyderabad during August 17-18, 2023

9 Dr. S M Shariff received 'Best Researcher' Award by Science Father-SciFax for Statistical Methods for Analyzing Engineering Data on September 30,2023

10 Dr. Gururaj Telasang received the 'Leadership Award-2023' for leadership and extraordinary contribution by SAEINDIA Southern Section Chennai on October 21, 2023

11 Dr. Gururaj Telasang received the 'Best Paper Presentation (Industry)' award at the "Advances in Laser & Arc Cladding Technologies – ALACT-2023 Conference" held the Indian Institute of Welding (IIW) – Jamshedpur during November 3-4, 2023

12 Dr. Balaji Padya was conferred with the 'Best PhD Thesis Award-2023' by the Indian Carbon Society, Mumbai on November30, 2023

13 Dr. Sanjay Bhardwaj received the Best Paper Award for paper titled “Translational Research in Sonochemistry” presented in “IIChE-CHEMCON 2023 International Conference on Energy Transition : Challenges and Opportunities” during December 27-30, 2023

14 Dr. Sanjay Bhardwaj was elected as Fellow, Indian Institute of Chemical Engineers (IIChE) in recognition of his outstanding contribution for the advancement of chemical engineering knowledge and practice on December 26, 2023

15 Dr. Mani Karthik was honoured as “Fellow of the Royal Society of Chemistry (FRSC)” by The Royal Society of Chemistry, London, United Kingdom (UK) on March 5, 2024

16 Mr. Ramay Patra (Dr. R. Subasri) received 'The AMPP Emerging India Scholarship 2024' by the CORCON Institute of Corrosion, India at AMPP Annual Conference and Expo at New Orleans, Louisiana on March 5, 2024

17 Ms. K S Athira received 'Om Vimla' award for Innovation in Materials for Society by IIT Hyderabad on March 21, 2024

Personnel

Personnel (as on March 31, 2024)

Director
Dr. Tata Narasinga Rao

Distinguished ARCI Chair
Prof. P. Rama Rao

Associate Directors
Dr. Roy Johnson (upto 31.03.2024)
D. Srinivasa Rao
Dr. Pawan Kumar Jain

Distinguished Emeritus Scientist
Prof. G. Sundararajan

Scientists

Dr. G. Ravi Chandra, Scientist 'G'
Dr. R. Vijay, Scientist 'G'
Dr. R. Subasri, Scientist 'G'
V. Balaji Rao, Scientist 'G'
Dr. L. Rama Krishna, Scientist 'G'
Dr. Bhaskar Prasad Saha, Scientist 'G'
Dr. Sanjay Bhardwaj, Scientist 'G'
Dr. S. Sakthivel, Scientist 'G'
Dr. Pramod H. Borse, Scientist 'G'
Dr. N. Ravi, Scientist 'F' (upto 29.02.2024)
Dr. I. Ganesh, Scientist 'F'
Dr. Joydip Joardar, Scientist 'F'
Dr. Malobika Karanjai, Scientist 'F'
Dr. Ravi N. Bathe, Scientist 'F'
Dr. G. Siva Kumar, Scientist 'F'
Dr. R. Prakash, Scientist 'F'
Dr. S. M. Shariff, Scientist 'F'
Dr. D. Siva Prahasam, Scientist 'F'
Dr. B. V. Sarada, Scientist 'F'
K. V. Phani Prabhakar, Scientist 'F'
Dr. T. Mohan, Senior Scientist* (upto 31.05.2023)
Dr. Neha Y. Hebalkar, Scientist 'F'
Dr. S. B. Chandrasekhar, Scientist 'F'
Dr. P. Sudharshan Phani, Scientist 'F' (upto 06.03.2024)
Dr. Nitin P. Wasekar, Scientist 'F'
Dr. Dibyendu Chakravarty, Scientist 'F'
Dr. Kaliyan Hembram, Scientist 'F'
Dr. Sanjay R. Dhage, Scientist 'F'
Dr. K. Suresh, Scientist 'F'
Dr. P. Suresh Babu, Scientist 'F'
Dr. Krishna Valleti, Scientist 'F'
Dr. M. Buchi Suresh, Scientist 'F'
Dr. Srinivasan Anandan, Scientist 'F'
Dr. K. Murugan, Scientist 'F'
Dr. Dulal Chandra Jana, Scientist 'F'
Dr. K. Ramya, Senior Scientist *
Ms. S. Nirmala, Scientist 'E'
Manish Tak, Scientist 'E'
Dr. Papiya Biswas, Scientist 'E'
Dr. Gururaj Telasang, Scientist 'E'
Dr. R. Easwaramoorthi, Scientist 'E'
Dr. R. Senthil Kumar, Scientist 'E'
Dr. S. Kumar, Scientist 'E'
Ms. Priya Anish Mathews, Scientist 'E'
Dr. Prasenjit Barick, Scientist 'E'
Dr. Naveen Manhar Chavan, Scientist 'E'
M. Ramakrishna, Scientist 'E'
Dr. Balaji Padya, Scientist 'E'
S. Sudhakara Sarma, Scientist 'E'
R. Vijaya Chandar, Scientist 'E'
Dr. Pandu Ramavath, Scientist 'E'
Arun Seetharaman, Scientist 'E'
Dr. Mani Karthik, Senior Scientist *
Dr. D. Prabhu, Scientist 'E'
Ms. J. Revathi, Scientist 'D'
Dr. M. B. Sahana, Senior Scientist *
Dr. R. Balaji, Senior Scientist *
Dr. Raman Vedarajan, Scientist *
Dr. Manjusha Battabyal, Scientist*
Dr. Shiv Prakash Singh, Scientist *
Dr. V. Ganapathy, Scientist *
Dr. Bijoy Kumar Das, Scientist *
Dr. Srikanti Kavita, Scientist* (upto 20.07.2023)
Shri S. Ramakrishnan, Scientist *
Ms. K. Divya, Scientist 'C'
Dr. Amit Das, Scientist 'C'
Dr. V. V. N. Phani Kumar, Scientist *
Dr. J.A. Prithi, Scientist* (upto 30.04.2023)
K.S. Athira, Scientist 'B' (from 12.12.2023)
Gyan Prakash Sahoo Scientist 'B' (from 15.12.2023)

* On Contract Basis

Technical Officers

Debajyoti Sen, Technical Officer 'E'
K. R. C. Somaraju, Technical Officer 'E'
Ms. V. Uma, Technical Officer 'E'
P. Rama Krishna Reddy, Technical Officer 'D' (upto 31.03.2024)
K. Srinivasa Rao, Technical Officer 'D'
Ch. Sambasiva Rao, Technical Officer 'D'
M. Srinivas, Technical Officer 'D'
C. Karunakar, Technical Officer 'C'
Ms. B. V. Shalini, Technical Officer 'C'
N. Venkata Rao, Technical Officer 'C'
M. Srihari, Technical Officer 'C'
J. Nagabhushana Chary, Technical Officer 'C' (upto 31.05.2023)
A. Raja Shekhar Reddy, Technical Officer 'C'
L. Babu, Technical Officer 'C' *
A. R. Srinivas, Technical Officer 'C'
E. Anbu Rasu, Technical Officer 'C'
S. Sankar Ganesh, Technical Officer 'C'
K. Naresh Kumar, Technical Officer 'C'
M. Ilaiyaraja, Technical Officer 'C'
P. V. V. Srinivas, Technical Officer 'C'
K. Ramesh Reddy, Technical Officer 'B' (upto 31.07.2023)
Ms. N. Aruna, Technical Officer 'B'
R. Anbarasu, Technical Officer 'B'
M. R. Renju, Technical Officer 'B'
J. Shyam Rao, Technical Officer 'A'

* On Contract Basis

Technicians

D. Krishna Sagar, Technician 'E'
K. V. B. Vasantha Rayudu, Technician 'E'
G. Venkata Rao, Technician 'E'
E. Konda, Technician 'E'
A. Sathyanarayana, Technician 'E' (upto 31.10.2023)
B. Venkanna, Technician 'E'
G. Venkat Reddy, Technician 'E'
P. Anjaiah, Technician 'E'
A. Ramesh, Technician 'E'
B. Subramanyeswara Rao, Technician 'E'
A. Praveen Kumar, Technician 'E'
B. Hemanth Kumar, Technician 'E'
D. Kutumba Rao, Technician 'E'
Kona Vigneswara Rao, Technician 'E'
K. Satyanarayana Reddy, Technician 'D'
D. P. Surya Prakash Rao, Technician 'D'
Kurra Venkata Ramana, Technician 'D'
Govinda Kumar, Technician 'D'
A. Jagan, Technician 'D'
Sushanta Mukhopadhyay, Technician 'D'
M. Satyanand, Technician 'D'
P. Suri Babu, Technician 'D'
G. Anjan Babu, Technician 'D'
Shaik Ahmed, Technician 'D'
K. Ashok, Technician 'D'
E. Yadagiri, Technician 'D'
I. Prabhu, Technician 'C'
Ch. Jangaiah, Technician 'C'
Mothe Lingaiah, Technician 'C'
S. Narsing Rao, Technician 'B'
Aan Singh, Technician 'B'
Gaje Singh, Technician 'A'
Kadiri Sai Charan, Technician 'A'
Sushant Nayak, Technician 'A'
Desetti Bala Surya Krishna, Technician 'A'
Gedela Janaki Rao, Technician 'A'
Rasikanta Maharana, Technician 'A'(upto 31.01.2024)
Vemula Prashanth, Technician 'A'

Technical Assistant
Gugulothu Murthy, Technical Assistant 'A'

Senior Staff Officer To Director
P. Nagendra Rao (upto 30.04.2023)

Staff Officer To Director
N. Aparna Rao (from 01.06.2023)

Senior Stores & Purchase Officer
N. Srinivas

Senior Finance & Accounts Officer
G. M. Rajkumar

Senior Administrative & Personnel Officer
A. Srinivas (from 01.05.2023)

Finance & Accounts Officer (Projects)
Anirban Bhattacharjee

Security, Fire & Safety Officer
D. Ramesh

Officers
Y. Krishna Sarma, Officer 'C'
Poduri Venugopal, Officer 'C'
Ms. P. Kamal Vaishali, Officer 'B'
Pothuri Venkata Ramana, Officer 'B' (upto 31.12.2023)
G. Gopal Rao, Officer 'B'
P. Dharma Rao, Officer 'B' (upto 29.02.2023)
B. Laxman, Officer 'B'
Ravi Singh, Officer 'A'
Ms. Rajalakshmi Nair, Officer 'A'
(on deputation to UIDAI w.e.f. 25.01.2023 to 31.10.2023)
Narendra Kumar Bhakta, Officer 'A'
Ms. K. Madhura Vani, Officer 'A'

Assistants
J. Bansilal, Junior Assistant (MACP)
Ramavathu Ranga Naik, Assistant 'B'
Boorgu Venkatesham, Assistant 'B'
Pokalkar Sai Kishore, Assistant 'B'
Sudheendra, Assistant 'B'
Pagadala Siva Prasad Reddy, Assistant 'B'
Ch. Venugopal, Assistant 'B'
Edunuri Ramesh, Assistant 'B'
A.Balraj, Assistant 'A'
K. Prashanth, Assistant 'A'
P. Prasad Babu, Assistant 'A'
Thati Thoti T Koteswar Rao, Assistant 'A'
Pakanati Ashoka Reddy, Assistant 'A' (upto 31.08.2023)
Nalamasa Sampathkumar, Assistant 'A'
Ramavath Sunil Naik, Assistant 'A'

Junior Translation Officer
Dr. Rambha Singh

Drivers
T. Satyanarayana, Driver 'C' (upto 31.01.2024)
M. A. Fazal Hussain, Driver 'C'
P. Ashok, Driver 'B' (MACP) (upto 18.08.2023)

Lab Assistants
Ms. Sakina Hussain, Lab Assistant 'A'

Consultants
Dr. V. Chandrasekharan
Dr. T.Mohan
P. Sampath Kumar
D. Thirunaryanan
G Venkata Narayana

Project Scientists In Projects
P. Sai Karthik (upto 31.08.2023)
Dr. P. Vivekanandhan
Dr. S. Paulraj
Dr. C. Priji
G. Vijayaragavan

Project Technical Assistant In Project
R. Vasudevan
N. Kannadasan
Debendra Nath Kar
K. Velmurgan
K. Shanmugam
T. P. Sarangan
A. Sivaraj
D. Vigneshwaran
N. Ramesh
K. Sudalaiyandi
M. Nandhagopal
B. Vishal Viswanadh
Gampolla Mukesh
Banoth Vinod
Pulapaka Nagaraju
Boshetti Karunakruparao
Chiliveru Pranay
Mandaloju Soumya
Nallamati Chandramani
R. Ramesh Naik
K. Bhagyalaxmi

Financial Report

Independent Auditors' 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 Advanced Research Centre for Powder Metallurgy and New Materials (ARCI)** ("the Society"), which comprise the consolidated Balance Sheet as at March 31, 2024, 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 and Standalone Balance Sheet, Standalone Income and Expenditure Account, Standalone Receipts and Payments Account and Standalone significant accounting policies and other explanatory notes of the following funds.

i) Operational Fund | ii) Technology Demonstration and Transfer Fund | iii) Sponsored Projects Fund

Management's Responsibility for the Financial Statements

Governing Body of the Society is responsible for preparation of these financial statements of the Society in accordance with the Generally Accepted Accounting Principles in India (GAAP) and the significant accounting policies stated in financial statements. This responsibility also includes 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.

Auditors' 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 judgement, 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 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 explanations given to us, the aforesaid financial statements of the Society for the year ended March 31, 2024 are prepared in all material aspects, in accordance with Generally Accepted Accounting Principles in India (GAAP) and the significant accounting policies stated in Note 24 ot the Financial Statements Other Matters:

a. 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.
b. The Balance Sheet, the Income and Expenditure Account, and Receipts and Payments account dealt by with this report are in agreement with the books of accounts.

For ANANT RAO & MALLIK
Chartered Accountants
FRN: 006266S
Sd/-
V. ANANT RAO
Partner
M No. 022644
Date: 13-09-2024
UDIN: 24022644BKANYH3377

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 31-3-2024

(Amount in Rs)

GRANTS - IN - AID: FUND AND LIABILITIES	Schedule	Current Year	Previous Year
GRANTS - IN - AID	1	1,227,998,769.81	1,206,342,317.35
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	402,686,412.69	364,975,635.97
TOTAL		1,630,685,182.50	1,571,317,953.32

ASSETS	Schedule	Current Year	Previous Year
FIXED ASSETS	8	1,020,556,827.32	966,658,277.36
INVESTMENTS - FROM EARMARKED /ENDOWMENT FUND	9	0.00	0.00
INVESTMENTS - OTHERS	10	0.00	0.00
CURRENT ASSETS, LOANS, ADVANCES ETC.	11	610,128,355.18	604,659,675.96
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)			
TOTAL		1,630,685,182.50	1,571,317,953.32
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

As per our report of even date
for M/s Anant Rao & Mallik
Chartered Accountants
Firm Registration No. 006266S

Sd/-
V.Anant Rao
Partner
Membership No. 022644
Date: 13-09-2024
Place:Hyderabad

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

Sd/-
D.Srinivasa Rao
Associate Director(Admin, Finance & Stores)

Sd/-
Dr.R.Vijay
Director

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 31-3-2024

(Amount in Rs)

INCOME	Schedule	Current Year	Previous Year
Income from Sales/Services	12	0.00	0.00
Grants/Subsidies	13	650,165,551.00	579,303,551.00
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	7,287,699.81	6,159,888.42
Other Income	18	33,621,375.19	35,044,868.49
Increase/(decrease) in-stock of finished goods and work-in-progress	19	0.00	0.00
TOTAL (A)		691,074,626.00	620,508,307.91
EXPENDITURE	**Schedule**	**Current Year**	**Previous Year**
Establishment Expenses	20	452,122,071.01	413,774,366.38
Other Expenses	21	251,505,252.74	240,224,045.84
Expenditure on Grants/Subsidies	22	0.00	0.00
Interest	23	6,478,425.00	11,243,397.00
Depreciation (Net Total at the year-end-Corresponding to Schedule 8)		142,083,288.79	159,460,931.09
TOTAL (B)		852,189,037.54	824,702,740.31
Balance being excess of Expenditure over Income (B-A)		161,114,411.54	204,194,432.40
Transfer to Special Reserve [Specify each]			
Transfer to /From General Reserve			
BALANCE being Excess of Expenditure over Income T/F to- GRANTS IN AID		161,114,411.54	204,194,432.40
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

As per our report of even date
for M/s Anant Rao & Mallik
Chartered Accountants
Firm Registration No. 006266S

Sd/-
V.Anant Rao
Partner
Membership No. 022644
Date: 13-9-2024
Place:Hyderabad

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

Sd/-
D.Srinivasa Rao
Associated Director (Admin, Finance & Stores)

Sd/-
Dr. R. Vijay
Director

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 Forty 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.

For M/s. Anant Rao & Mallik
Chartered Accountants
Firm Registration No 006266S
Sd/-
V. Anant Rao
Partner
Membership No. 022644
Hyderabad

Sd/-	**Sd/-**	**Sd/-**	**Sd/-**
G.M. Raj Kumar	**D. Srinivasa Rao**	**Dr. R.Vijay**	
Senior Finance & Accounts Officer	Associate Director (Admin, Finance & Stores)	Director	

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.65,85,00,000/ towards revenue and Rs:17,46,00,000/- as capital grant-in-aid under Plan (Previous year Rs. 62,59,00,000and Rs. 17,61,00,000/- towards revenue and capital respectively under Plan grant-in-aid). Grants were refunded /returned during the year Rs. 83,34,449 towards revenue and Rs. 5,48,80,921/- as Capital grant-in-aid under plan (previous year Rs: 4,65,96,449 and Rs: 17,93,01,857) .Under Non-Plan, Grant-in-aid sanctioned was nil.

2 Capital Work in Progress
Rs. 12,48,18,624/- as at March 31,2024 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 once these deficiencies. 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.

For M/s. Anant Rao & Mallik
Chartered Accountants
Firm Registration No 006266S
Sd/-
V. Anant Rao
Partner
Membership No. 022644
Hyderabad

Sd/-	**Sd/-**	**Sd/-**	**Sd/-**
G.M. Raj Kumar	**D. Srinivasa Rao**	**Dr. R.Vijay**	
Senior Finance & Accounts Officer	Associate Director (Admin, Finance & Stores)	Director	

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 31-3-2024

(Amount in Rs)

RECEIPTS	Current Year	Previous Year	PAYMENTS	Current Year	Previous Year
I. Opening Balances			**I. Revenue Expenses**		
a) Cash in hand	0.00	13,896.00	a) Establishment Expenses	423,393,671.00	417,649,520.00
b) Bank Balances			b) Other Expenses	250,180,414.94	265,334,690.46
i) In Current accounts					
ii) In Deposit accounts	0.00	150,000,000.00			
iii) Savings accounts	8,919,337.20	104,919,712.27			
Total Opening Balances	**8,919,337.20**	**254,933,608.27**	**Total Expenses**	**673,574,085.94**	**682,984,210.46**
II. Grants Received			**II) Payments made against various projects**		
a) From Government of India	769,884,630.00	576,101,694.00	Payments made against various projects	0.00	0.00
b) From State Government					
c) From other sources [details]					
1) Fund received on closed Projects					
Total Grants Received	**769,884,630.00**	**576,101,694.00**	**Total of payments Against Projects**	**0.00**	**0.00**
III. Income on Investments From			**III. Investments and deposits made**		
a) Earmarked /Endowment funds	0.00	0.00	a) Out of Earmarked/Endowment funds	0.00	0.00
b) Own Funds (oth investments)	0.00	0.00	b) Out of Own Funds (investments-others)	0.00	0.00
Total Income on Investment	**0.00**	**0.00**	**Total : Investments and Deposits**	**0.00**	**0.00**
IV. Interest Received			**IV. Expenditure on Fixed Assets & Capital Work - in- Progress**	**120,465,127.00**	**192,119,863.25**
a) On Bank Deposits	6,478,425.00	9,335,359.00			
b) Interest from Sponsored Projects	0.00	0.00			
c) Loans, Advances to staff etc.	0.00	0.00	**Total of Fixed Assets**	**120,465,127.00**	**192,119,863.25**
Total Interest Received	**6,478,425.00**	**9,335,359.00**			
V. Other Income	**34,820,207.00**	**53,132,356.39**	**V. Refund of surplus money/ loans**		
			a) To Government of India	0.00	0.00
			b) To State Governments	0.00	0.00
			c) To other providers of funds	0.00	0.00
				0.00	**0.00**

(Amount -Rs)

RECEIPTS	Current Year	Previous Year	PAYMENTS	Current Year	Previous Year
VI. Amount Borrowed	**0.00**	**0.00**	**VI. Finance charges (Interest)**	**0.00**	**0.00**
VII. Any other receipts [Give details]			**VII) Other Payments (Specify)**		
1) Sales of Fixed Assets	566,889.46	1,763,790.25	1) Interest - DST	6,478,425.00	11,243,397.00
2)Tax Deduction at Source & GST Deductions	0.00	0.00			
3) Deposits - Security	313,468.00	0.00			
4) TDS Refund IT Dept	1,706,728.00	0.00			
5) Sales-Subabul Trees	1,822,034.00	0.00			
Total Any other receipts	**4,409,119.46**	**1,763,790.25**	**Total Other Payments**	**6,478,425.00**	**11,243,397.00**
			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	0.00	0.00
			iii) In Savings accounts	23,994,080.72	8,919,337.20
			Total Closing Balances	**23,994,080.72**	**8,919,337.20**
Grand Total	**824,511,718.66**	**895,266,807.91**	**Grand Total**	**824,511,718.66**	**895,266,807.91**

As per our report of even date
for M/s V.Anant Rao & Mallik
Chartered Accountants
Firm Registration No. 006266S

Sd/-
V. Anant Rao
Partner
Membership No. 022644
Date: 13-09-2024
Place:Hyderabad

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

Sd/-
D.Srinivasa Rao
Associate Director(Admin,Fin & Stores)

Sd/-
Dr. R.Vijay
Director

Our Collaborators

- Altmin Private Limited
- Applied Materials
- Amara Raja Energy & Mobility Limited and Amara Raja Advanced Cell Technologies Private Limited
- Agropak Private Limited
- Andhra Pradesh MedTech Zone Limited
- Ashok Leyland Limited
- ABB Global Industries and Services Private Limited
- Bharat Electronics Limited
- Bharat Heavy Electricals Limited
- Bhabha Atomic Research Centre
- Belarusian State University of Informatics and Radio Electronics
- Caterpillar India Engineering Solutions Private Limited
- Council of Scientific and Industrial Research (CSIR)
- Charite Berlin- Germany
- Central Glass & Ceramic Research Institute
- Centre for High Technology
- CIPLA Limited
- Cancrie Private Limited
- Defense Research and Development Organization
- Felis Leo Widgets Private Limited (Nexus Power)
- GFCL EV Products Ltd.
- Hindustan Aeronautics Limited
- Hindustan Petroleum Corporation Limited
- High Energy Batteries
- Indian Institute of Chemical Technology
- Indian Space Research Organization
- Indira Gandhi Centre for Atomic Research
- Indian Institute of Technology-Bombay
- Indian Institute of Technology-Madras
- Indian Institute of Technology-Kanpur
- Indian Institute of Technology-Kharagpur
- Indian Institute of Technology-Hyderabad
- Indian Oil Corporation Limited
- Indian Rare Earths Limited Technology Development Council
- Institute for Problems of Materials Science (IPMS), Ukraine
- International Centre for Electron Beam Technologies, Ukraine
- Indigenous Energy Storage Technologies Private Limited
- Indify Fuel Cell Private Limited
- Jindal Specialty Chemicals India Pvt. Ltd.
- KPIT Technologies Ltd.
- KCS Europe GmbH- Germany
- Lion Energy Batteries Private Limited
- L&T Electrolyzers Limited
- Malaviya National Institute of Technology Jaipur
- Magic Myna Pvt. Ltd.
- Mishra Dhathu Private Limited
- MRP Nair Engineers and Contractors
- National Institute of Technology-Warangal
- National Institute of Technology-Tiruchirappalli
- National Institute of Technology- Nagpur
- Nsure Reliable Power Solutions Pvt. Ltd.
- Onelement Energy Private Limited
- Phasetron Engineers India (P) Limited
- Prototech Power Pvt. Ltd.
- Resil Chemicals Pvt. Ltd.
- Rastek Pvt. Ltd.
- Sri Chitra Tirunal Institute for Medical Sciences and Technology
- Shimita Systems
- Sieger Robotek Electric Pvt. Ltd.
- SAP Parts Pvt. Ltd.
- Shakti Chem
- Toyota Kirloskar Motor Pvt. Ltd.
- Tenaco Labs Pvt. Ltd.
- Tata Steel Limited
- TVS Lucas
- The Bombay Textile Research Association
- University of Hyderabad
- Wahl India Grooming Product Pvt. Ltd.
- Wipro Enterprises (P) Ltd.

Editorial Board

Address

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI)

Balapur Post
Hyderabad - 500 005, Telangana, India
Phone: +91-40-29561681, 24452301/400
E-mail: info@arci.res.in
URL: http://www.arci.res.in

arci_res_in arci.res.in

ARCI Hyderabad

Chennai Cell

Centre for Automotive Energy Materials & Centre for Fuel Cell Technology
IIT-M Research Park, Phase-1 2nd Floor, Section B1
TS No. 2D, F Block, 6 Kanagam Road, Taramani,
Chennai - 600 113, Tamil Nadu, India
Phone: +91-44-66632700/723/803 | Fax: +91-44-66632702

Delhi Cell

Plot No. 102, Institutional Area
Sector - 44
Gurgaon -122 003, Haryana, India
Phone: +91-124-2570215
Fax: +91-124-2570218

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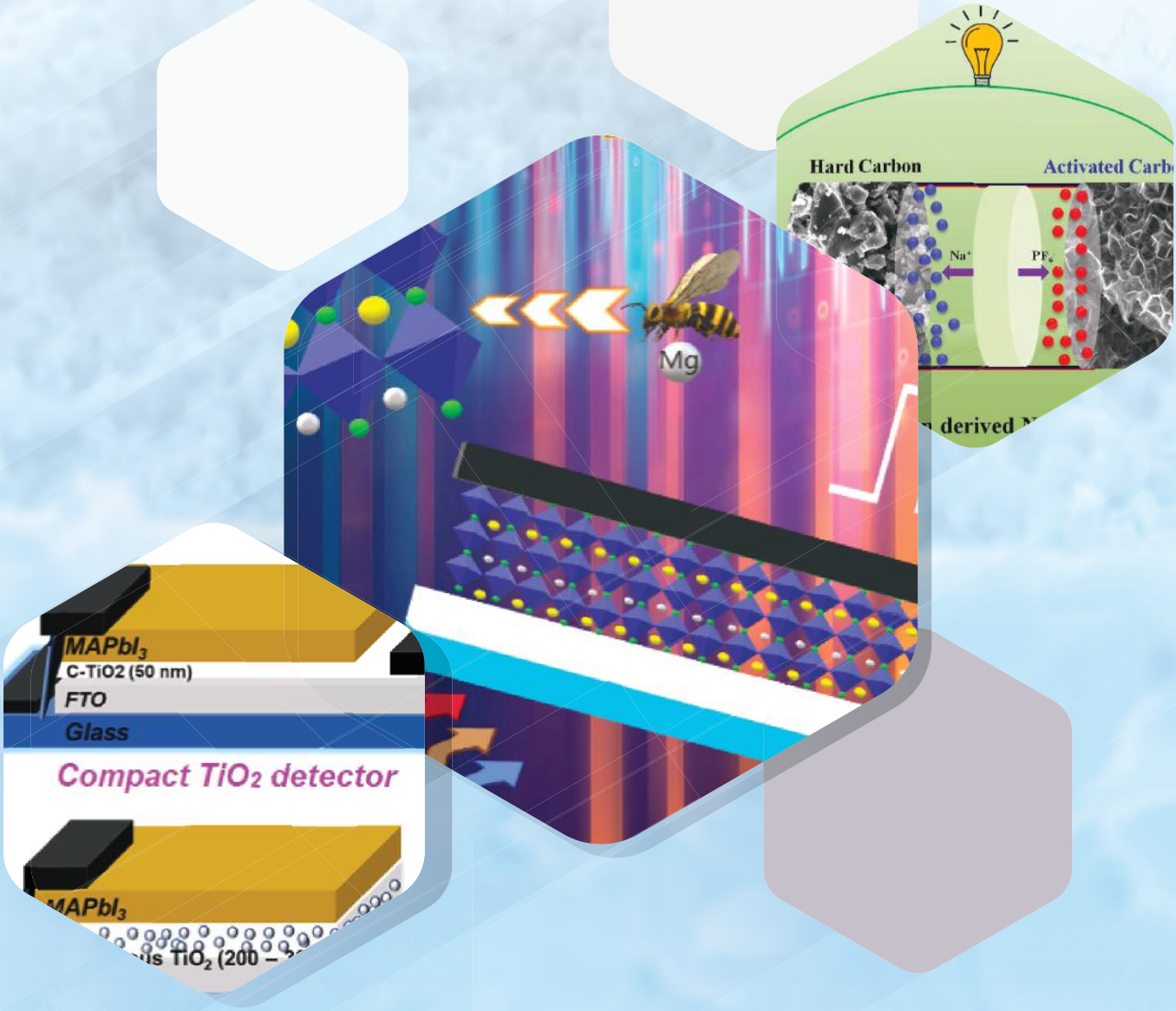

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI)

An Autonomous R&D Centre of Department of Science and Technology (DST), Govt. of India
Balapur P.O., Hyderabad - 500005, INDIA

0091-40-29561681, 24452301, 24452400
info@arci.res.in
www.arci.res.in
arci_res_in
arci.res.in