



# Networking and Brokerage Event Horizon Europe MSCA Staff Exchanges Call 2026

**Advanced Materials & Processes @CSIR-AMPRI, Bhopal (India)**

16 February 2026

- **R&D of Advanced Materials and Waste to Wealth Processes**
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# **CSIR-Advanced Materials & Processes Research Institute, Bhopal**

- **Area of Expertise: Engineering Materials with a focus on New Materials and Waste to Wealth Technologies.**
- **On a growth trajectory in terms of:**
  - **Scientific Outputs (~+100 SCI Publications Annually, Key Patents, Projects & Scientific Manpower)**
  - **State-of-the-art Infrastructure**
  - **Active Industry Interactions (through ToT, NDA, MoUs, Sponsored, Consultancy & Technical Services)**
- **~10% of our Scientists Feature in the World's Top 2% cited Researchers List of Stanford University.**

# Performance Snapshot in FY 25-26

Patents Filed - 1  
Granted (Abroad) - 2

Patents Filed - 5  
Granted (India) - 2

Patents Filed  
(Pipeline) - 5

(25-26)  
Publications ~  
43  
Avg. IF ~ 5.5  
Highest IF ~ 23  
>10 IF ~ 5

MoU/NDA  
9

Grant-in-Aid – 36

Sponsored - 4

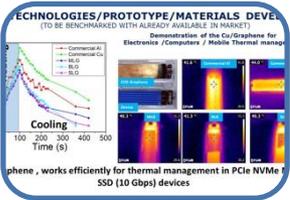
CSIR Funded – 42

IPR Status (Folio of 45+  
Active Patents)

Ongoing Projects (83)



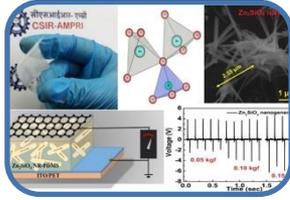
# Snapshot of top scientific contributions (Recent years)



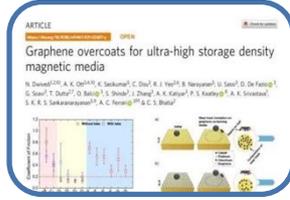
Graphene & 2D materials



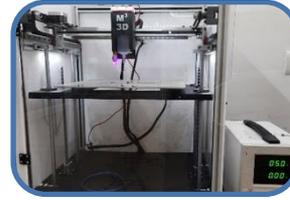
Lead free radiation shielding tiles



Piezo nanogenerators



Ultrathin Tribological coatings



Electrochemical 3D printing



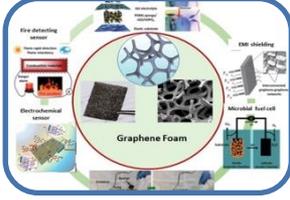
Bio sensors & antimicrobial coatings



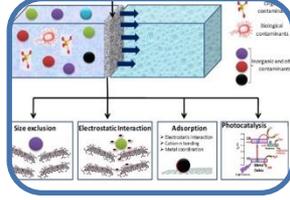
Additive Manufacturing of graphene composites



3D printing of pressure vessels



Graphene AI ion battery & Supercapacitors



Water splitting and Carbon capture



3D construction printing



Make in India Raman spectrometer

We look for active cooperation and collaboration in each of these areas

# Thrust Areas

**LIGHTWEIGHT  
MATERIALS &  
COMPOSITES**

**SUSTAINABLE CONSTRUCTION  
MATERIALS**

**INTELLIGENT  
MATERIALS & DEVICES**

**MAJOR  
R&D  
AREAS**

**ENERGY & ENVIRONMENTAL  
SOLUTIONS**

**FUNCTIONAL  
MATERIALS &  
COMPOSITES**

**INNOVATIVE MATERIALS &  
PROCESSES**

Academy of Scientific &  
Innovative Research  
(AcSIR)

Jigyasa

CSIR – Skill Initiative  
development

# LIGHTWEIGHT MATERIALS AND COMPOSITES

## • Expertise

- ❑ Lightweight Materials Design & Development (Defense, Automobile, Space & Construction)
- ❑ Mechanical Characterization: Fatigue & Fracture Evaluation
- ❑ Computer Simulation & Modelling
- ❑ Failure Investigation & Analysis

## • Technologies

- ✓ Flexible Carbon & Graphene-Based Foam Electrodes for Batteries
- ✓ Open-Cell Aluminium Foams for High-Energy-Density Battery Systems
- ✓ Hybrid Composite Metal Foam Core Sandwich Panels for Blast Resistance
- ✓ Laminated Composites for Ballistic Applications

## • Facilities

### Liquid Metal-based additive manufacturing Setup:

🖨️ Liquid Metal Additive Manufacturing, ⚙️ Lightweight Alloy Printing,

### Aluminium Hybrid Composite Closed-Cell Foam Facilities:

📦 Metal Foams, 🛡️ Anti-Mine Protection

### High-strength aluminium foam for Blast mitigation:

🔧 Aluminium Foam Manufacturing, 📦 High-Strength Metal Foam,

🛡️ Blast Mitigation Materials

**Metal Foams:** 🚀 Aerospace & Defence Foams,

🚗 Automotive Crash Materials, 🏠 Structural Foam Panels

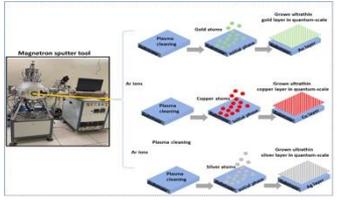


# FUNCTIONAL MATERIALS & COMPOSITES

- **Expertise**
  - Functional Coatings and Nano-Materials
  - 2D Graphene and MXene for Hydrogen Storage
  - Smoke and Heat Detectors using Hybrid shape memory-IR Concept
  - PVD Coatings for Artistic Structures
  - Red mud waste-based X-Ray Radiation Shielding doors/panels in pilot scale

- **Technologies**
  - ✓ Waste-to-Wealth Materials
  - ✓ Radiation, Thermal & Energy Shielding
  - ✓ Advanced Structural & Functional Composites
  - ✓ Bio-Medical & Smart Materials

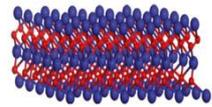
- **Facilities**
  - Functional Coatings and Nano-Materials**
    -  Ultrathin Gold Growth (PVD),  Co-Alloy-Based Data Storage Device, 
    -  Electrochemical Lead Sensor (Water)
  - 2D Graphene and MXene for Hydrogen Storage**
    -  2D Material Synthesis,  Layered Nanomaterials,  Advanced Functional Materials
  - Paddy Straw-PLA-based Packaging Materials**
  - Red mud waste-based X-Ray Radiation Shielding doors/panels in pilot scale for hospital sectors**





Thermal Evaporation (PVD)











# INTELLIGENT MATERIALS AND DEVICES

## • Expertise

- SMA Actuator Technologies
- Shape Memory Alloy Actuated Unlatching/Unlocking Lid Device
- Shape Memory Alloy Wire Actuator-based Soft Robotic Gripper with Machine Vision
- Analytical Instrumentation

## • Technologies

- ✓ Instrumentation for characterization of potentized homeopathic medicines
- ✓ Ferromagnetic Phase Sensing AI-Controlled SMA Actuators Smart Material Actuators
- ✓ Shape Memory Alloy (SMA) Actuators (Prosthetics, Robotics, Precision Systems)

## • Facilities

### Smart Material-Based Actuators (Automobile Applications)

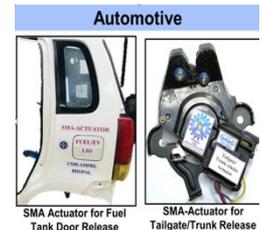
- ⚡ High Power-to-Weight, 🌿 Compact & Lightweight, 🔄 Long Fatigue Life,
- 🛡️ Corrosion Resistant ⚙️ Low Mechanical Complexity 📱 Embedded Controller Ready

### SMA-Actuated Unlatching / Unlocking Lid Device

- 🚀 Quick Actuation 🚫 Silent Operation 🧠 Smart Material Driven
- 🌿 Compact Mechanism 🔄 High Fatigue Endurance

### Ferro-Analyzer (Ferromagnetic Phase Assessment)

- ♻️ Non-Destructive Testing 📏 Ferromagnetic Phase Detection,
- 📊 High Accuracy, ⚡ Rapid Measurement, 🧪 Material, Characterization,



Ferro Analyzer for Ferro-Magnetic Phase Fraction in Fe-alloy

# ENERGY AND ENVIRONMENT SOLUTIONS

## • Expertise

- Lead Free Radiation Shielding Materials
- Point-of-Care (POC) Diagnostics & Healthcare Monitoring
- SODAR (Sound Detection and Ranging) System
- Synthetic Aggregates
- Anti – Viral Coatings

## • Technologies

- ✓ Radiation Shielding Materials & Flexible Radiation Shields
- ✓ Zeolites
- ✓ Waste-Derived Carbon Nanomaterials
- ✓ Electrochemical Diagnostics & Electrochemical Biosensors
- ✓ SODAR (Sound Detection & Ranging) System for Air Quality Mgt.

## • Facilities

### SODAR-Based Atmospheric Monitoring Facility:

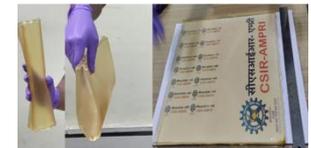
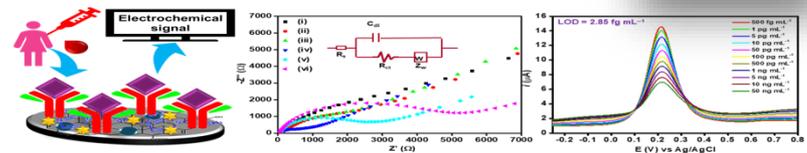
-  Real-Time Weather & ABL Profiling,  Air Quality & Dispersion Assessment
-  Thermal Structure & Turbulence Measurement
-  Aviation Safety & Urban Environmental Management

### Detection of Cancer Biomarkers in Clinical Samples:

-  Clinical Disease Diagnostics,
-  Cancer Biomarker Detection,
-  Environmental Pollutant Sensing

### Radiation Shielding Materials:

-  Gamma & Neutron Shielding Bricks,
- Transparent Radiation Shielding Composites,



Dried Transparent Flexible Metal Polymer Composite

# SUSTAINABLE CONSTRUCTION MATERIALS

## Expertise

- Advanced Geopolymer Concrete Prefabricated Precast Pathway Components
- Red Mud-based Advanced Gamma Ray Shielding Aggregate & Heavy-Density Concrete

## Technologies

- ✓ 3D Concrete Printing  
*(Additive construction of buildings)*
- ✓ Cement-Free Geopolymer Concrete  
*(Fly ash-based rigid pavement material)*



Fly Ash



Red Mud



Paver Blocks

## Facilities

### Fly Ash–Based Advanced (Cement-Free) Geopolymer Concrete for Road Applications

-  100% Cement Replacement,   Water-Curing-Free Process,
-  Early Strength Gain (Ready in 1 Week),
-  Bulk Fly Ash Waste Utilization

### Red Mud–Fly Ash Geopolymer Paver Blocks using Broken Sanitary Ware

-  High Compressive Strength,  Medium to Heavy Traffic Grade,
-  Multi-Waste Utilization (Red Mud, Fly Ash, Sanitary Ware),
-  Eco-Friendly Pathway



# INNOVATIVE MATERIALS AND PROCESSES

- **Expertise**

- ❑ **Innovative Materials**

- Graphene, 2D Materials, Functional Nano Materials

- ❑ **Processes Development**

- Advanced Manufacturing & Post-processing

- ❑ **Product Development**

- Make in India Raman Spectrometers

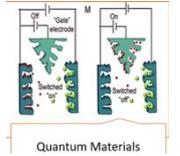
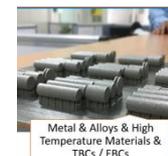
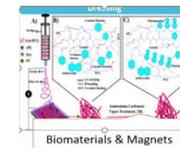
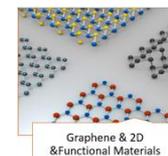
- **Technologies**

- ✓ **Multifunctional Antiviral Coatings**
- ✓ **Herbal Wound Dressings**
- ✓ **Bio-functional Nanofibers**
- ✓ **Graphene Heavy-Metal Sensors**
- ✓ **Antimicrobial Implant Nanocoatings**
- ✓ **Hydrogen Storage Type-IV High-Pressure Vessels**

- **Facilities**

The department hosts world-class, integrated facilities—

-  Material Science,
-  Application Engineering,
-  Project Management & Commercialisation,
-  Testing and Characterisation,
-  Design & Simulation,
-  Processing Engineering





**Thank You!**