RESEARCH & DEVELOPMENT

CIPET सि पे ट
probe · perform · practice · Plastics

केंद्रीय पेट्रोरसायन अभियांत्रिकी एवं प्रौद्योगिकी संस्थान

CENTRAL INSTITUTE OF PETROCHEMICALS ENGINEERING & TECHNOLOGY

रसायन और पेट्रोरसायन विभाग
रसायन और उर्वरक मंत्रालय, भारत सरकार
Department of Chemicals & Petrochemicals
Ministry of Chemicals & Fertilizers
Government of India

Central Institute of Petrochemicals Engineering & Technology (CIPET) was established in 1968 and at present having 46 functional campuses across the country. CIPET is a STAR Institute (i.e. Skilling / Technical support / Academics / Research) under Dept. of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, Government of India. All the centers are equipped with the state-of-the-art technical infrastructure at par with International Standards.

- An IS/ISO 9001:2015 certified institution
- NABL accredited laboratories
- NABCB accredited Type "A" Inspection body
- 1000+ working professionals with vast knowledge in the field of Polymers / Plastics / Petrochemicals / Mechanical / Manufacturing Engineering
- Enriched Institute – Industry Interface
- AICTE approved Institution and NBA accredited academic programmes
- Educating youth to stimulate the growth of petrochemicals and allied industries
- Generating Employment opportunities / Promoting Entrepreneurship for unemployed youth
- Applied Research leading to Technology transfer and commercialization
- Strong Alumni base spread across the globe occupying key positions in the industries

CIPET has an outstanding environment to encourage research activities. CIPET has established 3 Schools for Advanced Research in Petrochemicals (SARP) at Bengaluru, Bhubaneswar and Chennai . These centers provide aspiring researchers a perfect ambience to pursue their goals efficiently. These advanced research laboratories focus on developing working prototypes and find solutions to engineering problems thereby improving the quality of human life; thus enabling frontline researchers to execute their research goals in-line with the needs of the regions of the country. One of the major strengths of CIPET is its ability in building and nurturing sophisticated research facilities in-house and working towards the mission of being a Global R & D hub in India as well as in abroad.

The School for Advanced Research in Petrochemicals (SARP) works as multifunctional "one-stop" facility with full-fledged material characterization broad specialization in product development and simulation as per the national goals of 'Make in India'

CIPET has an enviable interface with its business and industry partners. Always in the forefront of strengthening technological capabilities and have been constantly building capacities and leveraging our expertise, caliber and skill sets to meet the emerging and evolving needs of the industry.

"Academics" is one of the main domains of CIPET. Industry oriented Diploma, Post Diploma and Post Graduate Diploma Programs are offered at 28 Centres. Undergraduate and Postgraduate courses are offered at 8 Centres, these courses are affiliated to respective State Govt. Universities.

"Skill Development" Training Programmes (with 37 different specializations) are being conducted at CIPET centres which are NSQF aligned and NSQC approved. Every year more than 50,000 Students have been successfully trained with excellent hands on practical exposure on state-of-the-art equipment and machinery at par with International Standards in short term Skill Courses.

"Technical Support Services" (TSS) CIPET offers TSS in the entire spectrum of Petrochemicals Including Plastics & allied Industries by offering high quality services across the globe. Over the span of 50 years, a large number of industry clients recognized CIPET by availing Technology Support Services in the areas of Design, Tooling, Processing and Testing and Quality Assurance. Many organizations including Government, PSU's, and Private Industries avails CIPET's expert domain knowledge as well as seek consultation. In addition to its core competency, CIPET serves as a Third-Party Inspection (TPI) agency for plastics & allied products, both in India and abroad.

CIPET: SARP – Advanced Polymer Design & Development Research Laboratory (APDDRL), Bengaluru.

APDDRL

CIPET: SARP – Laboratory for Advanced Research in Polymeric Materials (LARPM), Bhubaneswar.

larpm

CIPET: SARP - Advanced Research School for Technology and Product Simulation (ARSTPS), Chennai.

arstps
R&D wing of CIPET

Major R & D Projects:

- Development and Design of novel zwitter ionic foul release coatings with improved nanoscale interface, DST Govt of India
- Development and Evaluation of Weather Resistant Coating for Artlux, Mexico
- Resource recovery from waste electrical and electronic equipments (WEEE): Eco Friendly technology for recycling plastics and metallic components, DST, Govt of India
- Development of Polymer Microcellular foam
- Indigenous Development of outer casing Assembly for Directional Sonobuoy, for NPOL
- Development of new generation Acetabular Socket Liner and Femoral Head Prototypes with unique 3D microstructures and better fracture resistance for Osteoporosis and Osteoarthritis treatment, DST, Govt of India
- Translational Research on Biomaterials for Orthopedic and Dental applications, DBT, Govt. of India
- Development of Next-Generation Hybrid Solar Cells : Effectual diketopyrrolopyrrole / carbazole based materials for sustainable photovoltaics, Core Research Grant, SERB, DST Govt of India
- Competency enhancement of Micro, Small and Medium Enterprises in Foam Manufacturing Sector for ensuring smooth and sustainable phase out of HCFC141b, UNDP & MOEF & CC
- Development of functionalized gamma irradiated guar gum based biodegradable films for improved mechanical and high barrier packaging applications, BRNS, DAE, Govt of India
- Process Development for Effective Utilization of Lignocellulosic Natural Fibres Based Thermoplastics Hybrid Composites for high end structural application, DST, Govt of India
- Studies on the fire retardancy of nano-ATH in polymers, Ministry of Mines, Govt of India
- Development and supply of PVDF based materials as Piezoelectric prototype, BEL, Bengaluru
- Development of Hybrid Three-Dimensional Architecture Electrodes for High Energy Density Super capattery, DST, Govt of India

Prestigious Project Details:

Indigenous Development of Floating System for Installation of Solar PV Panel

As a part of **'Make in India'** initiative, CIPET has developed an indigenous floating Photovoltaic technology for NTPC, New Delhi and a pilot plant of 5kW was installed at NTPC Kayankulam, Kerala in the year 2016. Subsequently a power plant of capacity 100 kWp was demonstrated at the same location. In addition to the above, CIPET developed an alternative design for further cost reduction and value addition with the financial support of Department of Science and Technology through the scheme of Solar Energy Research Initiative (SERI) during the year 2019. The special feature of the developed technology over the existing includes that the floater system is stable, long lasting, cost effective and less space requirement for installation of power plants.

5kWp pilot plant of floating Solar PV System installed @ Rajiv Gandhi Combined Cycle Power Plant (RGCCPP), Kayankulam, Kerala

100kWp power plant of floating Solar PV System installed @ Rajiv Gandhi Combined Cycle Power Plant (RGCCPP), Kayankulam, Kerala

1 MWp Solar floating PV System at NTPC, Kawas, Surat, Gujarat

Fibre Reinforced Composites, Biopolymers, Polymeric Blends, Bio-Fillers

- Biopolymeric & Polymeric blends for sustainable development
- Biofiller Polymer Blends, Recycling & upscalling for economic development
- Polymer/ Biopolymer nanocomposites.
- Advanced Formulation development for allied area applications
- Fiber Reinforced composites for high strength applications

Bed for Magnetoencephalography (MEG)

For IGCAR Kalpakkam, Patient bed completely free from any metallic or magnetic elements was designed and fabricated using FRP and thermoplastics so that the interference to the measured signals shall be avoided during Magnetoencephalography (MEG). The sensor array helmet, an integral part of the MEG system which is used as brain imaging technique, was designed and developed by CIPET to hold both cylindrical and disc sensors with very high positional accuracy of sensors.

Bio-medical Waste Recycling into Value Added Products

- Collection, Segregation & Disinfection of Bio-medical Waste from Local Hospitals
- Recycling & Upscaling of Biomedical Waste including COVID-19 Waste
- Development of Formulation & Optimization of waste polymeric material
- Utilization of waste into value added products

Bio-medical Waste Bio-Dispenser

CIPET, jointly with Sri Ramachandra Institute of Higher Education and Research has developed an indigenous technology for safe disposal of biomedical waste in order to avoid the needle stick injuries and hence the infections for waste handlers in health care centres. Presently, the sharp disposal containers are being imported from other countries and the existing containers does not have the option of reusability due to the risk of infections. The project is funded by Department of Science and Technology, New Delhi under Waste Management Scheme. Both Sharp Disposal Container and sensor operated Biomedical waste bin complies the biomedical waste bin complies the biomedical waste management rules 2016.

Sharp Disposal Container with onsite decontamination

Non-Contact, Automatic Sensor Operated Biomedical Waste bin

Light Weight Auto-Parts from Bio-Composites

Light Weight Automotive

- Bio-based natural fiber reinforced composites
- Development of short / long fiber & microfibril composites
- Product development & validation
- Cost effective formulation with 20-25% loading of natural resource
- Low wear and tear of machinery vis-a-vis mineral filled compositions
- Cost reduction by 20% and weight reduction by 30%

Bio-derived Electroactive Materials for Energy Storage Devices

The research focuses mainly on the preparation of bio-derived/wastes, electroactive materials such as food waste, wood waste, marine wastes into activated carbon as electrode materials for supercapacitors.

Sustainable bio-based materials

Owing to fossil fuel depletion, and accumulation of plastic litter there is an increased demand for developing alternatives to petroleum-based plastics. CIPET works on the development of various biodegradable plastics to minimise the environmental pollution.

Development of PVC Compounds, Additives & Stabilizers

CIPET developed technology for transparent medical applications of PVC with non-toxic materials and additives. The technology has been developed with a focus for commercialisation, technology transfer to industries for large scale production and development of Indigenous technology over foreign dependency.

Advanced Foam Technology

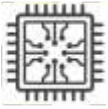
Focused to develop technology for transfer of technology to foam manufacturing sector for thermoware application. Successful trails have been undertaken on discontinuous PU panels and integral skin formulations for technology transfer to 113 SMEs.

Sectors Supported :

Refrigeration

Discontinuous Panel

Integral Skin Automotive

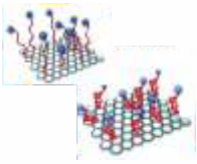


Electrical & Electronics

Smart Coating for Structural Applications

Vegetable Oils (Castor / Soybean)

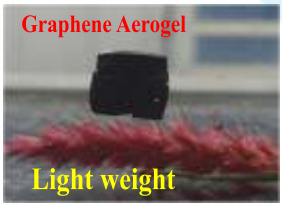
Epoxy / Polyurethane Resins



Functionization

Coatings & Adhesives

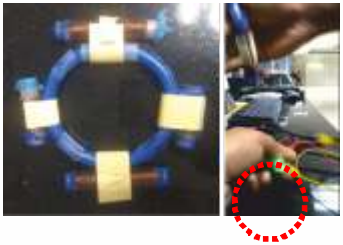
- UV Resistant upto 5 years
- High abrasion resistance
- Durable
- Dust repellant



Carbon Based Materials for Supercapacitor applications

Graphene Aerogel is highly open porous, 3D, light-weight with interconnected graphene structure. It allows higher surface area for charge storage and allow electrolytes flow through entire electrode surface.

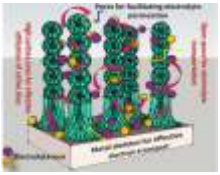
Developed the innovative aqueous based electrolytes with working potential of 2 V. Aqueous based electrolyte restricted in energy storage devices due to narrow electrochemical window of stability (1.23 V).



Plastic waste is used to generate the electricity through tribo-electrification process. Wearable multi-functional energy harvester has been developed using triboelectric and magnetoelectric process from the waste materials. The developed bracelet type proto type device can be used to power the electronic devices like smart watches, IoT devices, Health monitoring devices and so on.

Three-Dimension Electrodes for Energy Storage Devices

The research focuses mainly on the development of a high-energy density hybrid supercapacitors based on rationally designed hybrid 3D architecture electrodes.



Weld-free technology for sensor interconnection

- Adhesives with faster curing mechanism: An alternate to mechanical fastener
- Cost effective with wider range of applications
- Indigenous technology for fuel storage @ cryo-temperatures
- Applicable in automotive, marine, aerospace sectors
- Efficient glue material for metals & FRPs
- Durability under variable temperature & humidity conditions

High-End Products from WEEE Plastics

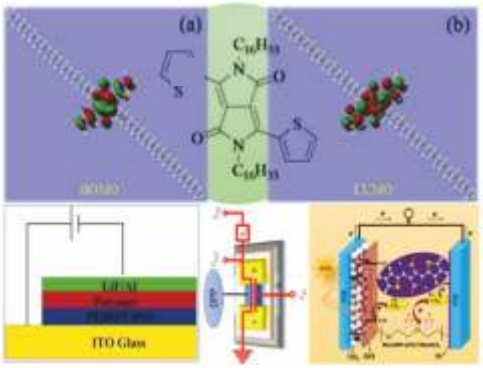
- Segregation & identification of plastics from Waste Electrical and Electronics Equipment (WEEE)
- Optimization of processing parameters
- Toxicity analysis during reprocessing
- Product development & validation

Energy Harvesting Devices

The research focuses mainly on the development and establishment of flexible polymeric based system for highly efficient mechanical energy harvesting.

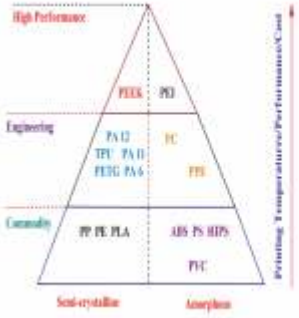
Electrochemical Energy Devices - Organic Electronic Device

- Design and development of novel solar energy materials through diketopyrrolopyrrole (DPP) Chemistry
- DPP derivatives stand out to be the excellent materials that provide both efficiency and stability
- New / functionalized materials (both small molecule as well as polymers) are synthesized for Organic Electronic Device (OFETs, OLEDs) and other electrochemical energy device applications



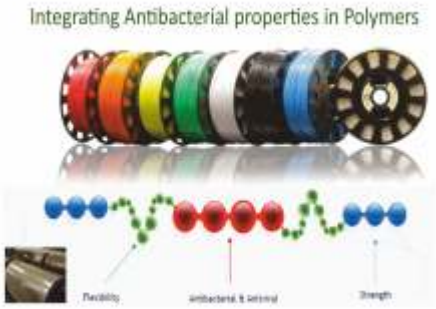
Development of Medical Grade Polymer Filaments for 3D Printing

- Development of medical grade polymer filaments for application in healthcare sector: An alternative solution to existing materials.
- Key Targets in the Polymer-filaments: Excellent strength-to-weight ratio, high heat, chemical and impact resistance biocompatibility, ease of processability with layer-layer deposition.
- Metal oxides/ Organic fillers have great physical and mechanical properties, low cost easy to process.



Targeted Range of Polymers

- ✓ PMMA
- ✓ PCL
- ✓ PLA
- ✓ PEEK
- ✓ TPU
- ✓ PVDF
- ✓ ABS



Focused Research Areas

1	2	3	4	5	6	7	8	9
Agriculture	**Automotive**	**Packaging**	**Clean Water**	**Alternate Power**	**Healthcare**	**Waste Management**	**Product Development**	**Foam Technology**
Increased yield & improved crop quality -Mulching Row Tunnels, Greens Houses Easy handling and maintenance	Light weight fuel efficient composites, Agro - based hybrid composites, Heat resistant Conducting paints	Bio-based origin High barrier Recyclable Blister Packaging	Affordable potable water devices Antibacterial/ Antifouling resistant Filters for Toxic micro-pollutant removal	Polymer electrolyte membranes Hydrogen / Methanol to power Solar energy to power	Glucose & Cholesterol Bio-Markers Fast response Medical Devices - Orthopedics, Dentures, Dialyzers	Value addition of WEEE, Packaging Waste Strategies for managing biomedical waste	3D Printing Rapid Prototyping Reverse Engg. Incremental Sheet Forming Metal-Plastic conversion	PU Foam waste recycling Polyol Synthesis Utilization of advanced foam formulation

अनुसंधान और विकास आवश्यकताओं के लिए
FOR RESEARCH & DEVELOPMENT REQUIREMENTS

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