



# VIDYUT ANUSANDHAN SAMACHAR

Issue No. 01

QUARTERLY NEWSLETTER

Oct-Dec 2023

## CENTRAL POWER RESEARCH INSTITUTE

### Director General's Desk

I am happy to announce the release of the first issue of CPRI Newsletter : “VIDYUT ANUSANDHAAN SAMACHAR” for the quarter October – December 2023. The ‘CPRI News’ was discontinued during Covid 19 pandemic and the publication of the same has now resumed. It gives me immense pleasure to place before you the 1st volume of the Re-launched ‘CPRI News’ on 16<sup>th</sup> January 2024 on the occasion of CPRI Institute Day Celebration.

CPRI, since its inception, continues to support power utilities, industries, manufacturer and overseas customers. CPRI’s commitment to ensure unparalleled quality of services in the area of research, testing, consultancy and third party inspections has ensured global recognition. Further, it is also noteworthy to mention that CPRI represents various forums both national and international arena among the power fraternity.

- B.A. Sawale  
DG, CPRI



VIDYUT ANUSANDHAN SAMACHAR

**Central Power Research Institute**

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## About CPRI

Central Power Research Institute (CPRI) was established by the Government of India in 1960. It became an Autonomous Institute in the year 1978 under the aegis of the Ministry of Power, Government of India. For the last six decades, CPRI has been rendering dedicated service to the power sector.

Over the years, CPRI has developed expertise in the areas of generation, transmission, distribution systems and has established world class facilities for research and testing in the areas of High Voltage, High Power, Short Circuit Power Capacitors, Power Cables, Solar PV, Smart Metering & AMI, Power System Studies, Energy Studies, Tower Design, Vibration Studies, Seismic Performance, Liquid Dielectrics, Diagnostics, Condition Monitoring, Cybersecurity, Smart Grid Systems, Energy Storage, RLA studies and development of novel materials for power sector.

### Activities of CPRI:

- Applied Research in Power Engineering.
- Independent Third Party National Laboratory for Testing & Certification.
- Consultancy & Field Testing Services.



## Research Highlights

CPRI plays a pivotal role in advancing research and development in the field of power generation, transmission, and distribution in India. With a particular emphasis on the clean energy transition, CPRI's research contributions are crucial for addressing the challenges faced by the Indian power sector. As India strives towards a sustainable and environmentally friendly energy landscape, CPRI's focus on clean energy technologies and solutions is indispensable. The institute serves as a catalyst for fostering innovation by providing a platform for researchers to explore and nurture their innovative ideas through various R&D schemes of Ministry of Power being implemented through CPRI. By creating a conducive environment for collaboration and knowledge exchange, CPRI facilitates the development of indigenous solutions to the complex challenges faced by the Indian power sector. The institute's commitment to research excellence not only contributes to the nation's clean energy goals but also empowers a generation of researchers to drive positive change in the power industry. Through its continuous efforts, CPRI is instrumental in shaping the future of India's energy landscape, propelling it towards sustainability and energy resilience.

## Key Highlights

The thirteenth meeting of the Technical Committee on Hydro Research was attended by representatives from CEA (HE&TD), CEA (R&D), BHEL, CPRI and was chaired by Prof. Arunkumar, IIT Roorkee through virtual mode on 22<sup>nd</sup> August 2023.

The fourteenth meeting of the Technical Committee on Thermal Research was attended by representatives from CEA (TE&TD), CEA (R&D), BHEL, NTPC-NETRA, CPRI and was chaired by Prof. Gautam Biswas, IIT Kanpur through virtual mode on 24<sup>th</sup> August 2023.

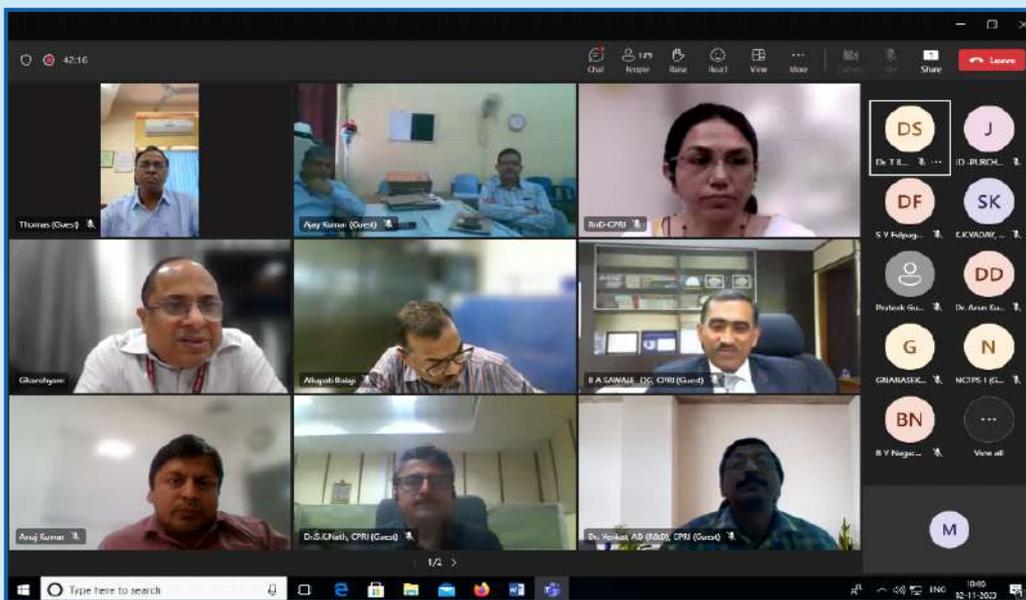
The fourteenth meeting of the Technical Committee on Transmission Research was attended by representatives from CEA (PSETD), CEA (R&D), IEEMA, POWERGRID, CPRI and was chaired by Prof. K. Shanti Swarup, IIT Madras through virtual mode on 22<sup>nd</sup> and 23<sup>rd</sup> September 2023.

The fifteenth meeting of the Technical Committee on Grid, Distribution and Energy Conservation Research was attended by representatives from CEA (DP&D), CEA (R&D), IEEMA, TANGEDCO, CPRI and was chaired by Prof. Sukumar Mishra, IIT Delhi through virtual mode on 5<sup>th</sup> and 6<sup>th</sup> October 2023.



## Research Highlights

A brainstorming session was conducted on 2<sup>nd</sup> November 2023 with the power sector stakeholders, to understand the operational/technical challenges in the power sector requiring research intervention. More than 100 experts from power utilities and CPSUs such as PGCIL, BHEL, NTPC, Grid India and SJVNL attended this interactive session.



Progress of the on-going R&D Projects taken up under SAMARTH mission which are being implemented at Punjab Agricultural University (PAU), SSS-NIBE, Kapurthala, NTPC-NETRA and ICAR-CIRCOT, Mumbai was reviewed on-site by the Sub-Group 1 members of SAMARTH under the Chairmanship of Director General CPRI.



Members of SAMARTH Team visit to Bio-mass based thermal power plant at Kapurthala



Meeting of SAMARTH team at ICAR-CIRCOT, Mumbai

## Research Highlights

### Mission on Advanced and High Impact Research (MAHIR)

The Ministry of Power and the Ministry of New and Renewable Energy have jointly launched a National Mission titled “Mission on Advanced and High-Impact Research (MAHIR)” to quickly identify emerging technologies in the power sector and develop them indigenously, scale and for deployment within the country and outside. The Mission aims to facilitate indigenous research, development and demonstration of the latest and emerging technologies in the power sector. By identifying emerging technologies and taking them to the implementation stage, the Mission seeks to leverage them as the fuel for future economic growth and thus make India a manufacturing hub of the world. CPRI is providing the necessary secretarial assistance to the Mission.

**"MAHIR to act as catalyst for realizing Net Zero, Start-Up and Make in India in the Indian Power Sector"**

The first meeting of the MAHIR Mission was held with the Directors of IITs, NITs, IEEMA and CMDs of PSUs. The meeting was chaired by Shri Ghanshyam Prasad, Chairperson, CEA, sought suggestions on emerging technologies that can be funded under MAHIR. A total of 76 experts from various organizations participated in the meeting.



Subsequently, two Technical Scoping Committee meetings were held under the Chairmanship of Chairperson, CEA in presence of representatives from MoP, MNRE, CEA, PGCIL, NTPC, CPRI and subject matter experts from academia, to gain insights into the emerging technologies in the power sector. The goal was to identify specific technologies that can be considered under MAHIR which will align with the long-term objectives of the Government of India in achieving net zero emissions by 2070.

**The Committee has initially identified the following areas of research for the Mission:**

- Geothermal energy
- Alternatives to Li-ion batteries
- Two shift operation of thermal power plants
- Indigenous development of power system software
- Carbon capture utilization and storage
- Green Hydrogen technologies

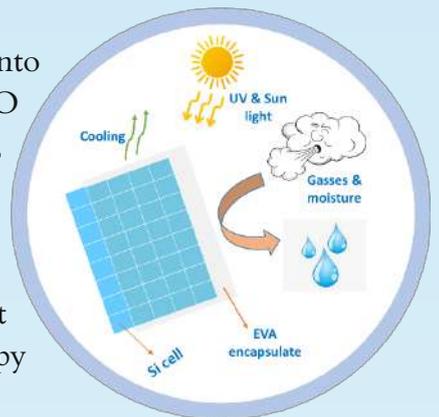
## Research Highlights

### Project in Focus

## New generation Ethylene Vinyl Acetate (EVA) nano-composites with high UV shielding properties for Photovoltaic Modules

Solar cells are susceptible to damage when exposed directly to the atmosphere, leading to internal circuit issues. To mitigate this, solar cells are typically encapsulated to provide protection from outdoor stress factors and structural support. Degradation of photovoltaic (PV) modules often stems from encapsulation-related issues such as delamination and material decomposition. Various polymeric materials, including silicone, EVA, PVB, TPU, and TPO, are used in the PV industry for encapsulation. In this project, Ethylene Vinyl Acetate (EVA) co-polymer was chosen as the base polymer.

ZnO nanoparticles, modified with a silane coupling agent, were incorporated into the EVA matrix to create nano-composites. Characterization of the EVA/ZnO nano-composites included volume resistivity, tensile and elongation properties, dielectric constant, tan delta, dielectric strength, FTIR, DSC, TGA, UV-Vis spectroscopy, UV aging, thermal aging, and damp heat aging. Results indicated satisfactory performance, with UV aging conducted for 1000 and 2000 hours. Solar modules were fabricated using the EVA/ZnO nano-encapsulant, and light transmission measurements, contact angle, and transmission electron microscopy studies were performed.



After 1000 hours of UV aging, the study concluded that the addition of 0.1phr ZnO nano particles achieved the desired level of electrical insulation properties, making it the optimum quantity of nano filler.



#### Project Leader:

Dr. Moumita Naskar  
Scientific Officer  
RTL, CPRI-Kolkata

## Technical Spotlight

### Special Tests

The Short Circuit Laboratory, CPRI successfully carried out Fault Test on 4.16kV, 95A Air Insulated Terminal Box at 50kA rms for 0.25s as per customer's requirement. The test was carried out for M/s. Toshiba Mitsubishi Electric Industrial Systems Corporation (TMEIC), Maruo - Machi, Nagasaki, Japan.



The Earthquake Vibration Research Centre, CPRI successfully carried out seismic qualification test on 800kV, 2500A condenser bushing with air and oil-end porcelain insulator mounted on support structure. The test was performed for M/s. CG Power and Industrial Solutions Limited, Nasik.

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The Short Circuit laboratory, CPRI successfully conducted short-circuit withstand strength test on main bus bars (50kA rms for 1s with 105kA peak) and conditional short-circuit tests on fuses at 50kA rms 440V were carried out on 550kVAR & 375kVAR capacitor panels for M/s. Underwriters Laboratories Middle East FZC, Dubai as per IEC 61921: 2017 & IEC 61439-1:2020. The capacitor panels were manufactured by M/s. SAS Power Industries FZE, Ras-Al-Khaimah, UAE.



# IPR Spotlight

## Patents Granted

**Patent Title: Green Insulating fluids for transformer application: A non edible vegetable oil**

**Inventors:**

- Dr. D. Gnanasekaran, Scientific Officer, CPRI
- Dr. C. Venkata Prasad, Scientific Officer, CPRI

**Brief Description:**

CPRI has developed a facile and cost effective methodology to obtain green insulating fluids from non-edible vegetable oils for transformer applications. Developed products are effective alternate to conventional insulating oil for transformer applications.



**Patent Title: Sensor System Replicating and Monitoring Formation of CuxS in High Voltage Power Transformer**

**Inventors:**

- Dr. J. Sundara Rajan, Additional Director (Rtd.), CPRI
- Late Shri. Mohan.S.Divekar, Consultant, CPRI
- Kum. Daisy Flora , Former SRF, CPRI

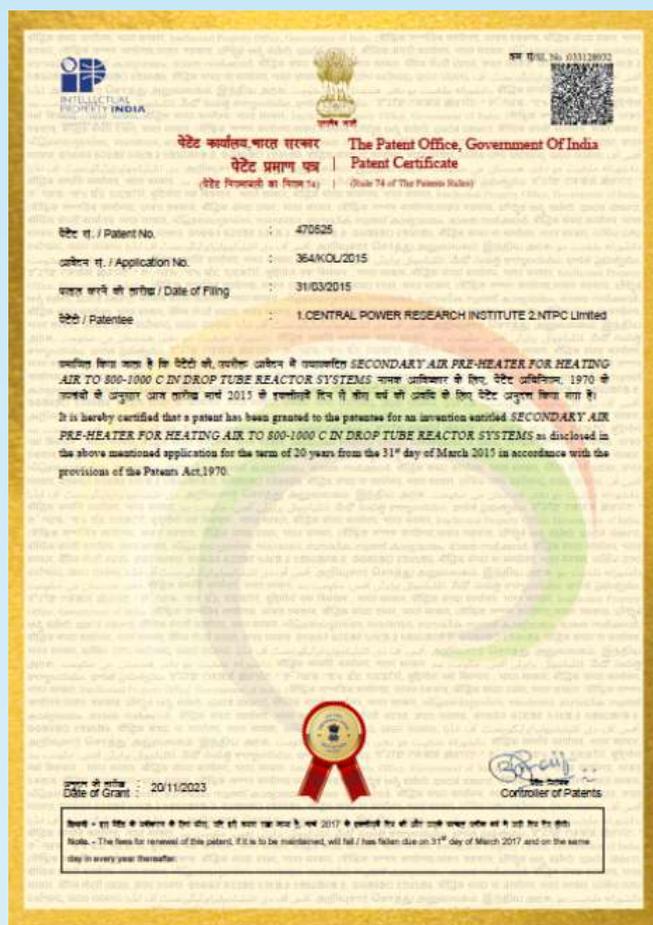
**Brief Description:**

The invention offers a completely isolated and remotely monitored system to detect the formation of Copper Sulphide during early stages of its formation in power transformers. The system consists of a capacitive sensor which replicates the formation of CuxS formation. The entire solution of sensor, electronics and software is simple to implement and it does not require periodic shutdown for removal of oil samples for analysis of the Sulphur content.



## IPR Spotlight

### Patents Granted



#### Patent Title:

Secondary Air Pre-Heater for heating air to 800-1000<sup>0</sup>C in Drop Tube Reactor Systems

#### Inventors:

Jointly by MTD-CPRI and NTPC

#### Brief Description:

This invention is used to instantaneously heat the air at the room temperature to the high temperatures up to 800-1000<sup>0</sup>C. As the air is having high specific heat capacity it is difficult to heat the air to very high temperature instantaneously. The technology behind this compact invention helps in heating the air from room temperature to very high temperatures.

## Events

### Visit of Parliamentary Standing Committee on Energy To CPRI



The Parliamentary Standing Committee for Energy visited CPRI Bengaluru on 4<sup>th</sup> November 2023. During the visit, the Committee unveiled the portrait of Dr. B.R. Ambedkar and the Preamble of Indian Constitution

## Swachhata Pakhwada

Swachhata Pledge was administered to all the employees of CPRI Bengaluru by the Director General. The pledge was administered by the respective heads of other units of CPRI. CPRI has also made an effort for segregating and removing unwanted scrap material/items in the campuses under Special Campaign 3.0.



Swachhata Pakhwada pledge taken by the officers and employees of CPRI units

## State Level Painting Competition on Energy Conservation 2023



The State Level Painting Competition on Energy Conservation for the year 2023 took place at the Center for Collaborative and Advance Research (CCAR), CPRI, on November 27, 2023. The event was well-attended by 50 students from group A and 48 in Group B.

Shri B A Sawale, Director General CPRI, presided over the prize distribution ceremony, and Sri Raghuvendra B S, Director, Public Instruction Department, Government of Karnataka, was the invited Chief Guest. Dr. M G Anandakumar, Joint Director, CPRI was the State Nodal Officer for the event.



## Shramdaan Activity

CPRI Bengaluru undertook cleanliness drive (Shramdaan activity) with participation of 100 plus volunteers, on 1<sup>st</sup> October 2023 at B Lakshminarayanpura village, Bidadi Hobli, Ramanagar Taluk. The place identified for the purpose is of importance, owing to its historical significance. The programme was undertaken as a tribute to mark the birth anniversary of Mahatma Gandhi.



## CPRI @ IITF 2023 EXHIBITION

CPRI participated in the India International Trade Fair (IITF) Exhibition, 2023 organised by ITPO during 14<sup>th</sup> to 27<sup>th</sup> November 2023 at Bharat Mandapam, Pragati Maidan, New Delhi. The theme of IITF is “Vasudhaiva Kutumbakam: United by Trade”.



Hon'ble Minister of Power & NRE, Sri. R. K. Singh inaugurated the Power Pavilion at IITF 2023. CPRI showcased its facilities through digital posters at the event attracting many visitors and guests.



## Conference / Training Program



Mechanical Engineering Division, CPRI Bengaluru organized a National Conference on “Latest Developments in Design & Testing of Transmission Line Towers/Poles & its Accessories” during 14<sup>th</sup> & 15<sup>th</sup> December 2023. About 175 delegates representing various power utilities, tower/pole & line accessories manufacturers, state transmission corporations & PowerGrid participated in the conference. The programme was inaugurated by Shri. B. A. Sawale, Director General, CPRI.

A three-week ‘Residential Induction Training Program’ was conducted for engineers of WBSEDCL-Kolkata during 4<sup>th</sup> to 23<sup>rd</sup> December 2023. The program is aimed to provide an impetus to the engineers for getting exposure in the domain of power distribution engineering. The training programme was organized by BD & CB Division, CPRI.



## Meri Maati Mera Desh

‘Meri Maati Mera Desh’ programme was conducted by CPRI Bengaluru. As part of the programme ‘Mitti Collection’ was undertaken at Shivapura Satyagraha Memorial Site near Maddur and at Vidhurashwatha village in Chikkaballapura District of Karnataka. Both the places are of significance and are identified with freedom struggle for Indian independence.



CPRI Team at Vidhurashwatha Veera Soudha Memorial Site



CPRI Team at Shivapura Satyagraha Soudha Memorial Site

CPRI has erected ‘Shilaphalakam’ memorial in its premises near the lake within the campus, which was unveiled by Sri B A Sawale, Director General, CPRI, to express gratitude and fond remembrances to the brave hearts who have sacrificed for the country during freedom struggle. The sacred soil brought from the memorial sites have been placed at the Shilaphalakam.



Shilaphalakam memorial being inaugurated by DG CPRI Shri B A Sawale

## Selfie Point



## Vigilance Awareness Week 2023

CPRI observed “Vigilance Awareness Week 2023” during October 2023. The programme commenced on 30th October, 2023 with administering “Integrity Pledge” to all the employees of CPRI Bengaluru and its Units. Several competitions were organized by the Institute for the students of KV School, Hebbal, Bengaluru and for the employees to create awareness on the theme “Say no to corruption; commit to the Nation; भ्रष्टाचार का विरोध करें; राष्ट्र के प्रति समर्पित रहें”. An Essay Competition was also conducted for Institute employees Institute on the theme.



Dr. (HC) Shyam Kumar P.K., CEO and Founder of Inner Truth delivered lecture on the core route components of Vigilance. Shri. S.K. Srivastava, Chief Administrative Officer (Retd.), DRDO addressed newly recruited officers as part of Induction programme and all employees of CRTL, Bengaluru, focusing on CCS Conduct Rules with special emphasis on Vigilance aspects on 08.11.2023. Shri. Satishchandra Jha, Dy SP of Police from CBI (Anti-Corruption Bureau), Bengaluru Branch, was the Chief Guest for the culmination programme on 16th November 2023



## Hindi Divas

CPRI Bengaluru and other units have celebrated Hindi Month & Hindi Divas during September, 2023.



Hindi Month and Hindi Divas Celebration at CPRI, Bangalore



Hindi Month and Hindi Divas Celebration at UHVRL, Hyderabad & STDS, Bhopal



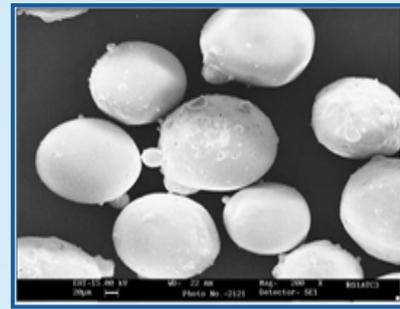
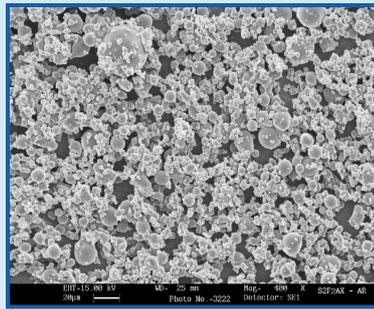
Hindi Month and Hindi Divas Celebrated at RTL-Noida & TRC-Nagpur

## Legacy Desk

# Enabling Value Added Ecofriendly Solutions for Fly Ash Utilization - A CPRI Perspective

Sustainable industrial solid waste processing is concerned with ways to progressively and systematically eliminate wastes from major industries, which will result in enhancing business performance and meet environmental regulations. An important contribution can thereto be made if wastes from one process can serve as raw materials for another process.

The Centre for Industrial Solid Waste Utilization (CISWU) at Central Power Research Institute, Bangalore showcases novel construction practices with fly ash materials, viz., autoclaved aerated concrete (AAC) panels for wall and roof in a composite structure, mosaic tiles for flooring, interlocking pavers and kerbstones for road and ground granulated blast furnace slag (GGBS) based designer tiles for pathways.



### Fly Ash and Fly Ash Cenospheres

CPRI has been involved in comprehensive characterization of fly ash and fly ash cenospheres and development of process cum product technologies keeping in view high volume, value added and high value environment friendly applications.

### End Use Technologies

Fly ash used has been used manufacture of dense building components, viz., bricks, blocks, interlocking pavers, kerbstones, designer tiles and mosaic tiles. These products show benefits in terms of reduced costs, improved casting operations, better strengths, dimensional stability and surface finish. Fly ash concrete for high volume application in road construction also reveals better properties at reduced cost.

These products have been demonstrated on a semi commercial scale at the Centre for Ash Utilization Technologies and Environment Conservation (CASHUTECH) at Raichur Thermal Power Station under the Indo-Norwegian Environment Programme.

## High Value Applications

Products include fly ash and fly ash cenosphere based glass fibre reinforced polyester matrix composite rods and flats by pultrusion, injection molded components.

Process for extraction of alumina from fly ash. The optimization results were translated in the pilot plant for extraction of alumina from fly ash under the MSEB Project at Koradi, Nagpur.

Metallic coatings on fly ash cenospheres. Fly ash, fly ash cenospheres, have been used as fillers in the development of polymer composite products, viz., bath tub, wash basin, kitchen sink, shower tray, soap dish, etc.

## Fly ash and Cenospheres composites

CISWU has been established in CPRI to encourage and facilitate greater utilization of industrial solid wastes, viz., fly ash and its derivatives, metallurgical slag's, mineral ore wastes, etc., in an environment friendly manner through development of value added products. The centre has the expertise and infrastructure to undertake testing, research & development projects, consultancy projects, technology transfers, training programmes, for environment friendly industrial solid waste utilization.



### Author

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Central Power Research Institute, Bengaluru

## Industry Trends

### Preparing for the EV revolution: A CPRI perspective

The accelerating growth of Electric Vehicle and renewable energy market is indication of batteries as one of the disruptive technologies. Batteries are gaining popularity for renewable, portable, drone and EV applications due to their numerous advantages such as high energy density, high coulombic efficiency, longer cycle life, low self-discharge, fast charging capacity, less polluting electrode material, and light weight. EV are being widely adopted due to their reduced carbon footprint. In EVs the main energy source is electric power taken from the battery. The main reason Lithium-ion batteries are so popular, is due to their higher specific energy and specific power as compared to lead acid batteries. However, safety is one of the major challenges that have to be considered in case of lithium-ion. With several reported instances of lithium-ion battery fires and explosions, it is essential to understand the performance and safety characteristics, as they pose a serious threat to human health and life if used in an improper manner. Various testing protocols and standards of IS, IRS and IEC have been developed to facilitate and regulate battery use in various applications. Manufacturing of lithium-ion batteries which satisfy the performance and safety requirements in accordance to standards and test protocols developed by these bodies ensures that the products are produced in accordance with government, regulatory, or industry requirements. These further results in ease of designing auxiliary components such as charging stations and sockets for EV battery charging irrespective of make of the batteries.

In CPRI, EATD undertakes testing of Lead Acid Batteries, Nickel Cadmium Batteries, Lithium-ion Batteries and battery packs (for two wheelers and four wheelers).

#### Facilities available in the Battery Laboratory:

1. Life cycle systems up to 18V, 200A & 30 to 450V, 300A.
2. Environmental test chambers.
3. Temperature baths.

#### Tests conducted on batteries are:

- Life Cycle Evaluation
- HPPC (Hybrid Pulse Power Characterization)
- Loss of Capacity
- Endurance Test



CPRI caters testing of batteries to various manufacturers and provides the data of testing and assists the manufacturers by creating data base for the parameters like voltage, current, temperature etc. The battery laboratory is NABL accredited, and also undertake the testing as per customer requirement. The division has successfully completed several in-house research projects and also undertake applied research on battery.

#### Authors

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Dr. P. Chandrasekhar, JD & HOD,  
Electrical Appliances Technology Division

## Collaboration Showcase



CPRI signed a MoU with IIT Mandi for research and academic collaboration. The scope covers collaborative R&D, academic interaction programs leading to enhance qualifications of CPRI officers and programs to benefit both the Institutes.

CPRI has signed a MoU with RTMNU Nagpur to promote academic and research co-operation. RTMNU recognizes CPRI Nagpur as “Place for Higher Learning and Research” in the area of Mechanical/Thermal Engineering.



## Awards and Honors



Shri B A Sawale, DG, CPRI - has been recognised with IEC 1906 award 2023 for his expert contribution in IEC T13 committee

Sri. Suresh, Attendant Gr 4, Planning Division has participated at Singapore Para Bowling International 2023 and clinched Bronze medal in double category



CPRI has been awarded Certificate of Appreciation by Ministry of Power, GoI for the commendable performance during the Swachhata Pakhwada during May, 2023. The award was presented by Secretary, Ministry of Power Shri Pankaj Agarwal to Director General, CPRI Shri B. A. Sawale.